2021

WHITE PAPER ON TRANSPORTATION TECHNOLOGY INDUSTRY POLICY

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS

2021

White Paper
on Transportation
Technology
Industry Policy

**MINISTRY OF
TRANSPORTATION AND
COMMUNICATIONS**

Minister's Preface

WANG, Kwo-Tsai
Minister of Transportation and Communications

Practitioners in the industry often say, "transportation is the mother of progress, the source of wealth, and the core of national defense." Indeed, transportation and mobility lays the foundation for a well-functioned society and economy. It drives growth, creates jobs, fosters social interaction and connection, and shapes the way we live. Faced with a wide range of challenges—a rapidly aging population, climate change and air pollution, urban traffic jams, inadequate transportation infrastructure in remote areas—the Ministry of Transportation and Communications (MOTC) needs to address existing mobility demand and meet future challenges with innovative solutions through leveraging modern technologies and future-proof trends such as automation, connectivity, electrification, and sharing.

Under the leadership of former minister, Dr. Lin Chia-Lung, MOTC established the Board of Transportation Technology Industries in September 2019, composed of representatives and experts from the industry, academia, and government and tasked with formulating policies for the transportation technology industry. In June 2020, the *2020 White Paper on Transportation Technology Industry Policy* was published as a high-level policy framework to lead the development of Taiwan's transportation technology industry in the medium and long-term. The white paper covers the industrial development and promotion policies for 10 transportation technology task groups, including railway technology, smart public transportation service, smart electric bus technology, smart electric scooter technology, bicycle and tourism, smart port and airport service, UAV technology, smart logistics service, transportation big data technology, and 5G smart transportation application promotion. In the second half of 2020, two new task groups for harbor and airport green energy industry, as well as climate industry were introduced for a more comprehensive look into the transportation technology landscape.

With rapid technological advances and emerging applications, the Ministry is dedicared to constantly reviewing and optimizing its policies and measures through effective dialogues with industry players. We are very grateful to the Board and the advisory members of each task group for their efforts and meaningful deliberations over the past year, which has resulted in a great deal of constructive feedback for the Ministry. Their input, along with the Ministry's knowledge and experience, have helped us review and improve policy directions for the 10 task groups, give birth to two new task groups for harbor and climate, and ultimately contributing to the *2021 White Paper on Transportation Technology Industry Policy*. I would like to express my sincere gratitude to all the staff who made this publication possible.

The MOTC Board of Transportation Technology Industries was founded with a mission to listen, engage, and be an agent of change. With this in mind, we are determined to drive innovation in transportation management, and hope this white paper could serve as proof of the Ministry's dedication to promoting the transportation technology industry. In the future, we will continue to leverage inter-ministerial resources to support industry growth and build a transportation network with a people-centric approach, in order to provide the public with mobility options that are safer, cleaner, more convenient, more efficient, and more sustainable. It is our hope to have all stakeholders and the public to join us and create a better future for Taiwan's transportation technology industry.

WANG, Kwo-Tsai
Minister of Transportation and Communications
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Introduction

Advances in innovative technologies and their applications fuel the economy and improve people's quality of life. However, as urban population continues to grow, with increasing public awareness on environmental protection and safety, along with pressure from an aging society, people nowadays have greater demand for convenient, safe, clean, and diverse modes of transportation, which has led to the creation of real-time, integrated transportation information and application services.

Digital technology has been viewed by advanced nations around the world as a key economic driver and enabler of national development. In response to such trend, the Executive Yuan launched the "DIGI+" program in 2016, and the *Forward-looking Infrastructure Development Program* in 2017, in order to accelerate a nation-wide industrial upgrade and transformation. In the same year, the MOTC began implementing the Smart Transportation System Development Plan, with a vision to "Build Smart Transportation, Create Smart Life". The plan is an attempt to stay up-to-date with the latest technological and economic trends, and address a range of issues—from traffic congestions, low adoption of public transport, enhancing traffic safety, to reducing impact of traffic accident—through a combination of systematic methods and integrated smart transportation strategies. Efforts have also been made to tap into Taiwan's strengths in industrial manufacturing and ICT to enhance technical capabilities and market competitiveness of the local transportation technology industry, to develop integrated smart transport solutions, and to build Taiwan into an internationally recognized high-tech center of smart transportation.

Transportation infrastructure spans across sea, land, and air, and competent authorities that oversee relevant products and services include those for transportation, technology, economic affairs, interior affairs, finance, and environmental protection. The transport industry itself is an extensive ecosystem involvng many closely connected industrial and service sectors in Taiwan. To create a cross-department and cross-industry platform to facilitate engagement from the industry, government, academia, and research institutes, MOTC established the Board of Transportation Technology Industry in September 2019 to consolidate resources and draw collective innovative capabilities of the transportation technology industry. The Board is tasked with reviewing the current status and identifying key development topics of 12 sectors (railway, smart public transportation services, smart electric buses, smart electric motorcycles, bicycles and tourism, smart port and airport services, UAV technology, smart logistics services, transportation big data, and 5G smart transportation application promotion, harbor and airport green energy, and weather), and promoting innovative management approaches and development measures instead of the old way of supervising and regulating. The Board aims to constantly adapt to new directives and regulations, provide an industry-friendly environment for system verification to enable product innovation and real application, become an incubator for innovative transportation services, and further help the industry gain a foothold in the global market.

This White Paper is a collection of feedback and aligned input from hundreds of representatives and experts from the industry, government, academia, and research institutes, which presents an overview of the 12 sectors, their respective development goals, major issues, development strategies, and promotion measures. It not only helps inform future policy-making, but offers insights for the public on the topic of smart transportation. Most importantly, it serves as a guide for the industry when it comes to decision making on future investments. It is hoped that the public and private sectors would join hands through mutual trust in using innovative technologies to create a smart, safe transportation ecosystem for the public, at the same time contributing to enhanced competitiveness of industries in Taiwan.

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White Paper
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Industry Policy

I.
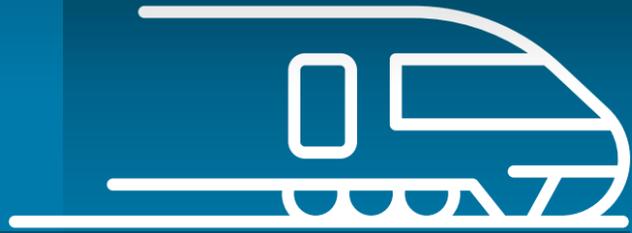
Policy for the railway technology industry

Railway transportation offers the advantages of energy conservation and low pollution, which is in-line with the global trend for low-carbon and green transportation. Furthermore, the annual output value of the global railway market is nearly NT$7 trillion, and domestic railway development projects will provide business opportunities reaching NT$2 trillion over the next decade. The government should encourage vendors to increase their technological autonomy to invest in the market. However, railway system technologies involve software and hardware relating to vehicles, signals, communications, power supply, depots, tracks, and civil engineering. This makes technology integration very difficult in an extremely competitive market. In the future, the government must seek to create an environment suitable for industrial development, in order to enhance the industry's technological capabilities. As a result, domestic companies will not only gain a foothold in the domestic market, but also seize business opportunities in the international market. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. Further development strategies and promotion measures are then outlined on this basis.

i
Current Status and Development Vision

Statistics show that there are currently 57 railway, MRT, and light transportation infrastructure projects that are under construction or in planning. The total budget for the projects reaches NT$1.97 trillion, in which the total budget for the next 5 years is approximately NT$0.8 trillion, and the total budget for years 6-10 is approximately NT$1.17 trillion. The investments made by all of the projects are expected to generate domestic output value reaching approximately NT$3.21 trillion, and will provide approximately 34,000 employment opportunities each year over the next 10 years. The total output value of railway projects is estimated at NT$1.17 trillion, MRT projects at NT$1.8 trillion, and light rail projects at NT$0.24 trillion; output value estimates for each item (as shown in Table 1):

Furthermore, railway operators will purchase approximately NT$61.9 billion in maintainence spares over the next 10 years, in which roughly one third are domestic products. Combined with the demand for spares from the Taoyuan MRT, Taichung MRT, and New Taipei City Light Rail,

the economic scale will grow with each passing day. International institutions estimate that the global output value of railways will reach EUR192 billion (approximately NT$6.9 trillion) in 2023 with the Asia-Pacific, Western Europe, and North America as its main markets.

It is necessary to increase the autonomy of domestic companies with respect to key technologies for vehicle and signal systems, in order to seize business opportunities in domestic and overseas markets. Products that need to be developed and locally manufactured must be proposed from the perspective of construction and based on the needs of railway operators for maintenance spares. Testing capabilities and standards need to be established. It is also necessary to step up technological development and talent cultivation through R&D and transportation infrastructure projects. We will sort out

Table 1 Railway transportation infrastructure projcet and estimated output value

| Item	Total output value (NT$ billion)	Rolling Stock	Signalling System	Power Supply System	Telecommuni-cation System	Track Work	Civil Engineering
Railway project	11,700	-	821	1,173	352	821	8,533
MRT project	18,000	2,642	1,780	1,075	687	934	10,882
Light rail project	2,400	558	252	139	257	283	911

Note: Figures for MRT and light rail transportation construction engineering do not include depots, and other electrical and mechanical work is calculated as part of civil engineering
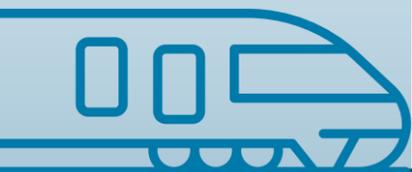
procurement needs for light rail to expand the market, and will establish standardized specifications. By implementing a series of support measures, such as programs of policy, opinion exchange platforms, standard procurement clauses, and review mechanisms, the effect of localization will be demonstrated by railway system procurement guidelines. We will encourage local government to create an environment that benefits industrial development.

In the development of railway technology in next generation, in terms of hardware, the technology of electric multiple units (EMUs) commuter of Taiwan Railways Administration has similar to light rail with domestic production rate nearing 50%. The network of Taiwan Railways Administration is being planned in coordination with the national high speed rail, and the system is developing towards faster trains and local trains in Eastern Taiwan. The technologies needed by faster train systems include overall vehicle design and energy conservation (Light-weight, better transmission efficiency of the traction system, and development of aluminum alloy carbody), better safety and performance for train control system, real-time communications and track structure reinforcement, and adjustments to power supply capacity of traction substations. For light rail systems, efforts will be directed towards the development of vehicle and signal systems, in hopes that domestic companies will obtain core technologies of electromechanical systems. As for high speed rail and MRT systems, efforts will be directed towards domestically produced maintenance spares due to the technical barriers.

In terms of software, advanced technologies such as Internet of Things (IoT), big data, cloud computing, and artificial intelligence (AI) will be integrated to provide better real-time monitoring and information feedback applications for passenger services, train control,

maintenance, and safety. Hence, Taiwan urgently needs to establish a system structure and development strategies for smart railway to establish an IoT platform, establish specifications for system structure, and interface standards through edges, networks, and cloud, and bring together railway operators and ICT companies to drive the development of the smart railway industry. The MOTC assembled the R-TEAM, a group of subsystem and ICT companies, to established the development strategy and blueprint for the railway industry, and formed the industry supply chain by integrating their opinions and practical experience including technical development and markets. The R-TEAM is expected to be a main contractor of domestic light rail transportation infrastructure in the early stage; to engage in the R&D projects of subsystems and fulfill the policy demand for domestic producion rate 50% in core electromechanical and track systems and 70% in vehicle system in the middle stage; to tender for overseas market with completely system design, manufacture, and integrate ability eventually.
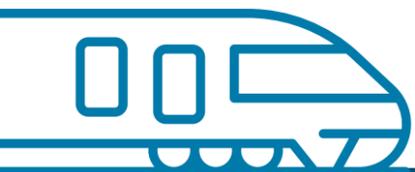
ii
Key Issues

(i) Promotion of technological development and testing/certification to help the industry gaining autonomy

In the past, the strategic policy to drive the development of a domestic supply chain through railway construction was not proposed. Since most tenders for core electromechanical systems were awarded to foreign companies, domestic companies could not manipulate the design of vehicle and electromechanical systems, which resulted in special specifications of maintenance spares. Domestic companies were unable to be suppliers in the whole system life cycle. In the meanwhile, system upgrade or expansion were manipulated by foreign companies, which leaded to expensive cost for Railway operators. It is expected that through the implementation measures, such as development of domestic products, establishment of national standards and testing/ certification mechanisms will assist the domestic industry in gaining technological autonomy, and finally fulfilled the future goal for indigenous rolling stock and core electromechanical systems.

(ii) Resolving issues with tendering, expanding market scale, and integrating procurement requirements

The central government as well as municipalities include Taipei and Kaohsiung City Government are required to comply with Government Procurement Act and Agreement on Government Procurement (GPA), so they are unable to specify domestic products and domestic production rate intender. The MOTC established railway system procurement guidelines to help domestic companies participate in railway transportation infrastructure projects by resolving issues with tenderer qualifications. The procurement agencies were guided to implement localization measures and integrate procurement requirements of each local government, so as to expand the market size. Since the railway operators implemented maintenance localization policy individually, and they didn't share experience, moreover the procurement requirements weren't clearly understood by industries, it is necessary to strengthen the integration and exchange of information and business disclosure to increase the demand on localization of maintenance spares, also the procurement guidelines will assist local companies in tendering for the maintenance spares.

(iii) Utilizing the strengths of Taiwan's ICT industry to promote smart railway services

As network technology and ICT continue to flourish, smart railway has become a trend in developing railway transportation. The development trends overseas should be refered; to propose smart railway development strategies, establish the environment and specifications framework for smart railway, and improve localized abilities of software for smart railway. The strengths of ICT industry should be utilized to assist domestic industries in acquiring technical autonomous of smart railway system from components to systems gradually.
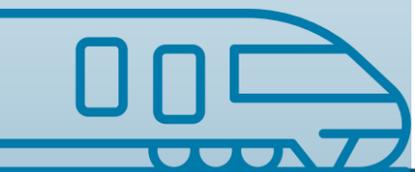
iii
Development Strategy

(i) Promote indigenous rolling stock and electromechanical systems by development of railway technology and related industries

Select prioritize items for localization, for light rail systems the prioritize items are vehicle systems (including bogie, traction system, onboard lithium-ion traction batteries, and body side entrance systems) and signalling systems (including switches and positive train control system), for tranditional railway system the prioritize items focus on the development of faster trains in Eastern Taiwan and local trains, and aims to improve the performance of vehicles, signal communication, power supply, and tracks. The grant mechanism should be established to provide resources to industry, academia to conduct R&D. Not merely a complete railway product testing and certification system adopting national standards aligned with international standards, but a railway testing and research institute should be established. Finally, assisting academic institutions in cultivating railway talent should be promoted.

(ii) Increase opportunities and willingness of domestic companies to tender for railway transportation infrastructure projects and maintenance

Establish and implement railway system procurement guidelines and support measures to increase opportunities for domestic companies to participate in engineering construction and maintenance spares. Constantly provide business opportunities for domestic companies to retain R&D capability. Cultivate railway turnkey contractors to assemble a local supply chain, which will enable domestic companies to tender for domestic and overseas procurements.

(iii) Develop smart railway 4.0 and related industries

Establish structure and specifications of smart railway system, promote mutual learning and integration of railway domain knowledge and smart technology 4.0, and gradually incorporate 4.0 technology such as network communications, IoT, cloud computing, big data, and AI into railway systems. Strive for dedicated communication bandwidth for railways, establish an opinion exchange platform for smart railway industry development, and implement incentive measures.
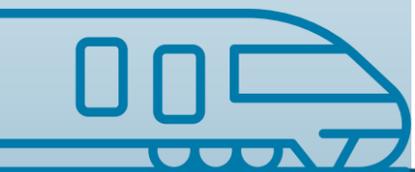
iv
Implementation Measures

(i) Prioritize items for localization

Short-term:

The Board of Railway Industry Promotion and R-TEAM reviewed priority items and their sequence of R&D. For light rail system, core electromechanical systems, such as rolling stock and signal system, are the focal points, on the other hand, improving the safety and performance of rolling stock and train control system are the focal points of tranditional railway.

Medium-term and long-term:

By conducting the feasibility study of faster train networks in Eastern Taiwan, the board will review the priorities items for localization from vehicle, signalling and power supply system to increase operating speed to 160 km/h.

(ii) Integrate research, development and testing/certification capabilities

1. Develop railway technologies:

Short-term:

Allocate funds to assist railway development; establish a railway industry innovation grant mechanism; establish an R&D team through the R-TEAM members and relevant sections such as industry, academia, and research institutions, to engage in technology research of subsystems or components. The approach of acquiring advanced technologies includes technology transfer from foreign companies in the early stage, assisting domestic industry in developing autonomous technology and integration capabilities gradually.

2. Establish a testing and certification system:

Short-term:

Review and integrate technology capabilities of domestic research institues through the testing/certification platform, and establish a supply/demand information exchange and collaboration scenario; amend laws to establish a testing and certification system for railway product, and establish testing procedures and certification standards for designated items to ensure product safety and quality.

Medium-term and long-term:

Promote mutual recognition agreement of testing and certification for railway product between domestic and foreign conformity assessment bodies to eliminate trade barriers.

(iii) Establish national standards

Short-term:

Establish significant national standards aligned with international or regional standards for priority items; propose the recommendation structure for railway national standards and propose the list of significant international or regional standards which will be transfer to CNS in the long run.

(iv) Establish a Railway Technology Research and Certification Center

Short-term:

Establish an institute to conduct railway research and testing/certification ; install phase-1 instruments and equipment, and obtain accreditation from the Taiwan Accreditation Foundation (TAF).
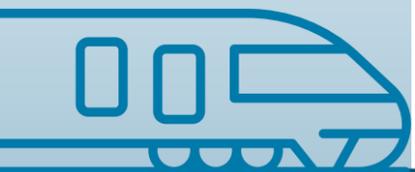
Medium-term and long-term:

Install phase-2 instruments and equipment and establish a testing track; obtain accreditation from the TAF; formulate a master plan for the railway industry development; establish exchange, collaboration, and mutual recognition mechanisms between domestic and foreign testing/certification institutions to obtain accreditation from foreign accreditation bodies.

(v) Establish railway system procurement guidelines and support measures for localization

Short-term:

Prioritize light rail construction projects, sort out procurement needs of local governments, establish top-down system specifications, establish light rail system procurement guidelines, and encourage local governments to adopt the guidelines through programs of policy implementation. Establish a communication platform, assist procurement agencies with implementing the guidelines and resolving implementation issues; complete the standard procurement clause and convert support measures for localization (including flexible contractor qualifications, product use/qualification certificates, most advantageous tender, upper limit on scores assigned to domestic products, general specifications, and lower limit on the domestic production rate) according to the guidelines into contract clauses for project implementation; establish a guideline review mechanism to determine if feasibility studies and overall planning is excuted according to the guidelines; formulate localization support measures for individual procurement, such as eco-friendly trains on branch lines of the Taiwan Railways Administration, increasing opportunities for domestic companies to participate in tenders; establish support measures and mechanism for maintenance spare parts R&D and procurement by domestic companies.

Medium-term and long-term:

Establish funding review and evaluation mechanism ensuring localization in railway transportation infrastructure projects are properly implemented; formulate procurement guidelines and localization support measures for other railway systems.

(vi) Provide maintenance business opportunities

Short-term:

By sharing localization experience in open platforms or conferences, railway operators review and propose demand on valuable and consumable maintenance spares; Encourage every railway operator to establish a material management information system to organize technical specifications and procurement requirements, which is beneficial to information exchange.

(vii) Establish a smart railway system structure and incorporate 4.0 technology

1. Establish systems:

Short-term:

Establish specifications for the structure of smart railways and amend related laws and regulations; establish and announce standards for edge, network, and cloud equipment and endpoint interfaces; establish a big data platform, integrate communication protocols, transmission methods, and conversion formats; implement information security measures in railway IoT equipment.

2. Develop technologies:

Short-term:

Explore AI applications in railway safety monitoring, preventive maintenance, inspection, and passenger services; plan objectives for each phase of smart railway development, establish policies to encourage railway companies to incorporate 4.0 technology; establish certification mechanisms for edge, network, and cloud equipment; establish a smart railway test field (including information security).

Medium-term and long-term:

Implement TC 4.0 technology for Taiwan Railways Administration, and establish a comprehensive continuous monitoring train control system based on 5G communications technology and a structure with multiple communication methods; establish a maintenance monitoring database with data analysis and feedback functions.
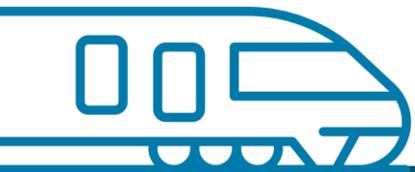
3. Strive for railway spectrum:

Short-term:

Review requirements and issues on the immediacy and stability of mobile communications for smart railways; strengthen external signal communications, such as voice, image, and data, and improve the immediacy of mobile communications reception by vehicle design; discuss the necessity of retaining a dedicated spectrum for railway systems.

Medium-term and long-term:

Encourage domestic telecommunication operators to participate in railway network construction and maintenance.

4. Establish incentive measures:

Short-term:

Establish a platform for industry, government, academia, and research institutes to exchange opinions relating to smart railway; establish procurement guidelines and incentive measures, and implement a policy program.

Medium-term and long-term:

Establish a certification label for smart railway equipment; encourage railway operators to collaborate with industry, academia, and research institutes in R&D, standards establishment, and product testing.

(viii) Assist academic institutions with cultivating railway talent

Short-term:

Bring industry, government, academia, and research institutes together to establish an academy that cultivates talent for the railway industry, and build the educational resources of academic institutions in railway software and hardware technologies; assist academic institutions and railway operators jointly compiling teaching materials on railway fundamental and innovative technologies, and establish a practice site for industry-academia collaboration.

Medium-term and long-term:

Implement a railway program certification system recognized by administrative authorities, and integrate talent cultivation cross universities; implement a mutual recognition system between education and employment to reduce training cost for railway operators.

(ix) Assemble the R-TEAM and develop railway electromechanical system turnkey contractors in Taiwan

Short-term:

Implement localization measures through implementing projects, and increase opportunities for domestic companies to participate in tenders; review both domestic production rate of implementing projects and reference list of domestic products(non-safety related items will be included firstly); reveal progress of executing projects and information on overseas markets through the R-TEAM and industry joint conference, providing opportunities for domestic companies; assist the R-TEAM and domestic companies in participating in international railway exhibitions to demonstrate the industry's technical capabilities, and seeking for cooperation with foreign companies on the foundation of performance records; provide guidance to companies in using the government's grants to develop business abroad.

Medium-term and long-term:

Review the tendering strategies of domestic executing projects to assist domestic companies becoming turnkey contractors with system integration capabilities, which is conducive for industry ecosystem in Taiwan and for corporate with foreign companies; establish grant mechanisms for the railway industry to expand its overseas business.

II.
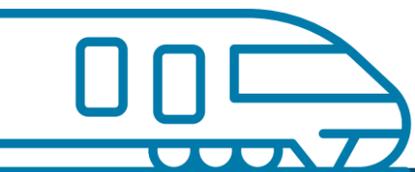
Policy for the smart public transportation service industry

Public transportation services are an integral part of people's daily lives, and also an important foundation for urban development. Following the development of 5G, IoT, cloud computing, AI, and self-driving vehicles, "smartification" is an important trend in the development of public transportation services. Related industries have great development potential in the global market, and also have very high output value. Based on international estimates, the output value of smart public transportation services will reach approximately US$16 billion or NT$480 billion in 2022, and is growing at an annual rate of 12%. Taiwan's electronics and ICT industries not only have solid R&D capabilities, but also the ability to rapidly create a supply chain for up-, mid-, and down-stream products. If suitable policies can be utilized to guide domestic transportation and ICT companies with key technologies to accelerate the development of smart public transportation services, it will lead to the development of internationally competitive products and services, and create new opportunities for the industry. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. Further development strategies and implementation measures are then outlined on this basis.

2021

White Paper on Transportation Technology Industry Policy

i
Current Status and Development Vision

Figure 1 Concept of smart public transportation

Safety
Mobility
Accessibility
Responsiveness
Trustiness

Following the rapid development of ICT facilities, popularization of smart mobile devices, and applications of AI, big data, and IoT, public transportation services will be able to effectively fill in the gap in the service chain through strategies that integrate the abovementioned technologies, equipment, and systems, which will increase the convenience, safety, and reliability of public transportation. Furthermore, the implementation of smart public transportation will not only create new opportunities for transportation and vehicle manufacturing companies, but also drive developments in cash flow, information flow, and service flow, as well as related industries, creating the vision of SMART (Safety, Mobility, Accessibility, Responsiveness, and Trustiness) public transportation (as shown in Figure 1).

The MOTC public transportation project has a budget of approximately NT$4 billion in 2020. The next phase of the public transportation project starts in 2021 and allocates NT$4 billion a year for smart public transportation, investing a total of NT$20 billion over the next 5 years, and a total of NT$40 billion in years 6-10. This is expected to drive investments of NT$60 billion and generate at least NT$100 billion in output value, while providing over 20,000 employment opportunities. In the future, the MOTC will utilize the abovementioned resources to help transportation companies and other e-ticket or mobile payment companies, ticket equipment companies, smart transportation companies, IT equipment companies, and even tourism companies to invest in smart public transportation, in hopes of providing more convenient, safer, and more reliable public transportation, and help transportation companies improve their operations management. This will create a positive cycle in related industries, form a public transportation industrial chain, and create opportunities for international output.

ii
Key Issues

(i) New generation smart payment and mobile services

Plan and implement new generation applications integrated with mobile device payment systems, such as e-tickets for public transportation, mobile payment, QR code, and Taiwan fun cards, and guide related industries, such as e-tickets, electronic payment, system platforms, and clearing institutions, to become involved in development. Create an environment for widespread use, in order to integrate and strengthen applications for analyzing public transportation ticket data, and create diverse marketing services for public transportation (as shown in Figure 2).

Figure 2 Using ICT to integrate smart payment and mobile services

(ii) Digital transformation and governance of public transportation

Promote operations management IT equipment and smart stations for public transportation companies (urban areas/highway bus/rail), integrate urban area/highway bus/rail public transportation services and safety management mechanisms, provide guidance to accelerate the digital transformation of transportation companies, cultivate professional talent to drive the development of technology and transportation information related industries, and strengthen corporate governance and safety management (as shown in Figure 3).

(iii) Rural area transportation system integration and development

Implement a demand responsive integrated service platform, establish

Figure 3 Using technology equipment to strengthen digital governance

< 30km/hr or turning
OBD II gyroscope

On
Warning light for difference of radius between inner wheels

01

02

Return
Computer Facilities

05

04
Notification
Driver

03
Detect pedestrians/ vehicles
Blind spot /Difference of radius between inner wheels detection system (BSD)

a joint reservation and dispatch system, effectively match supply and demand and promote resource sharing, and formulate transportation service related laws based on characteristics of rural areas. Establish a diversified, localized, micro public transportation service model through cross-industry collaboration, in order to accelerate the development of public transportation services in rural areas, and develop a transportation service industrial chain through cross-industry collaboration (as shown in Figure 4).

Figure 4 Concept of rural area transportation system integration
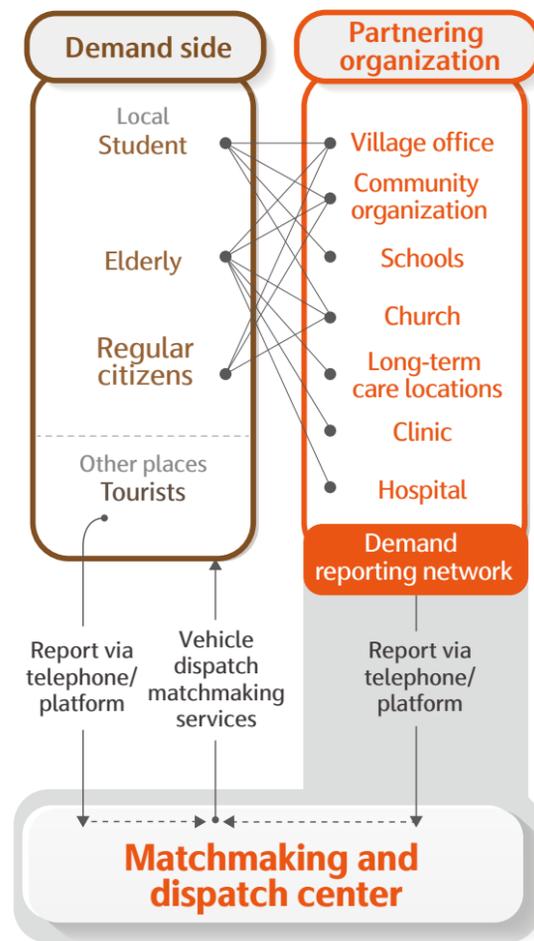
iii
Development Strategy

(i) Develop an environment that accepts multiple tickets and payment methods, and strengthen cross-industry integration and value-added applications

Establish standards for systems and equipment that accept multiple forms of payment for public transportation using mobile devices, develop a new generation integrated ticket barrier machine, and assist public transportation companies to replacing and upgrading systems and equipment at stations and in vehicles. Furthermore, the development of diverse payment methods is also utilized to link together resources across industries for marketing, to drive the use and development of public transportation, and to encourage e-ticket and e-payment companies to develop diverse payment channels or platforms. These channels and platforms are integrated with Mobility as a Service (MaaS) and enhance value-added applications of information, providing one-stop public transportation services while driving the development of related industries.

iv
Implementation Measures

(ii) Accelerate the digital transformation of public transportation, and improve traffic safety and operational performance

Provide guidance to accelerate the comprehensive digitalization of transportation companies' operations and service information, establish a mobile digital ticket reservation and sale service system and smart public transportation stations, and step up the implementation of safety equipment (e.g., vehicle collision prevention system and new drive recorders) and drive management system for public transportation vehicles, improving traffic safety through smart technology. Also, utilize smart technologies and equipment to guide the digital transformation of transportation companies.

(iii) Establish micro public transportation systems in rural areas, integrate local resources, and strengthen supply and demand matchmaking:

Establish the Rural Area Public Transportation Promotion Project, develop a transportation service industrial chain with cross-industry collaboration, and integrate mobile technology platforms for demand responsive services. Establish a reservation and dispatch system that can be jointly used, and review and amend relevant laws and regulations in a timely manner; establish a diversified, localized, micro public transportation service model through cross-industry collaboration.

(i) Provide guidance to system and equipment companies in developing and manufacturing new generation ticket barrier machines, and establish industry standards

Short-term:

Taiwan Telematics Industry Association organized companies in the industry (including bus, mobile payment, and equipment companies) and determined compliant payment tools according to market mechanisms, established diverse payment systems, equipment, and API for public transportation using mobile devices, and established industry standards such as authentication codes. It provides guidance to system and equipment companies in developing, manufacturing, and assisting in the verification of compliance with product standards.

(ii) Establish a subsidy plan for new generation ticket barrier machines

Short-term:

The Directorate General of Highways formulated a subsidy plan to integrate new generation ticket barrier machines, and will replace and upgrade ticket barrier machines on all vehicles and stations of public transportation companies nationwide by region and year.

(iii) Plan an integrated payment and clearing mechanism and standard ticket formats

Short-term:

Bus, ticket, and mobile payment companies jointly discuss and plan an integrated payment and clearing mechanism and standard ticket formats, jointly enjoying the benefits of clearing integration, and using tickets for public transportation big data analysis applications.

(iv) Implement public transportation reward point discount measures

Short-term:

Integrate the back-end platforms of public transportation companies, mobile payment companies, and cross-industry companies, plan and implement public transportation reward point and discount measures, establish a reward point exchange and clearing mechanism, and expand and increase the stickiness of public transportation services.

(v) Develop one-stop integrated public transportation

Short-term:

E-ticket, e-payment, and transportation companies cooperate with public transportation mobile service platforms, and develop one-stop integrated public transportation (including bus, Taiwan Railways Administration, Taiwan High Speed Rail, light rail, and other transportation industries) and tourism services, make public transportation more convenient for citizens, and use ticket information for value-added applications, which will drive the development of related industrial chains, including transportation, tourism, tickets, and transportation information.

(vi) Establish information systems on services provided by bus companies and stations

Short-term:

The MOTC organizes ITS Taiwan, Taiwan Telematics Industry Association, and related companies to establish items and functions (e.g., real-time bus status, real-time passenger information, mobile ticket reservation and selling service, and station guiding system) of service information systems and equipment of urban area/highway bus companies and stations, and also plan implementation progress and goals.

(vii) Plan the installation of technological safety equipment and management systems in public transportation vehicles

Medium-term:

The MOTC organizes ITS Taiwan, Taiwan Telematics Industry Association, Vehicle Safety Certification Center, Automotive Research & Testing Center, and bus companies to plan the progress for installing technological safety equipment and management systems in public transportation vehicles, and include regulatory requirements at appropriate times.

(viii) Develop smart electrical equipment and systems for vehicles and a public transportation service information platform

Medium-term:

The Directorate General of Highways establishes subsidy strategies and plans, utilizes cloud computing and Artificial Intelligence of Things (AIoT) technologies, develops smart electrical equipment and systems for vehicles, integrates urban area/highway bus/rail transportation service systems to link together services across transportation tools, and uses smart technologies and equipment for digital governance of drivers and vehicles.

(ix) Plan the establishment of professional organizations and institutions for the public transportation service industry

Medium-term:

Plan subsidies to support the public transportation service industry in integrating and establishing professional organizations and institutions (e.g., companies or institutes), assist the integration of system platforms, provide guidance for the industry's digital transformation, and train professional talent needed by public transportation related industries (e.g., electric buses or driverless cars).

(x) Establish information security specifications and standards for public transportation service systems and platforms

Medium-term:

Taiwan Telematics Industry Association organizes companies to establish information security specifications, standards, and protection mechanisms needed for the integration of public transportation service systems and platforms.

(ix) Plan and integrate business models and a shared platform for public transportation in rural areas

Short-term:

The MOTC organizes ITS Taiwan and related companies, including application platforms, to plan and integrate business models and a shared platform and mechanisms for public transportation in rural areas.

(xii) Add specifications for systematic operations of transportation systems in rural areas

Short-term:

The Directorate General of Highways and local governments enact and amend laws for the motor carrier industry, and add specifications for the systematic development of Bus of Happiness as a local micro public transportation system in rural areas.

(xiii)Implement the Rural Area Bus of Happiness Project

Short-term:

The Directorate General of Highways will implement the Rural Area Bus of Happiness Project, subsidize and assist rural areas in accelerating the development of a local micro public transportation systems (including driverless cars, bus companies, taxis, rental cars, and NGOs), provide friendly public transportation services, meet the basic transportation needs of rural areas, whether for private purposes, tourism, seeking medical attention, or going to school, step up transportation system integration, and develop an industrial chain for cross-industry collaboration in transportation services.

III.

Policy for the smart electric bus technology industry

The revolution of smart and green transportation is not only a development trend in the international transportation industry, but also shows a nation's technological capabilities, as well as determination and actions to protect the environment. As one of the main transportation tools for short and middle distance travel in urban areas and between townships, buses are an inseparable part of people's daily lives. It is a challenge but also an opportunity to use electric, smart, and driverless technologies to become more eco-friendly and provide users with greater comfort and convenience, while guiding the domestic conventional vehicle industry towards a new generation of technological innovations and application services. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. Further development strategies and implementation measures are then outlined on this basis.

2021

White Paper on Transportation Technology Industry Policy

i
Current Status and Development Vision

ii
Key Issues

In response to the trend of energy conservation and carbon reduction and to reduce air pollution, the MOTC has promoted electric buses since 2011. Furthermore, the Executive Yuan at the end of 2017 announced the policy objective to make all buses electric before 2030. Hence, the Directorate General of Highways supported the electric bus promotion policy by collecting information on the development and key technologies of electric buses and autonomous driving in Taiwan and overseas, and also reviewing the business environment for buses, as well as electric bus operations in Taiwan. It determined key issues based on characteristics of electric buses, and also analyzed development scenarios for combining electric buses with autonomous driving technologies, which will serve as the basis for subsequent implementation of the electric bus policy, and effectively improve management efficiency and traffic safety. It will use innovative technology to create a smart environment, and provide people with safer and more reliable transportation services.

The public transportation project of the Directorate General of Highways, MOTC has a budget of approximately NT$4 billion in 2020, of which at least NT$800 million will be used to promote large electric passenger vehicles. Furthermore, the MOTC's Highway Public Transportation Service Upgrade Project will invest at least NT$10 billion in the promotion of electric buses in the next 5 years, and at least NT$80 billion in years 6-10. These investments are expected to create NT$170 billion in domestic output value and create 56,000 employment opportunities over the next 10 years.
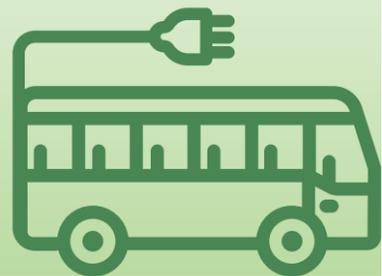
(i) Develop electric buses using new technology and implement autonomous driving technology

Develop electric buses using new technology, create an environment for integrating technologies of the electric bus and autonomous driving industrial chain, first integrate R&D results of advanced safety equipment

Figure 5 Application of smart driving assistance system

01 Low speed warning sound of electric vehicle
02 Driving vision assistant system (cameras on both sides and the back)
03 Driver monitoring system
04 Tire pressure detection and warning system
05 Advanced emergency braking system (AEBS)
06 Vehicle stability control system
07 Lane departure warning system (LDWS)

Orange items are mandatory in the laws of the R.O.C.
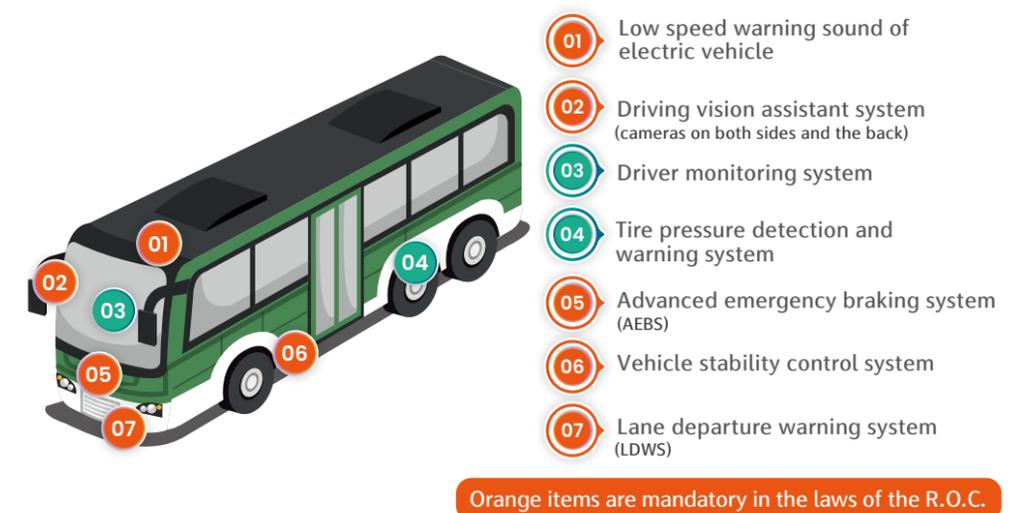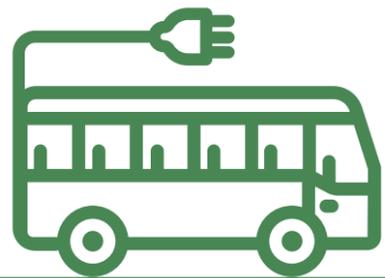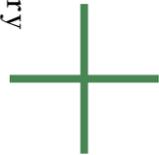
for driverless vehicles (as shown in Figure 5), incorporate commercial design, accelerate the upgrade of industry technologies in Taiwan, and enhance the commercial competitiveness of products.

(ii) Electric buses by 2030

Expand the commercial operation of electric buses, provide an ideal business environment and incentives system for bus companies to adopt electric buses, and strengthen the logistics support system to achieve the transition to electric buses by 2030.

(iii) Develop equipment capabilities for an electric bus verification platform

Integrate the development of a local industrial chain for key parts and components of electric buses and whole vehicle manufacturing; develop equipment capabilities for a product development, testing, and verification platform for electric bus performance, parts and components, and advanced safety equipment; attract foreign companies to collaborate in technological development in Taiwan, in order to accelerate the improvement in electric bus performance and shorten the time it takes to commercialize related equipment and products.

(iv) Mutual recognition of certifications with the European Union for compliance of key parts and components and system equipment

Promote the mutual recognition of certifications with foreign countries (e.g., EU) for the compliance of whole vehicles, key parts and components, and system equipment of electric buses in Taiwan; lower non-technical barriers to trade and expand business opportunities to output products with higher competitiveness.

iii
Development Strategy

(i) Implement applications of electric bus designs with new technologies

Design and establish requirements and specifications for standard functions of electric bus equipment with new technologies; establish functional requirements, standards, and specifications for the application of driverless vehicle advanced safety equipment in electric buses; support the application of driverless vehicle advanced safety equipment and system development results in the design of electric buses with new technologies.

(ii) Create an ideal environment for transition to electric buses

Adjust and establish the 2030 Electric Bus Popularization Project, provide incentives for sustainable operation in coordination with the Electric Bus Popularization Project, establish feasible strategies and measures for the exit of large diesel passenger vehicles, create an ideal environment for electric buses, and strengthen the vehicle logistics support system to create an ideal environment for transition to electric buses.

iv
Implementation Measures
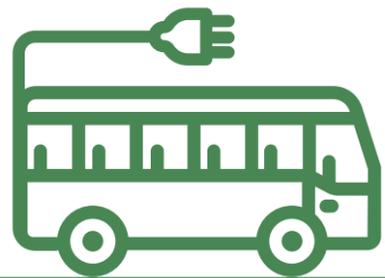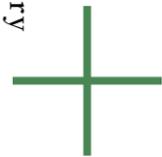
(iii) Enhance key equipment capabilities of the domestic smart electric bus industry

Integrate and establish key parts and components (e.g., vehicle control unit , motor, battery, and managing systems, etc.) to be developed for the domestic electric bus industry, as well as requirements and specifications for electric bus performance; establish a product development, testing, and verification platform and equipment capabilities for electric bus performance, parts and components, and advanced safety equipment and systems; establish strategies and measures for foreign companies to collaborate in technological development in Taiwan.

(iv) Support domestic vehicle safety testing and certification institutions

Build adequate testing and certification capabilities for electric buses, assist domestic and foreign testing and certification institutions in establishing collaboration and mutual report recognition mechanisms, and formulate feasible methods for implementing vehicle safety certification in Taiwan, as well as mutually beneficial mutual recognition with foreign institutions.

(i) Integrate the vehicle industrial chain to establish new specifications and develop new products

Short-term:

Bring together vehicle manufacturers, V2X (Vehicle-to-everything) companies, manufacturers of key parts and components for electric buses with the testing institution (Automotive Research & Testing Center), and certification institution (Vehicle Safety Certification Center), design and establish new specifications for electric buses, in order to develop new electric bus products.

(ii) Implement specifications for advanced equipment and systems applied in electric buses and verification

Medium-term:

Establish advanced equipment and systems (e.g., AEBS, LDWS, and adaptive cruise control system) of electric buses that autonomous driving development results can be applied in, and functional requirements and specifications that must be met for commercial use.

(iii) Gain the ability to independently develop key parts and components and integrate systems of driverless vehicles

Long-term:

Pool funds together for a project to support driverless vehicle manufacturers in expanding the commercialization of R&D results; gain

the ability to independently develop key parts and components and integrate systems of driverless vehicles; accelerate applications in the design of electric buses with new technologies.

(iv) Transition to electric buses

Short-term:

Establish the 2030 Electric Bus Popularization Project, and provide incentives for bus companies to accelerate the transition to electric buses.

(v) Establish tax preference items and industry projects

Medium-term:

Establish feasible tax preference items and industry support projects to accelerate the commercial manufacturing and sales of electric buses in Taiwan.

(vi) Improve the infrastructure to meet power requirements of electric buses

Long-term:

Implement a feasible exit system for large diesel passenger vehicles of bus companies in coordination with the electric bus popularization project, complete the power supply system for electric buses, establish charging standards and charging interface compatibility specifications, popularize charging facilities, and build infrastructure for the vehicle logistics support system.

(vii) Promote key parts and components and specifications of vehicles

Short-term:

Cross-departmental collaboration in bringing together vehicle manufacturers, V2X companies, manufacturers of key parts and components for electric buses with the testing institution (Automotive Research & Testing Center), and certification institution (Vehicle Safety Certification Center), promote key parts and components in which Taiwan has an advantage, promote electric bus performance requirements.
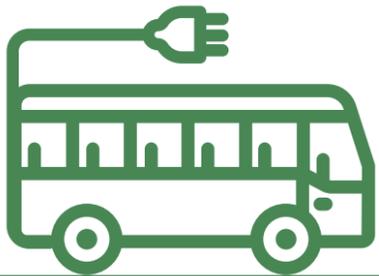
(viii) Establish a vehicle system and equipment sharing platform

Medium-term:

Formulate a subsidy plan to support testing and certification institutions or companies in the industry; build equipment capabilities for a testing and certification platform for electric bus performance, parts and components, and advanced safety equipment and systems.

(ix) Enhance technical capabilities and competitiveness of Taiwan's finished vehicles and key parts and components

Long-term:

Establish feasible tax preference items or subsidy measures, attract foreign automobile manufacturers to set up plants in Taiwan and jointly develop key items, and enhance technical capabilities and competitiveness of Taiwan's finished vehicles and key parts and components.

(x) Build testing and certification capabilities for electric buses

Short-term:

Support domestic vehicle safety testing and certification institutions, and build adequate testing and certification capabilities for electric buses.

(ix) Establish collaboration and mutual report recognition mechanisms with foreign institutions

Medium-term:

Support the domestic vehicle testing institution (Automotive Research & Testing Center), certification institution (Vehicle Safety Certification Center), and work together with foreign institutions in establishing a mutual report recognition mechanism.

(xii) Establish vehicle safety certifications with the EU

Long-term:

Establish feasible strategies to prioritize mutually beneficial mutual recognition of vehicle safety certifications with the EU.

IV.

Policy for the smart electric motorcycle technology industry

"Energy conservation and carbon reduction" is a global trend across industries. Countries around the world are attaching growing importance to the development of markets and industries related to low-carbon and green energy transportation tools, and are providing subsidies to guide their domestic industries to take the lead in establishing international standards. Motorcycles are an indispensable transportation tool to most Taiwanese people in their daily lives. The depth of the domestic market has made Taiwan a major motorcycle manufacturer worldwide for half a century. Taiwan has world class manufacturers and complete parts and components supply capabilities. If Taiwan can incorporate advanced ICT (Information Communication Technology) into plans for the electric motorcycle and smart in-vehicle communications industries, motorcycle manufacturers can find new ways to provide value, generate revenue, and improve efficiency through sharing services in an era of digital transformation, creating a new "pride of Taiwan" in the international smart electric motorcycle market. Important issues that must be prioritized are clarified below based on observations of the status and the vision and objectives. Further development strategies and implementation measures are then outlined on this basis.

i

Current Status and Development Vision

The United Nations Paris Agreement took effect on November 4, 2016, and countries should soon reach the peak of their greenhouse gas emissions. The world is becoming more and more supportive of replacing gas-powered vehicles with electric vehicles. Many countries (e.g., Taiwan, the Netherlands, France, Germany, the United States, and Japan) provide subsidies and tax reductions or exemptions to encourage their citizens to purchase electric motorcycles. Electric vehicles are the way of the future, and the global electric motorcycle market will soon enter a phase of rapid growth. To drive the development of the smart electric motorcycle industry, Taiwan's government will invest NT$16.661 billion in related projects and subsidies between 2020 and 2030. This is expected to increase output value by approximately NT$50 billion and create approximately 21,000 jobs in the next 5 years. If the global market grows at an annual rate of 30%, the projects are expected to increase output value by approximately NT$145 billion in the next 10 years.

The future vision for the smart electric motorcycle technology industry was outlined as follows 4 advisory meetings:

(i) Promote eco-friendly electric motorcycles to effectively improve Taiwan's issue with air pollution.

(ii) Improve traffic safety management through V2X applications of big data from smart motorcycles.

(iii) Promote smart electric motorcycles and develop innovative business models.

(iv) Enhance the international competitiveness of electric motorcycles to create a NT$100 billion industrial chain.

According to statistics from the Ministry of Economic Affairs (MOEA) on the motorcycle and parts manufacturing industry in 2018, there were a total of 522 domestic motorcycle manufacturers (37 motorcycle manufacturers and 485 motorcycle parts manufacturers), which employed 22,000 people (approximately 7,300 people in motorcycle manufacturing and 15,000 people in motorcycle parts manufacturing). Furthermore, according to statistics of Taiwan Transportation Vehicle Manufacturers Association, approximately 30% of domestically produced motorcycles is exported. Taiwan's motorcycle industry possesses a complete design, manufacturing, and parts and components supply system and system integration capabilities, which give it an advantage in developing the electric motorcycle industry. Domestic companies have shown their support for the policy to transition to electric motorcycles. Most manufacturers of parts and components for gas-powered motorcycles can directly transform into a member of the supply chain for the electric motorcycle industry. The government will use policy tools (e.g., Technology Development Program and R&D subsidies) to guide the gradual transformation of companies, and will also help companies develop an export-oriented strategy for the global gas-powered motorcycle market.

Current government subsidies for electric motorcycles are mainly on the user end and subsidize purchase or use, including subsidies provided by the MOEA for citizens to purchase electric motorcycles and companies to set up charging facilities; the Environmental Protection Administration provides subsidies for citizens to replace their old motorcycles with new ones; the Ministry of Finance provides tax reductions for citizens to replace their old

motorcycles with new ones; the MOTC provided citizens with subsidies between 2019 and 2020 for purchasing new motorcycles under 125 cc with an anti-lock braking system (ABS) or combination braking system (CBS); the Tourism Bureau encourages motorcycle rental companies to replace old motorcycles with new electric motorcycles, and provided subsidies for tourists to rent electric motorcycles on offshore islands and in Hualien and Taitung between 2017 and 2020; local governments provided additional subsidies for citizens to replace their old motorcycles with new ones. In addition, the MOTC has invested NT$7.246 billion in industrial research and development, the Ministry of Labor invested NT$15 million in 2021 to enhance the professional skills of locomotive companies, and the Office of Science and Technology Advisors invested NT$100 million in the Intelligent Transportation System Development Plan from 2017 to 2020 for projects related to motorcycle V2X safety. Government agencies will invest a total of approximately NT$16.661 billion over 10 years (as shown in Table 2).

Table 2 Government projects and subsidies for the electric motorcycle industry

No.	Subsidy/Project Name	Subsidy/ Project Budget	Responsible department
1	Intelligent Transportation System Development Plan (2017 to 2020) – Development of Motorcycle V2X Safety Equipment	NT$100 million	Ministry of Transportation and Communications
2	Electric motorcycle industry R&D, subsidize citizens to purchase electric motorcycles, and subsidize companies to set up charging stations	NT$7.246 billion	Ministry of Economic Affairs
3	Subsidize the replacement of old motorcycles with new electric motorcycles or gas-powered motorcycles that meet 7th generation emission standard gas-powered motorcycles	NT$400 million (2021)	Executive Yuan Environmental Protection Administration
4	Improve the professional skills of motorcycle repair shops	NT$15 million	Ministry of Labor
5	Subsidize new purchases or trading in old motorcycles for electric motorcycles	Approximately NT$8.9 billion	Local governments

ii
Key Issues

(i) Implement "smart" motorcycle technologies

Promote equipping electric motorcycles with smart technologies such as V2X and safety equipment, and encourage the development of innovative application services for motorcycle sharing, which will reduce the possession and use of private transportation tools in urban areas. Also, integrate resources of the ICT and intelligent transportation system (ITS) industries, integrate sensor and communication technology applications, collaborate with international companies to expand the industry's international market opportunities, and further facilitate the industry's development of innovative models.

(ii) Create a friendly "electric" user environment

Conduct rolling reviews of national standards for electric motorcycle charging/battery swapping stations and battery product regulations, standardize related products, and increase the penetration rate of electric motorcycle charging/battery swapping stations to increase citizens' willingness to use electric motorcycles. Establish an energy and vehicle information management platform; collect big data on recharging and vehicle operation, and operate recharging facilities. Explore the repurposing of batteries in electric motorcycles to establish an eco-friendly business model for the industry.

iii
Development Strategy

(iii) Guide the upgrade and transformation of the motorcycle industry

Steady transformation of the motorcycle industry that considers to both the development of the gas-powered motorcycle industry and the transformation and upgrade of energy used to power motorcycles, planning a policy that simultaneously promotes electric/gas-powered motorcycles. Guidance for the upgrade and transformation of conventional motorcycle repair shops from 2019 to 2022, repair technique courses for electric motorcycles and 7th generation gas-powered motorcycles were offered, and assistance was provided for obtaining funds to improve the employment environment. Electric motorcycle manufacturers are required to release repair and sales opportunities to improve the skills of mechanics and revenue of motorcycle repair shops.

(i) Promote equipping electric motorcycles with smart technologies such as V2X and safety equipment

Continue to coordinate with the United Nations Economic Commission for Europe to implement motorcycle safety and smart technology regulations in Taiwan, encourage and subsidize companies to engage in the development of smart/safety technologies such as V2X, and implement them in motorcycles available in the market for consumers to choose from. Guide and encourage local governments and private companies to develop smart roadside facilities needed to develop smart motorcycles, and develop an integrated cloud service platform.

(ii) Encourage the development of innovative application services for motorcycle sharing

Encourage motorcycle sharing application service providers, motorcycle manufacturers, and local governments to integrate related resources to develop a turnkey business model, and encourage local governments to reference the transportation information obtained through the collaboration model when planning smart city development. Output the business model of the motorcycle sharing industry, and increase the willingness of overseas markets to

adopt the business model. Expand turnkey output, form alliances to establish plants in ASEAN countries, and develop emerging markets to meet the demand of cities worldwide on green transportation.

(iii) Conduct rolling reviews of national (industry) standards for electric motorcycle charging/battery swapping stations and battery product regulations

Continue to review national standards for electric motorcycle charging (battery swapping) equipment, simultaneously apply to charging/battery swapping stations, and reference international standards and the implementation status in Taiwan. Determine items in lithium batteries and chargers used by electric motorcycles that need to be inspected, and periodically disclose information on qualified electric motorcycle batteries and chargers for user safety and traffic safety, and to ensure the safety and quality of electric motorcycle batteries and chargers.

(iv) Increase the penetration rate of electric motorcycle charging/battery swapping stations, and establish an energy and vehicle information management platform

Assist electric motorcycle companies and motorcycle sharing application service providers with applications to establish charging facilities or motorcycle sharing locations in public transportation stations and locations under the jurisdiction of local governments; amend the signage of electric motorcycle charging and switching stations to expand the usage rate of electric motorcycle charging and battery swapping stations. Promote the joint development of energy solutions and an operations information management platform by manufacturers and state-owned enterprises; collect big data on recharging and vehicle operations, and operate recharging facilities.

(v) Repurposing batteries

Encourage manufacturers or operators to establish a model for repurposing batteries, encourage and provide subsidies to companies to use repurposed batteries for practical applications, such as energy storage, and continue to repurpose batteries to achieve source reduction and reuse.

(vi) Implement the policy to promote both electric and gas-powered motorcycles

Plan subsidies to replace 1-4th generation gas-powered motorcycles with electric motorcycles or 7th generation gas-powered motorcycles. Combine the capabilities of government and corporations to provide guidance and assistance to the industry with transformation in motorcycle manufacturing, marketing, repair, and use.

(vii) Transform and upgrade motorcycle repair shops

The Ministry of Labor has continued to aid the Ministry of Economic Affairs (MOEA) to implement the "Skills Training Program to Promote the Upgrading and Transformation of Motorcycle Companies" and to encourage labor unions and institutions (e.g., motorcycle companies) to apply for vocational training programs to offer courses related to electric motorcycles. Provide guidance to motorcycle repair shops to diversify, increase their sources of revenue, and enhance their competitiveness. Encourage electric motorcycle manufacturers to establish a new mode of cooperation with conventional motorcycle repair shops for repair and sales. Make electric motorcycle repair techniques available through training, and allow the repair of electric motorcycle parts not covered under warranty.

iv
Implementation Measures

(i) Guide and encourage local governments and private companies to develop smart roadside facilities needed to develop smart motorcycles, and develop an integrated cloud service platform

Short-term:

Build on research results of the Project of Adopting V2X Technology to Improve Motorcycle Safety and Field Trial Analysis, provide guidance and encourage private companies and local governments to participate in R&D, and establish related information platforms.

(ii) Encourage and subsidize companies to engage in the development of smart/safety technologies such as V2X, and apply the technologies in motorcycles available in the market for consumers to choose from

Short-term:

Continue to carry out the Project of Adopting V2X Technology to Improve Motorcycle Safety and Field Trial Analysis, and strengthen smart management of motorcycle safety. Continue to carry out extension projects in the future, consider ways for breaking through usage limitations of the current system, and integrate AI with existing roadside facilities to strengthen detection and warning performance, so that roadside equipment can be used for in-depth analysis of driving behavior.

(iii) Continue to align with international standards by coordinating with the United Nations Economic Commission for Europe to implement motorcycle safety and smart technology regulations in Taiwan, making motorcycles safer, smarter, and more high-tech

Medium-term and long-term:

Continue to look into international regulations on motorcycle safety and smart technologies, and review and amend the Road Traffic Management and Penalty Act, Regulations Governing Road Traffic Safety, and Vehicle Safety Testing Directions when appropriate. Establish standards for vehicle, information, privacy, etc., of intelligent technology/safety devices, such as V2X, to improve driving safety by actively providing drivers with relevant alerts through intelligent electric motorcycles.

(iv) Integrate resources of ICT and intelligent transportation system (ITS) industries across departments, jointly establish common industry standards, become aligned with the international market, and enhance industrial competitiveness

Medium-term and long-term:

With regard to the strategy for developing industrial clusters, the MOEA engages in technological development while the MOTC carries out actual field verification, and uses motorcycles as a vehicle for smart and electric technologies. Corporations assist by integrating resources of the ICT and ITS industries and establishing common standards, developing motorcycles into a smart mobile service platform that integrates sensor and communications technologies. The corporations collaborate with international companies to expand the industry's international market opportunities, and further facilitate the industry's development of innovative models.

(v) Integrate planning of motorcycle information and communications, traffic control system, and smart safe intersections into the traffic management information and communication platform to improve traffic safety

Short-term:

The MOTC and county/city governments all have a traffic monitoring system, but the large amounts of image data are currently only used for traffic flow and road monitoring. Camera or radar integrated with roadside equipment is the market trend, the roadside equipment above will be combined with advanced augmented reality image recognition technology, and will integrate traffic flow, signals, and intersection information to improve traffic safety.

(vi) Encourage the development of innovative applications for motorcycle sharing: Reduce possession and use of private transportation tools in urban areas through service and industry development

Medium-term and long-term:

Motorcycle service providers launch sharing services following the arrival of the digital transformation era, providing the motorcycle industry with new customer experiences, business models, and operating procedures through motorcycle sharing, finding new methods to provide value, generate revenue, and improve efficiency. Encourage the development of innovative application services for motorcycle sharing, such as WEMO, GoShare, reducing possession and use of private transportation tools in urban areas. Encourage motorcycle sharing application service providers, motorcycle manufacturers, and local governments to integrate related resources to develop a turnkey business model. Encourage local governments to reference the traffic information obtained through the mode of cooperation when planning smart city developments.

(vii) Encourage motorcycle manufacturers to use the turnkey business model for international output

Medium-term and long-term:

Evaluate using diplomatic resources to output the motorcycle sharing industry's business model, and increase the willingness of overseas markets to adopt the business model. Expand turnkey output, form alliances to establish plants in ASEAN countries, and develop emerging markets to meet the demand of cities worldwide on green transportation. Develop customized business models based on recharging and vehicle operations big data, with the aim of developing Taiwan into an international center for big data on electric motorcycle operations, which will benefit output overseas and create new business opportunities, and also developing an integrated cloud service platform.

(viii) Ensure the safety and quality of electric motorcycle batteries and chargers

Short-term:

Determine items in lithium batteries and chargers used by electricmotorcycles that need to be inspected, and periodically disclose information on qualified electric motorcycle batteries and chargers. Electric motorcycles must pass battery insulation resistance measurement, circuit insulation resistance measurement, dielectric strength tests, continuity of potential equilibrium between any two exposed conductive parts, car wash tests, and flooded road driving tests in "the prevention requirements for high temperature, compression, and electrical shock of electric motorcycles" set forth in Article 65 of the Vehicle Safety Testing Directions.

(ix) Continue to review national standards for electric motorcycle charging (battery swapping) equipment

Medium-term and long-term:

Continue to conduct rolling reviews of national standards for electric motorcycles and charging/battery swapping stations based on the 21 national standards for electric motorcycles and 5 national standards for electric motorcycle charging/battery swapping stations established by the Bureau of Standards, Metrology & Inspection, Ministry of Economic Affairs. Simultaneously apply it to charging/battery swapping stations, and reference international standards and the implementation status in Taiwan to continue improving management regulations.

(x) Increase the penetration rate of electric motorcycle charging/ battery swapping stations

Short-term:

Complete the establishment of 3,310 electric motorcycle charging/ battery swapping stations under the "Electric Motorcycle Industry Innovation and Upgrade Project" before 2022, so that cumulative number of recharging facilities will reach 4,910 stations. Assist electric motorcycle companies and motorcycle sharing application service providers with applications to establish charging facilities or motorcycle sharing locations in long distance public transportation stations, such as Taiwan Railways Administration and Taiwan High Speed Rail, and locations under the jurisdiction of local governments. Encourage and promote shared recharging facilities to increase the utilization of facilities and increase incentives to establish recharging facilities. Amendment of Article 122-2 of the "Regulations for Road Traffic Signs, Markings, and Signals" to expand the feasibility of using electric motorcycle charging and battery swapping stations.

(xi) Promote collaboration between motorcycle manufacturers and state-owned enterprises in developing energy solutions and an operations information management platform

Medium-term and long-term:

The Industrial Development Bureau (IDB), MOEA provides guidance to motorcycle manufacturers and state-owned enterprises to jointly establish complete services from production and sales, maintenance, charging, to battery swapping. The IDB continues to collect data from recharging facilities established with subsidies, and references the data for future implementation and establishment of recharging facilities.

(xii) Encourage motorcycle manufacturers or operators to establish a battery repurposing model

Medium-term and long-term:

The IDB cooperates with the EPA in encouraging motorcycle manufacturers or operators to establish a battery repurposing model, in order to properly handle waste batteries and reduce environmental pollution.

(xiii) Continue to implement battery repurposing to achieve source reduction and reuse

Medium-term and long-term:

Pursuant to the Waste Disposal Act enacted by the EPA, waste batteries are processed in Taiwan or overseas. The resource management model for reusing waste effectively achieves source reduction, recycling, and reuse. The supervisory authority of highways helps remind citizens to cooperate with the EPA's waste battery repurposing policy when citizens scrap their old vehicle or collect their license plate.

(xiv) Plan subsidies to replace 1-4th generation gas-powered motorcycles with electric motorcycles or 7th generation gas-powered motorcycles

Short-term:

The EPA expanded the subsidy plan for replacing old motorcycles with new ones starting in 2020, encouraging citizens to replace their 1-4th generation gas-powered motorcycles with electric motorcycles or 7th generation gas-powered motorcycles.

(xv) Combine the capabilities of government and corporations to provide guidance and assistance to the industry with transformation in motorcycle manufacturing, marketing, repair, and use

Medium-term and long-term:

Combine the government and corporations' capabilities for industrial chain integration, development of common parts and components, establishment of additional charging (battery swapping) stations for new models, promotion of innovative business models, promotion of vehicle models with high cost-performance ratio, and provision of greater incentive to purchase and use vehicles.

(xvi) Improve the professional skills of mechanics at motorcycle repair shops, so that they not only know how to repair gas-powered motorcycles, but also have learned how to repair electric motorcycles

Short-term:

The Ministry of Labor uses the Employment Security Fund in coordination with the transformation of motorcycle repair shops, and provides guidance to the 28,000 motorcycle repair shops nationwide. The "Promotion of Counseling Skills Enhancement from 2019 to 2022" project aims to assist motorcycle companies to improve the maintenance technology of new environment-friendly gas-powered motorcycles and electric motorcycles. The

project cooperates with domestic industries and universities to launch professional technology and management courses, providing courses on practical skills of gas-powered and electric motorcycle maintenance, E-system operation and management, etc., to guide operators to transform their software and hardware capabilities, as well as their diversified services.

(xvii) Provide guidance to motorcycle repair shops to diversify, increase their sources of revenue, and enhance their competitiveness

Short-term:

The strategy to "enhance gas-powered/electric motorcycle maintenance and repair abilities" was implemented in 2019, diversifying the business of motorcycle repair shops to increase their sources of revenue, and enhancing the professional skills of mechanics to increase their employment opportunities. The Ministry of Labor also offered the "Small Business Manpower Enhancement Program" and the "Enterprise Manpower Enhancement Program," under which the government subsidizes part of or all the training costs of labor unions with training capabilities to jointly train the relevant technical manpower required by the motorcycle industry.

(xviii) Encourage electric motorcycle manufacturers to establish a new mode of cooperation with conventional motorcycle repair shops for repair and sales

Short-term:

The government encourages gas-powered motorcycle and electric motorcycle industries to grow together, and coordinates electric motorcycle manufacturers to make repair techniques and opportunities available in the motorcycle transformation process. The government will also provide guidance to conventional motorcycle dealers to sell electric motorcycles, mitigating the impact on conventional motorcycle dealers and allowing them to successfully complete transformation.

V.

Policy for the bicycle and tourism industry

With increasing environment and health awareness, the general public has gradually accepted bicycles as a transportation tool that can be used for getting around and leisure activities. The government has set out to encourage the use of bicycles along with public transportation to form a green transportation network, which will reduce energy consumption and environmental pollution. The Annual Report on Tourism from the Tourism Bureau shows that foreign visitors are changing the way they travel in Taiwan and are increasingly choosing experience-based travel activities. In the future, and according to this trend, the government's focus in promoting the bicycle and tourism industries will be on how to continue to improve the safety and user-friendliness of bicycle networks, connect with the tourism industry, and link together the regional cycling route network to deepen visitors' experience. Important issues that must be prioritized are clarified below based on observations on the current status and vision. Further development strategies and implementation measures are then outlined on this basis.

i

Current Status and Development Vision

The number of cars and motorcycles has grown rapidly along with economic development. This has brought great convenience to public life, but has resulted in challenges ranging from traffic jams to air pollution in urban areas. In recent years, the effects of global warming and climate change have led to the development of green transportation, more specifically a green transportation network formed by bicycles and public transportation systems, which provide a solution to energy consumption and pollution by means of transportation. The MOTC has dedicated itself to devising a bicycle network and integrating tourism marketing since 2009, and implemented the "Bicycle Lane Network System in the Eastern Region Plan," which has transformed Hualien and Taitung into a cyclist's paradise. The trunk cycling network around Taiwan (Cycling Route No. 1 and 25 branch routes) was completed in the period from 2015–2018 and has given rise to a trend of cycling around the island.

To attract more domestic and foreign tourists to participate in bicycle tours and strengthen the development of the tourism and bicycle industries at the same time, the MOTC has set 2021 as the year of bicycle tourism in Taiwan, and plans to invest NT$1.6 billion in the "Circum-Island Bicycle Path Upgrade and Route Integration Project" between 2020 and 2023.

The MOTC will continue to ensure the safety and user-friendliness of the cycling system in the future and connect the bicycle and tourism industries by linking the circum-island trunk route with local cycling networks and scenic spots. The MOTC will also offer seamless transfer between railways and cycling routes, build cycling (rental) stations, improve the quality of the tourism environment and service facilities, and reinforce the connection between bicycle laws and regulations and local culture, industries, tourism, nature, and the environment, in order to create a high-quality and friendly cycling environment, and stimulate the development of the bicycle and tourism industries.

The MOTC has organized a wide range of bicycle-related travel events since 2011, which has led to the rise in domestic bicycle touring events. Bicycle industries (e.g., electric bicycles) were included in coordination with the Council of Transportation Technology Industry, and new employment opportunities and total output value in the next 5 and 10 years are estimated below (as shown in Figure 6).

Figure 6 Expected job increase and total output value of the bicycle industry in 5 and 10 years

2023 **5 years**	2028 **10 years**	2023 **5 years**	2028 **10 years**
new employment opportunities	new employment opportunities	in total output value	in total output value
5.165 /person	**12.023** /person	NT$**4.45** billion	NT$**10.36** billion
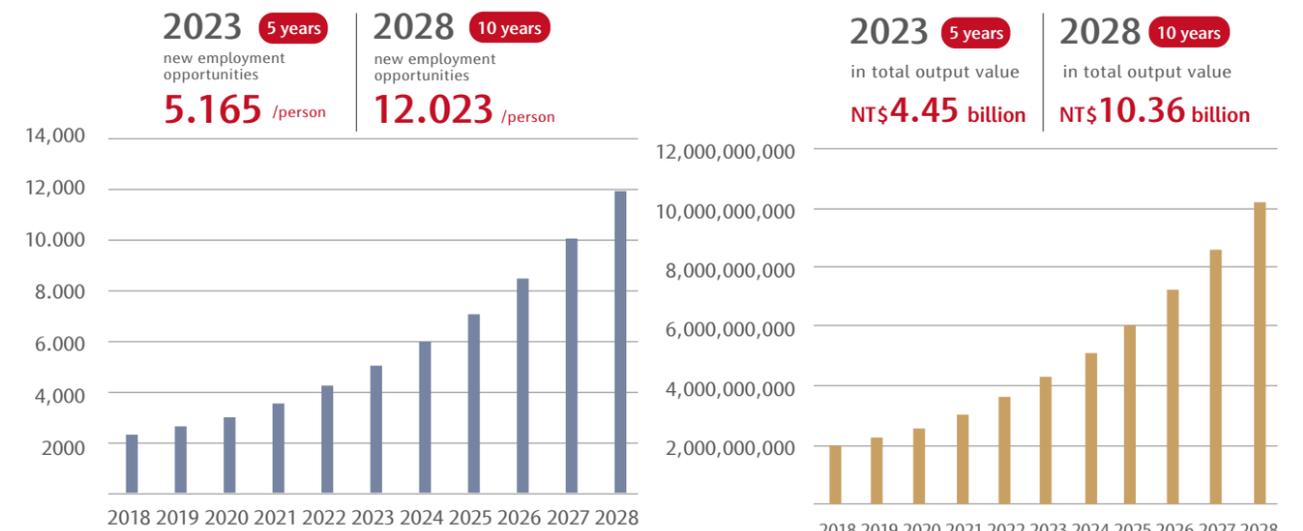
Source: Tourism Bureau

Note: data contains cycling events organized by the jurisdiction of the Tourism Bureau, peripheral economic output value created by cycling teams of travel agencies, and annual output value of electrically assisted bicycles.

ii
Key Issues

(i) Roaming around Taiwan on a bicycle

"Driving is too fast and walking is too slow. Roaming on a bicycle is the best way to see and experience Taiwan." Hence, the primary mission is to plan an inclusive cycling route and establish a friendly and safe cycling environment. In addition, proper travel service information and promotion will allow places around Taiwan to garner more attention and popularity, and create greater output value and benefits for tourism.

(ii) Linking together green transportation tools

The range of in-depth roaming for bicycles is comparatively restricted. Hence, people who carry their bicycles can take TRA bicycle-friendly trains or take the train and then rent bicycles when they arrive at stations. Using train stations as a starting point for a wide variety of cycling tours will expand the range of cycling tours and tourist economy.

(iii) Involvement of the private sector and future development of the bicycle industry

The bicycle and tourism industries also require upgrading and transformation as time progresses. In the past, the government had invested resources solely in building a bicycle network and promoting related events, but that no longer meets the current demand. In the future, private sectors are encouraged to work with the government in legislating and attracting support from companies, which will contribute to the development of bicycle industries.

iii
Development Strategy

(i) Plan cycling routes for in-depth roaming and create a friendly cycling environment

The MOTC approved the "Circum-Island Bicycle Path Upgrade and Route Integration Project" which spans 2020–2023. The project uses the completed circum-island cycling route network as the main system under national scenic park jurisdiction, and develops a variety of cycling networks with the local government. The direction of the plan aims to achieve one-stop service, circum-island upgrade 2.0 (better safety, better supplies), localization, internationalization, and smart bicycle tours.

(ii) Establish a friendly tour service platform

The MOTC will use existing travel websites as the main medium of promotion and provide citizens with more user-friendly information that incorporates tourism industries and bicycle rentals, which allows citizens to plan their own bicycle tours more effectively.

(iii) Guide or establish complete bicycle rental locations

Linking together green transportation tools can expand the area of tours and stimulate the tourist economy. Hence, guiding or establishing complete bicycle rental locations will benefit the promotion of green vehicles and attract more visitors to engage in low-carbon tourism.

(iv) Plan marketing and promotion work

The MOTC implemented the "Bicycle Lane Network System in the Eastern Region Plan" in 2009–2012 and the "Overall Planning of a Nationwide Bicycle Friendly Road Network and MOTC Cycling Route Network Construction Project" in 2015–2018, and bicycle tours have become popular ever since. In the future, besides promoting routes that were already completed, the diverse routes included in the "Circum-Island Bicycle Path Upgrade and Route Integration Project" will be promoted in 2020–2023 to provide citizens with a wider variety of bicycle tours to choose from.

(v) Well-planned TRA schedule and user-friendly, accessible ticket reservation system

A well-planned TRA schedule and ticket reservation system will help citizens take the train with their own bicycle, or travel by train and rent bicycles at destinations; this will become a more convenient and seamless way for citizens to transfer between modes of transportation and draw them to low-carbon tours.

(vi) Encourage bus companies to provide luggage compartments to place bicycles on the bus

For some destinations that cannot be reached by train, bus companies are encouraged to provide the luggage compartment to place bicycles. Thus, citizens can bring their own bicycles on the bus to experience the convenience of seamless transfer and participate in low-carbon tours.

(vii) Well-planned public transportation for incoming passengers and cooperation from related companies

The number of foreign visitors on cycling tours has risen in recent years. Friendlier public transportation information will be provided for incoming travellers to use in the future.

(viii) Promote human-oriented transportation and a livable city

"Human-oriented transportation" is the MOTC's foremost administrative policy. The MOTC looks forward to incorporating cycling route practices into urban (road) design through the review of establishment rules and design specifications which can create an environmentally friendly human-oriented transportation.

(ix) Continue to review the type and positioning of e-bikes

Promoting e-bikes is the key to the development of bicycle tours, but the market positioning of e-bikes remains ambiguous, as comprehensive laws and regulations have not yet been finalized. Hence, the issue concerning the types and positioning of e-bikes will continue to be reviewed and reshaped in accordance with the requirements of laws and regulations in the future.

(x) Promote and supervise e-bike companies to provide qualified e-bikes, in order to ensure consumer rights and cycling safety

Promoting e-bikes will play a vital role in improving bicycle tours in the future. The MOTC will continue to promote and supervise e-bike companies to offer qualified e-bikes to ensure consumer rights and cycling safety.

(xi) Legalize passenger carrying on bicycles

Carrying passengers on bicycles has become widely accepted and is regarded as legal in countries such as Japan and the Netherlands. Thus, the MOTC will continue to review the laws to permit young children to be carried on bicycles.

(xii) Invite the private sector to jointly promote cycling and provide a cycling-friendly environment

In addition to bicycle projects supervised by the government for creating a cycling-friendly environment, the MOTC will invite the private sector to promote cycling and encourage citizens to cycle to work, which can reduce energy-consumption and carbon emissions.

iv
Implementation Measures

(i) Plan and establish diverse cycling routes

Short-term, medium-term, and long-term:

The MOTC plans to implement the "Circum-Island Bicycle Path Upgrade and Route Integration Project" in 2020–2023, and will improve the circum-island bicycle network, plan diverse cycling routes, and set up a website to provide more inclusive recommended routes.

(ii) Provide service information on partnership among tourism and bicycle industries

Short-term:

The MOTC will use main existing travel websites, including travel agencies, followed by hotels and bicycle rental companies.

(iii) Provide public bicycles at major transportation stations or information on bicycle rentals in each county/city

Short-term, medium-term, and long-term:

Linking together green transportation tools can expand the range of tours and create greater benefits for the tourism industry. Hence, the MOTC commissioned every domestic county and city to establish public bicycle systems or provide information on bicycle rentals at major transportation stations.

(iv) Develop international cycling routes and unique tours

Short-term:

The MOTC has organized cycling competitions and tours in the Taiwan Cycling Festival since 2011, and will continue to design international cycling routes and unique tours in the future to develop in-depth local bicycle tours alongside Taiwan's stunning attractions, while also linking with local industrial promotion.

(v) Reshape the TRA system and equipment

Short-term:

Improve TRA's schedule to meet the needs of bicycle riders; increase the number of the train cars to make bicycle riders more comfortable; create a ticket reservation system that is more accessible to citizens and foreign visitors.

(vi) Encourage bus companies to replace old buses with qualified bicycle buses

Medium-term and long-term:

Besides linking TRA trains with green transportation tools, the MOTC will also encourage bus companies to replace obsolete buses with qualified buses that can carry bicycles.

Improve transfer information at Songshan, Taichung, Kaohsiung, and Taoyuan international airport for inbound and outbound passengers who bring their bicycles

(vii) Discussion on the optimization of bicycle transfer and related information for passengers carrying bicycles who are arriving in and departing from Songshan, Taichung, Kaohsiung, and Taoyuan International Airports

Short-term:

Apart from linking together green transportation tools to serve domestic passengers, public transportation designed for foreign passengers is also required. Hence, the MOTC is scheduled to offer more detailed transfer information onto the websites of the Taipei, Taichung, Kaohsiung, and Taoyuan airports to foreign travelers who travel with their bicycles.

(viii) Plan to incorporate cycling route practices into urban (road) design specifications and dissemination

Short-term:

Review the space requirements of bicycles when arranging slow lanes or bicycle lanes, and set up a "motorbike waiting zone" at intersections as needed. In the event that the roads are not wide enough, alternative routes or reducing the speed limit on the outside lane will be considered in order to ensure a safe and friendly cycling environment. The Directorate General of Highways, MOTC plans to adjust the minimum width of the slow lanes from 2 m to 1.5 m in the Highway Route Design Specifications, in order to make the cycling environment friendlier and safer.

Medium-term and long-term:

Implement pilot projects in coordination with requirements of bicycle-related projects and amend article contents of the "Regulations for Road Traffic Signs, Markings, and Signals."

(ix) Continue to review the type and positioning of e-bikes

Medium-term and long-term:

Continue to align with international standards, properly review the type and positioning of e-bikes and transportation laws and specifications.

(x) Promote and encourage e-bike companies to offer qualified e-bikes

Medium-term and long-term:

Promote and assist e-bike companies to provide qualified e-bikes and prohibit modifications to the electronic control device for customer safety. Continue to inspect non-compliant e-bikes in the market to ensure they follow relevant vehicle management laws, and take all necessary measures in accordance with regulations to ensure consumer rights.

(xi) Implement supporting measures to legalize passenger carrying bicycles

Short-term:

Continue to review traffic laws, legalize the carrying of young children on bikes, and implement complete supporting measures for bicycles, luggage racks, and child bike seats.

(xii) Encourage the private sector to jointly promote cycling and create a friendly cycling environment

Medium-term and long-term:

Assess the feasibility of government and companies encouraging or subsidizing the purchase of e-bikes. Encourage the establishment of bicycle supply stations and bicycle-friendly companies to organize cycling events. Assess the feasibility of granting transfer subsidies for both public bicycles and public transportation tools.

VI.

Policy for the smart port and airport service industry

P ort and airport facilities not only have to meet basic requirements for international trade and transportation; their performance concerns a nation's overall competitiveness and is a key factor to drive economic growth. Besides reviewing and planning the positioning and layout of ports and airports from the perspective of national spatial planning and economic development, the government must continue to invest resources in the development and update of related software and hardware facilities, in order to improve the effectiveness of resource use and meet the need for industrial development. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. About future development strategies and implementation of the smart port and airport service measures are further outlined on this basis.

2021

White Paper on Transportation Technology Industry Policy

i
Current Status and Development Vision

Ports and airports are our gateway to the world and concern the efficiency and quality of Taiwan's connections with the world. Maritime and air transport of Taiwan have developed on a good foundation over the years. Evergreen Marine Corp. and YangMing Marine Transport Corp. are among the world's top 10 ocean carriers. Taoyuan International Airport repeatedly scored high in international ratings, and ranks up to the top in terms of freight volume. The ICT industry solid capabilities provides an advantage for Taiwan's innovative developments. Therefore, we will make good use of information and communication technology to build smart ports and airports that meet the requirements of efficiency, quality, safety and sustainability. We will also continue to promote the smart transformation of the service industry in ports and airports to provide a sense of service to inbound and outbound passengers and convenient transportation of goods, and promoting the nationalization and autonomy of the port and airport service industry.

To apply smart technology for the renewal of Taiwan's national gateway and open up a new digital era for airports and ports, we will reference and learn from smart technology applications used in benchmark international ports and airports. On this basis, we will propose smart port and airport development

projects, gradually complete smart port and airport infrastructure, and create an excellent development environment to create business opportunities for the industry. The MOTC plans to invest NT$192.8 billion in ports and airports by 2024, and expects to increase economic output value by approximately NT$182.9 billion and create 15,429 employment opportunities, in which approximately NT$51.8 billion will be invested in smart technology to create economic output value of approximately NT$ 130.5 billion, while creating 6,414 employment opportunities. Cumulative investments by 2029 will reach NT$221.7 billion, and are expected to create an economic output value of approximately NT$ 460.8 billion and 101,770 employment opportunities, in which cumulative investments in smart technology account for approximately NT$80.7 billion, and are expected to create an economic output value of approximately NT$356 billion and 83,614 employment opportunities (the investments above do not include airside facilities such as land acquisition and runways/taxiways).

To achieve policy goals for smart ports and airports, smart port and airport task forces will each be established to propose development plans, which will work with the industry to create an ecosphere and form a national team. The task forces will systematically review development requirements and priorities of smart ports and airports. Subsequently, key infrastructure for software and hardware will be constructed based on operational and core technology requirements, and a field for applying new technologies will be provided for R&D by innovative industries in Taiwan and overseas. Furthermore, to improve operational efficiency and the effectiveness of industry inputs, the MOTC hopes to bring together industry, government, academia, and research institutes to develop a system for coordinating and integrating resources for the development of applications and sharing, and then expand smart technology applications on this basis in ports and airports (as shown in figure 7 and figure 8). Driving the innovative development of the ICT industry will allow smart ports and airports to become a self-sufficient and localized industry that will create business opportunities and achieve the vision for future developments.

Figure 7 Smart airport applications
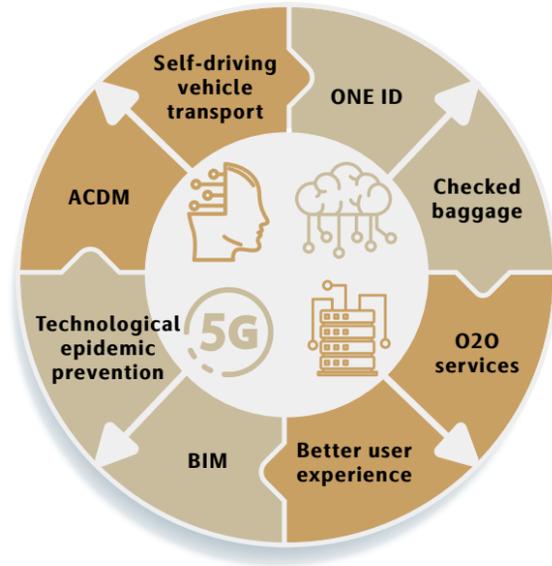
Figure 8 Smart port applications
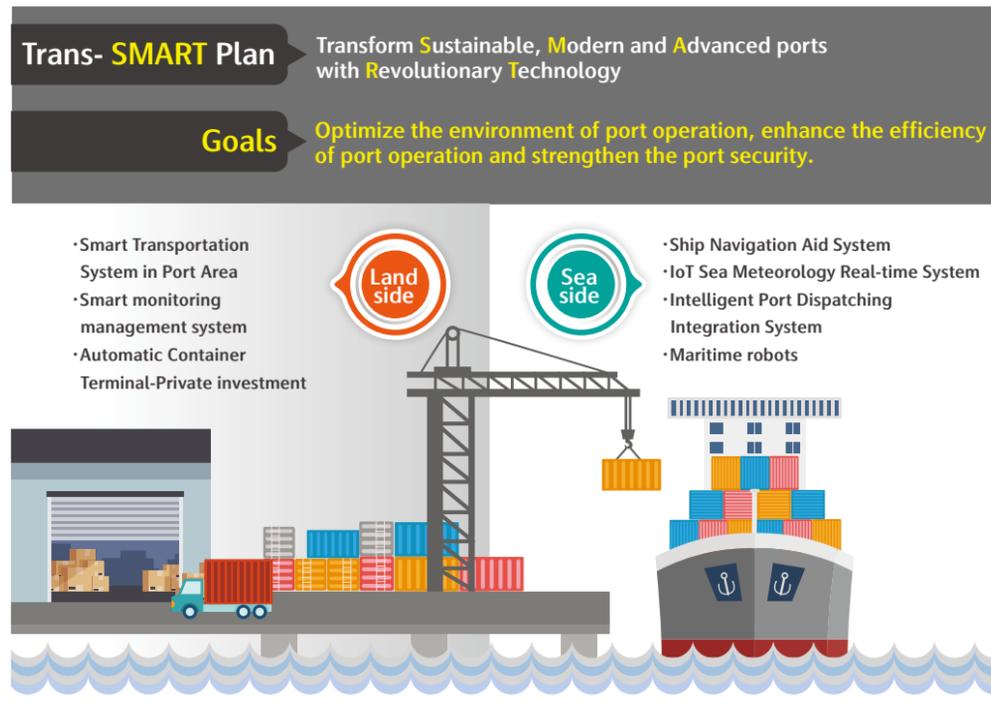
ii
Key Issues

(i) Port and airport ICT infrastructure need to be actively and constantly upgraded

The first and most important task for smart port and airport development is the establishment of software and hardware infrastructure, such as the deployment of 5G network facilities and sensors, and the development of smart basic life supporting facilities, in order to establish good foundation for smart technologies. Furthermore, it is becoming increasingly difficult for existing software and hardware to meet operational requirements due to increasing in passenger volume and complex disasters. Under the limited land and human resources, aviation and ICT industries need to be integrated for airport transformation and upgraded. Meanwhile, ports must respond to growingly larger vessels, fluctuations in shipping supply and demand, and restructuring of shipping alliances, as well as bottlenecks in improving port performance, and industry informatization. Therefore, Taiwan's airports and ports urgently need to improve their smart infrastructure to provide aviation and shipping industries with an excellent development environment, and to improve the operational and decision-making efficiency of airports and ports.

iii
Development Strategy

(ii) Smart port and airport technology applications and industrial development are still in the initial stage

The application of smart technologies in airports and ports is still in the initial phase in Taiwan, and the industry's innovation and development can be accelerated through the expansion of smart technology applications and integration of upstream and downstream industries, including airlines, ocean freight forwarders, customs, trade, and peripheral industries.

(iii) Smart ports and airports need to be industrialized for stronger competitiveness

Besides improving the efficiency and quality of airports and ports, it is also necessary to industrialize smart ports and airports from an export-oriented perspective, in order to further increase the industry's momentum, enhance its competitiveness, and increase output value and business opportunities. To output port and airport industries worldwide, it is necessary to form an industry alliance, match companies with business opportunities through diverse channels, and achieve policy coherence for the industry's localization and self-sufficiency.

(i) Complete smart port and airport infrastructure, create an excellent development environment

To achieve the goal of completing smart port and airport facilities and creating an excellent development environment, a smart port and airport task force will be established to conduct a complete and in-depth review of the software and hardware requirements for smart ports and airports, as well as their development priority. The task force will establish the vision and goals for smart port and airport development, formulate forward-looking, integrated projects for the development of smart ports and airports, and build software and hardware infrastructure on this basis to create an excellent environment for developing smart ports and airports. Considering the large number of competent authorities related to port and airport management and related industries, an information sharing platform will be established in the future to improve the operational decision-making efficiency of competent authorities.

iv
Implementation Measures

(ii) Expand smart technology applications, drive industry innovation and development

An innovation/technology industry and service test field is needed for proof of concept of smart technology applications that are not yet finished or still in the idea phase. For smart technologies already mature in the current phase, companies are encouraged to apply the smart technologies in ports and airports, so as to improve the traveler experience and operational management performance. After ports and airports expand smart applications and services in the future, the port and airport industry ecosphere will be formed by industry, government, academia, and research institutes, to encourage enterprise adoption of new technology, and thus driving the industry's innovative development.

(iii) Implement export-oriented industrialization of smart ports and airports

In order to promote the industrialization of smart sea and air ports, a smart port and airport industry alliance will be organized to comprehensively enhance the level of domestic smart technology and innovation development, so as to promote the nationalization and autonomy of the industry; in addition, exporters will be matched with compatible foreign importers through multiple channels to facilitate business opportunities. Supporting measures of smart technology and administrative resources will also be coordinated to create an export-oriented smart port and airport industry.

(i) Establish the vision and goals for the development of smart ports and airports to formulate a forward-looking and integrated smart port and airport development plan

Short-term:

The smart port/airport task force will be established to conduct a complete inventory and in-depth investigation of the needs and development priorities of the smart port/airport software and hardware. The task force will propose a forward-looking investment plan for smart port, set specific short-, medium- and long-term development plans, set targets and performance evaluation mechanisms, develop a smart airport development plan, and propose an overall plan through a systematic and itemized approach.

(ii) Establish software and hardware facilities for smart port and airport to create an excellent development environment

Short-term:

Build smart ports software and hardware facilities (such as automatic port air and water quality measurement stations, environmental exceedance alarms, dangerous goods dynamic management, IoT sea meteorology real-time system, international commercial port gate posts, Ship navigation aid system, etc.), smart airport software and hardware facilities (such as 5G, wifi6

network facilities, BIM and other systems), establish a digital database of port/airport passenger and cargo transportation, and optimize existing port/airport information systems.

(iii) Provide pilot sites for new innovation/technology industries and services to develop POCs (Proof of Concept)

Short-term:

Invite startup entrepreneurs to conduct port/airport field exploration and testing, and to introduce small-area field verification measures, including driverless vehicle passenger shuttle services and UAS-based port smart inspections, etc.

(iv) Import smart technology to improve the passenger experience and port/airport management performance

Short-term:

Passenger check-in, customs clearance, and baggage check-in will be integrated with smart technology. AR and VR technologies will be used to enhance O2O services at the airport. AI technologies and smart aviation security systems will be implemented to enhance port operation management, smart monitoring and security. Diverse information channels will be implemented to disseminate information and provide advice to port passengers.

Medium-term and long-term:

Build the Airport-Collaborative Decision Making (A-CDM) System.

(v) Establish a Smart Port and Airport Industry Ecosystem

Short-term:

Establish a port/airport cross-domain ecosystem, strengthen resource integration and coordination, and plan business partner initiatives to encourage investment in port/airport smart services, creating business opportunities in the smart technology industry. Participate in international smart port/airport promotion organizations to learn from international benchmark airport and port smart practices. Use incentives, subsidies, promotion, and advocacy measures to encourage universities/associations to organize smart port/airport professional training courses.

Medium-term and long-term:

Expand industry-academia cooperation internship or observation programs to enhance professional skill levels and talent capabilities.

(vi) Promote the introduction of new technologies for enterprises to provide excellent services at ports and airports

Medium-term and long-term:

Explore methods to promote the digital transformation of enterprises (such as incentives and subsidies, competitions, campaigns and promotions, etc.)

(vii) Reconcile smart technology support measures and administrative resources to facilitate the application of smart technology

Short-term:

With the help of the Board of Transportation Technology Industries and the task force's consultation and communication platform, coordinate support measures and administrative resources for the development of regulations, information sharing, and confidentiality related to smart technology development.

(viii) Establish a smart port and airport industry alliance to promote the nationalization and autonomy of core technologies and the industry

Medium-term and long-term:

The Smart Port Alliance is an alliance of industry, government, academia, and research institutions to promote the nationalization and autonomy of core technologies and industries.

(ix) Match companies with business opportunities through diverse channels

Medium-term and long-term:

By organizing international forums and exhibitions for the port/airport industry, work together with TAITRA and industry unions to match industry opportunities and promote technology exports to increase the value of the industry.

VII.

Policy for the UAS technology industry

Following the advancement of electronics and ICT, the development of Unmanned Aircraft Systems (UAS) application services has already become an international trend. The high mobility and highly flexible deployment of UASs can effectively improve the mobility, accessibility, and safety of transportation systems. UASs can also help conventional transportation companies and logistics companies to engage in digital transformation and provide innovative services. More specifically, the R&D of UASs is no longer limited to the 3C entertainment industry. Thanks to breakthroughs in technical capabilities, it is possible for UASs to become important transportation vehicles in the future, and the development of diverse transportation applications will surpass the current scale to create immense value and business opportunities. To accelerate resource integration between industry, government, academia, and research institutes, and develop UAS technology application services in hopes of promoting Taiwan's experience to the international market, important issues that must be prioritized are clarified below, based on observations of the current status and the vision and objectives. Future development strategies and implementation measures are further outlined on this basis.

2021

White Paper on Transportation Technology Industry Policy

i
Current Status and Development Vision

According to Drone Industry Insights, a UAS market research firm, the global UAS market is expected to grow at a compound rate of 13.8% from 2020 to 2025, with Asia exhibiting the most significant growth. According to the company's 2018 survey, the main industry sectors in which commercial UASs are currently used are, in order of priority: energy, public administration, agriculture, science and technology services, transportation and storage, healthcare and social services, and construction. In addition, there are many traditional aviation, automotive, and start-up companies in the world that have invested in the design and manufacture of UAS for Urban Air Mobility (UAM) passenger applications, with some of them already reaching the test flight stage, making UAM one of the latest trends in the transportation field.

Considering the relatively small UAS market in Taiwan, future development of the UAS market should focus on international markets. According to market research and forecasts of the International Data Corporation (IDC), the compound annual growth rate of the global UAS market between 2017 and 2021 may reach 29.8%. The output value of UASs in Taiwan may reach NT$39.4 billion by 2030 if this growth continues, and will drive investments of NT$27 billion and create 9,000 employment opportunities.

To seize the opportunities in this industry, the MOTC will work together with the Ministry of Economic Affairs (MOEA), Ministry of Science and Technology (MOST), and Ministry of Education (MOE) in guiding the domestic UAS industry to form the U-Team. The MOTC will summarize the requirements of each department on UAS applications, plan and roll out the Integrated Pilot Program (IPP), and organize a UAS creative application contest. The MOTC plans to showcase the innovative technology development and application results of Taiwan in UAS industry forums and international conferences, and will invite leading UAS companies in Taiwan and overseas to summits and technology exchanges. The implementation strategies above are summarized in the Roadmap 2.0 for UAS developments in the field of transportation in Taiwan (as shown in Figure 9), which will guide the future development of Taiwan's UAS technology industry.

Looking towards future international trends, the next phase of development will focus on high-end aerial vehicles—the Air Taxi. The MOTC will dedicate its efforts to attracting leading multinational companies to invest in Taiwan and collaborate with domestic companies that possess key technologies, allowing Taiwanese companies to move to the forefront of the next generation UAS industry.
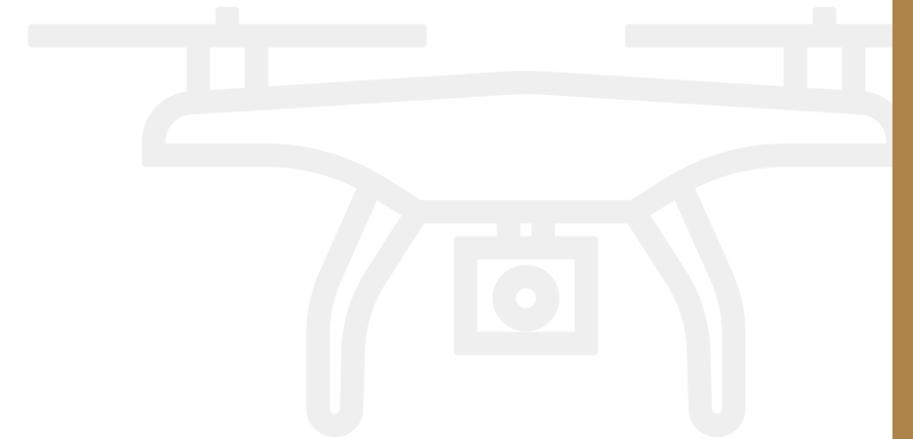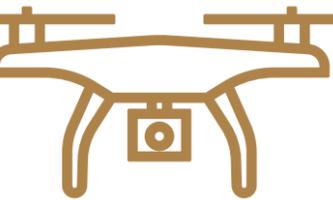
Figure 9 Roadmap 2.0 for UAS developments in transportation in Taiwan

Aspects	Goals	Strategies	Agency in charge	Short-term measures 2021–2025 (Focus on R&D)	Medium-term measures 2026–2030 (Capacity-building)	Long-term measures 2031– (Promotion and popularization)
Technology	Provide safe and reliable transportation services	Promote UAS testing for multiple applications	Ministry of Transportation and Communications / Ministry of Economic Affairs	Implementation of the Integrated Pilot Program (bridge inspection and logistics)	Promote logistics and UAM field test and verification projects	
			Ministry of Transportation and Communications	Implementation of countering UAS measures	Continue development of countering UAS measures	
		Invest in the research and development of key UAS technologies	Ministry of Transportation and Communications / Ministry of Economic Affairs	Promote the UAS sandbox verification program (bridge inspection, logistics)	Promote sandbox verification programs for urban logistics and rural UAM	Promote urban UAM sandbox verification project
		Subsidize basic UAS technology research	Ministry of Science and Technology	Subsidize UAS-related basic research via science and technology programs		
		Promote UAS air traffic management	Ministry of Transportation and Communications	Develop UAS tracking and identification technologies and air traffic management rules	Develop UAS air traffic management mechanisms	
		Establish UAS test sites	Ministry of Science and Technology / Ministry of Economic Affairs	Planning and construction of testing center sites and equipment	Planning and construction of testing center sites at various levels	Field tests and operations at various levels
Industry	Establish a fair and sustainable industrial ecosystem	Accelerate the introduction of UAS for public service applications	Ministry of Science and Technology / Ministry of Economic Affairs / Ministry of Transportation and Communications	Promote the IPP and replace Made-in-China UAS	Normalize the introduction of UAS for public service applications	
		Form the U-Team	Ministry of Science and Technology / Ministry of Economic Affairs / Ministry of Transportation and Communications	Establish an inter-ministerial collaboration mechanism and form the U-Team	Expand the scale of the U-Team	Export U-Team technologies internationally
		Plan innovative UAS service operation and management	Ministry of Transportation and Communications	Plan UAS-related operations, services, rights, responsibilities, insurances, and information security	Expand planning for for innovative UAS service sector and systems	
		Strengthen international marketing	Ministry of Transportation and Communications / Ministry of Economic Affairs	Organize domestic and international seminars and exhibitions	Organize international expos to attract international collaboration and investment	
Environment	Create a sound development environment	Harmonize regulations and management methods	Ministry of Transportation and Communications	Coordinate regulations and management methods	Harmonize regulations and management methods by referencing international management standards	
			Ministry of Transportation and Communications	Implement UAS certification	Harmonize certification standards by referencing international technology standards for UAS.	
			Ministry of Education	Devise UAS courses and teaching materials	Work with the relevant departments and observe industry talent demand to expand the development of UAS-related expert talent.	
		Cultivate UAS R&D and management professionals	Ministry of Transportation and Communications	Organize the UAS Innovative Application Contest	Observe industry and application needs to promote UAS industry-academia collaboration.	
		Public outreach and promotion	Ministry of Transportation and Communications	Raise awareness for UAS-related laws and regulations / Organize the UAS Innovative Application Contest	Continue to organize events for public outreach and education	

ii
Key Issues

(i) Closely align technological developments in the private sector with domestic demand on UAS applications

Public/private sector demand on UAS applications is unclear at the current stage, and domestic UAS companies are not yet certain what course to take for technological development. Hence, technological developments in the private sector should be closely aligned with domestic demand on UAS applications, so that the domestic UAS industry can concentrate resources to develop technologies suitable for applications and expand the market scale.

(ii) Strengthen international cooperation and improve the domestic environment for industrial development

For the UAS industry to establish its foothold in Taiwan while also looking beyond Taiwan, it is necessary to help domestic UAS companies engage in technology exchanges and collaboration with leading multinational companies, and develop specialized UASs with high added value. Furthermore, domestic companies must increase their international marketing and exposure to output UAS software/hardware and application services to the international market.

(iii) Accelerate the establishment of management systems and talent cultivation in Taiwan

International UAS management methods should continue to be adopted and related laws coordinated with innovative UAS applications. After the UAS chapter in the Civil Aviation Act took effect, local government agencies held different attitudes towards UAS applications due to their insufficient expertise and management capabilities, and this will affect the development of the UAS industry. Hence, it is necessary to accelerate talent cultivation.
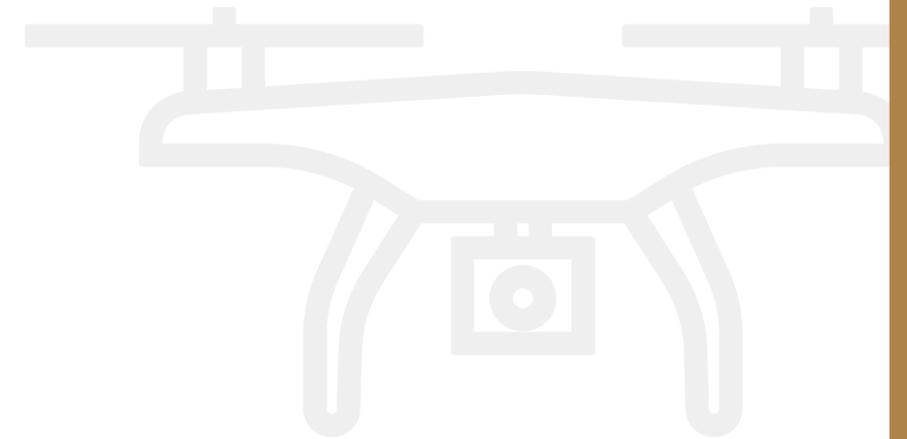
iii
Development Strategy

The UAS development strategy is divided into three categories: technology, industry, and environment. Goals and promotion measures should be set according to each category. The main objectives of each category are respectively: "to provide safe and reliable transportation services," "to establish a fair and sustainable industrial ecosystem," and "to create a sound development environment."

(i) Promote UAS testing for multiple applications

Provide a suitable field (harbor, highway, airport, tracks etc.) for POC, and assist government agencies with UAS applications such as logistics, disaster prevention/relief, infrastructure monitoring, UAS detection and mitigation, and traffic data collection. Also, encourage professional companies to participate in the IPP.

(ii) Invest in the research and development of key UAS technologies

Integrate inter-ministerial resources to promote the R&D and application of UAS within a sandbox verification program, as well as to encourage relevant corporations and manufacturers to invest in R&D to create key technologies.
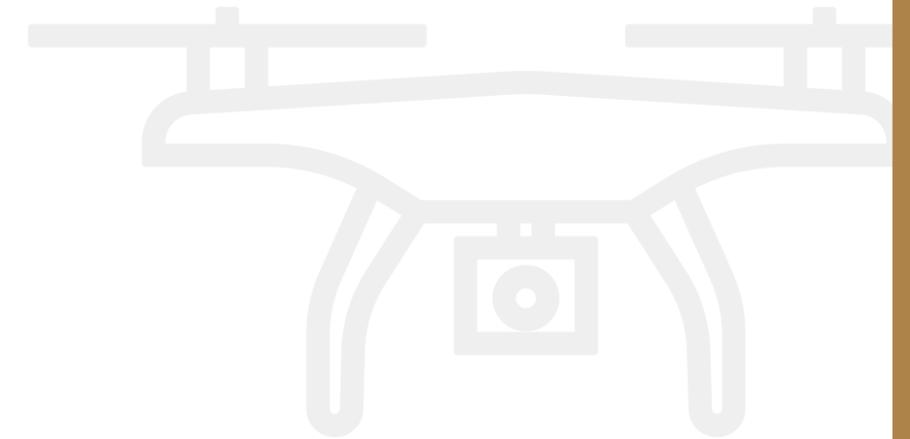
(iii) Subsidize basic UAS technology research

Subsidize UAS-related basic science research in accordance with nominations from their respective academic fields to improve UAS R&D capabilities in Taiwan.

(iv) Promote UAS air traffic management

As UAS technology develops, the Unmanned Aircraft System Traffic Management (UTM) needs to keep pace with the development of industrial technologies thereby establishing a suitable domestic UAS flying environment and air traffic management mechanisms.

(v) Establish UAS test sites

Utilize large idle public facilities or venues to establish test sites for UAS and form industrial clusters for the UAS technology industry.

(vi) Accelerate the introduction of UAS for public service applications

Utilize government policies to accelerate the development of the UAS industry driven by public service needs as well as continue to expand UAS applications to popularize the use of UAS for public service applications.

(vii) Form the U-Team

Guide companies to output UAS software/hardware and application services through review and integration of the UAS industry and development of key technologies.

(viii) Plan innovative UAS service operation and management

To prepare for widespread commercial UAS adoption, preemptively investigate UAS service operation and management issues, as well as propose the division of rights and responsibilities between the government and vendors.

(ix) Strengthen international marketing

Provide an international stage for Taiwan's UAS industry and create opportunities for technology exchange and exposure.

(x) Harmonize regulations and management methods

Reference both the state of UAS services and international standards to gradually carry out coordinated changes to regulations and management methods.

(xi) Cultivate UAS R&D and management professionals

Provide UAS software/hardware design related academic research institutions with sufficient resources, drive technology R&D in the industry, and strengthen the management capabilities of central and local governments.

(xii) Public outreach and promotion

Increase the exposure of UAS-related applications, educate the public on UAS-related laws and regulations, and continue to engage in public outreach activities.
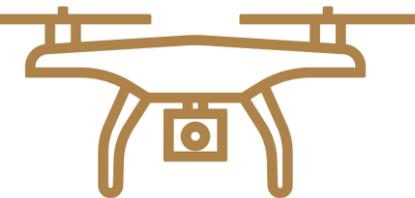
iv
Implementation Measures

(i) Promote UAS testing for multiple applications

1. Implementation of the Integrated Pilot Program (IPP)

Short-term:

Referencing international UAS development experiences, promote the Integrated Pilot Program (IPP) with bridge inspection and logistics as the program's main applications.

Medium-term and long-term:

Expand application items for logistics and UAM field test verification.

2. Implementation of countering UAS measures

Short-term:

Select critical transportation infrastructure to test countering UAS measures.

Medium-term and long-term:

Invite domestic and overseas industry, government, academia, and research institutes to participate, and carry out technology transfer and experience sharing after technology matures and considerable experience is accumulated, in order to support the development of hardware equipment and software service industries.
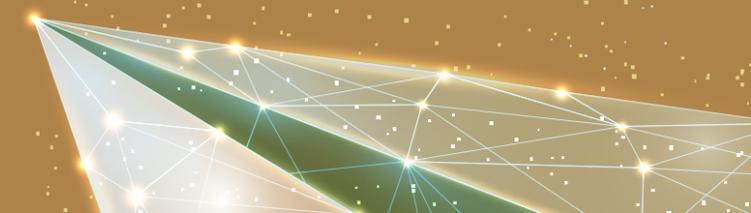
(ii) Inrest in the research and development of key USA technologies

Short-term:

Promote the sandbox verification program that focuses on bridge inspection and logistics in remote areas.

Medium-term and long-term:

The sandbox verification program will be expanded in phases, with the medium-term focus being urban logistics and rural UAM, and the long-term focus being urban UAM.

(iii) Subsidize basic UAS research

Short-term, medium-term, and long-term:

Subsidize UAS-related basic science research in accordance with nominations from their respective academic fields to improve UAS R&D capabilities in Taiwan.

(iv) Promote UAS air traffic management

Short-term:

Develop UAS tracking and identification related technologies and air traffic management rules.

Medium-term and long-term:

Develop UAS air traffic management mechanisms.

(v) Establish UAS test sites

Short-term:

Plan and study conditions, implementation strategies, and division of labor between departments for a suitable site, actively obtain a suitable site from central and local governments, and outline the planning and construction of testing center sites and equipment.

Medium-term and long-term:

Engage in technology exchanges with leading UAS companies worldwide in coordination with the MOEA to conduct technical exchanges with leading manufacturers in the international drone industry, strive for investment in Taiwan, and plan and build UAS testing sites at various levels to form UAS-related industrial clusters.

(vi) Accelerate the introduction of UAS for public service applications

Short-term:

Promote the use of UASs in public services by implementing the IPP, and gradually phase out UAS products made in mainland China that may pose information security risks.

Medium-term and long-term:

Normalize the introduction of UAS for public service applications

(vii) Form the U-Team

Short-term:

Establish an inter-ministerial mechanism for the division of labor/cooperation between industry, government, academia, and research institutes, conduct domestic and foreign UAS-related industry and key technology inventory operations, and form the U-Team.

Medium-term and long-term:

Increase the size of the U-Team and export technologies to international markets.

(viii) Plan innovative UAS service operation and management

Short-term:

Plan commercial operation and management systems for future UAS commercial applications, including the operation and management, service, responsibility, insurance, and cyber security.

Medium-term and long-term:

Expand the exploration of innovative UAS applications and design their operation and management systems.

(ix) Strengthen international marketing

Short-term:

Organize domestic and international seminars and exhibitions, and work with overseas UAS manufacturers.
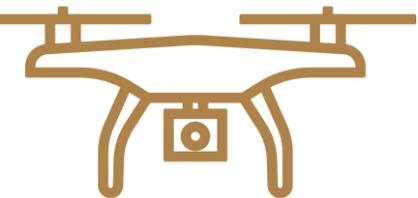
Medium-term and long-term:

Continue to organize UAS industry forums and participate in international conferences, showcase innovative technology development and application results in Taiwan, participate in overseas exhibitions as teams, invite foreign UAS companies to engage in exchanges, and attract foreign industry-leading companies to invest in Taiwan.

(x) Harmonize regulations and management methods

1. Harmonize regulations and management methods

Short-term:

Harmonize regulations and management methods in accordance with the UAS section in the Civil Aviation Act.

Medium-term and long-term:

Harmonize regulations and management methods by referencing international standards for UAS.

2. Implement UAS certification

Short-term:

Implement UAS certification in accordance with the Civil Aviation Act

Medium-term and long-term:

Harmonize certification standards by referencing international technology standards for UAS.

(xi) Cultivate UAS R&D and management professionals

1. Devise UAS-related courses and teaching materials

Short-term:

Work with the relevant departments to devise UAS-related courses and teaching materials to cultivate students' UAS-related capabilities.

Medium-term and long-term:

Work with the relevant departments and observe industry talent demands to raise UAS-related expertise talent nurturing.

2. Organize the UAS Innovative Application Contest

Short-term:

Organize the UAS Innovative Application Contest to encourage industry-academia collaboration.

Medium-term and long-term:

Observe industry and application needs to promote UAS industry-academia collaboration.

(xii) Public outreach and promotion

Short-term:

Continue to hold meetings to explain the laws and regulations governing UASs, establish a central and local collaboration mechanism, and have local governments take part in UAS regional management and advocacy issues. In addition, the UAS Innovative Application Contest can be used to build a positive social image of UASs.
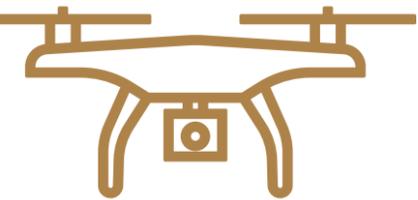
V.

Taiwan's UAS Transportation Application Milestones by 2025

VII. Policy for the UAS technology industry

(i) **Establish a mechanism for replenishing supplies in remote areas and outlying islands using UAS technology**

The resupply service using UAS technology is estimated to finish POC and proof of service (POS) validation by 2024, and proof of business (POB) validation by 2025. The service will work with Chunghwa Post to establish a reliable operation mechanism.

(ii) **Expand the use of UAS technology to assist with bridge inspection operations**

The technologies used in UAS bridge inspection from 2021 to 2024 include automatic flight, Artificial Intelligence-based deficiency recognition automation, and management platform automation. UASs will gradually be introduced to assist with the bridge inspection process by establishing functional specifications and information security requirements for tender vendors. The goal is to expand the use of UAS technology in bridge inspection processes for bridges managed by the MOTC by 2025.
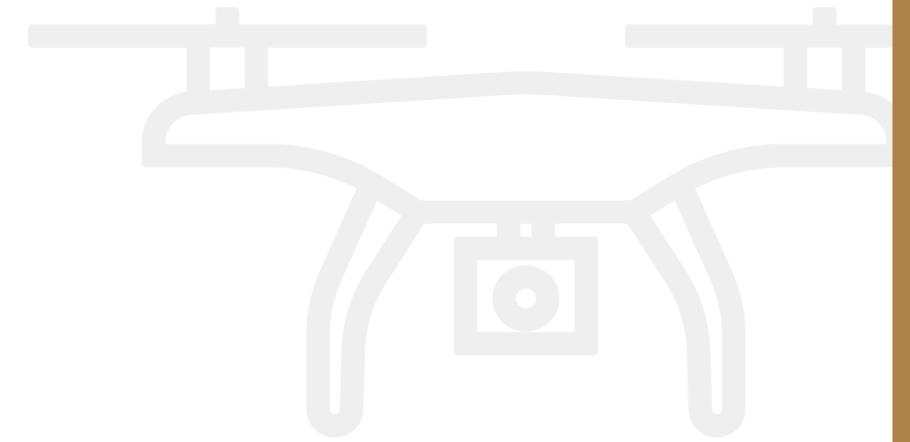
VIII.

Policy for the smart logistics service industry

Logistics has become an important indicator of a national competitiveness due to the trend of globalized trade and competition. Taiwan is an export-oriented island nation, and the development of any industry from manufacturing, sales, to delivery all require logistics services. Hence, logistics is a key industry that affects entire economy of Taiwan. The government needs to assist the industry in utilizing ICT and smart automation technology to create a good logistics environment, and enhance the international competitiveness of industries and the overall economy. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. Future development strategies and implementation measures are further outlined on this basis.

i

Current Status and Development Vision

Taiwan is an island nation with a good foundation of land and sea transportation infrastructure, providing convenient transportation to nearby countries. Taiwan is located at a key position in Asia and it gives Taiwan an advantage in developing a global logistics service network. Under the impact of the U.S.-China trade war and the COVID-19 pandemic, the global supply chain has undergone huge changes in recent years. To grasp this wave of development opportunities, strengthening the convenience and global connectivity of Taiwan's logistics services, and improving the related logistics environment are all important issues that need to be addressed as soon as possible.

The consumption model of controlling logistics channels through e-commerce and online shopping is already facing bottlenecks and challenges. In order to better meet consumers' needs under the zero-contact economy model caused by the COVID-19 pandemic, an omni-channel service model with O2O integration has become an important global development trend in consumption and logistics. This has led to the development of smart logistics services and growing demand on such services, creating great business opportunities for smart logistics. Taiwan has a globally leading ICT

industry and properly utilizing 5G, Artificial Intelligence of Things (AIoT), big data, and UAV technologies will give Taiwan the opportunity to become a "smart logistics kingdom".

Therefore, in order to create a favorable development environment for logistics and promote investment opportunities in the industry, the MOTC will promote the development plan of forward-looking port-airport and postal logistics parks and the tender process for the port, airport, and postal parks (as shown in Figure 10). In addition to providing at least 320 hectares of land for logistic industry use, the MOTC will actively invest in related smart technology facilities, investing a total of NT$37.262 billion over 5 years, which is estimated to generate at least NT$127 billion in economic output and create 660 job opportunities. In addition, the MOTC will follow the trend of logistics development, promote sharing platforms of logistics services and information, and continue to provide guidance and incentives for the logistics industry to introduce technological equipment and services, so as to promote the upgrading and transformation of the industry and expand the revenue and efficiency of the logistics industry. For years the logistics industry has faced issues of regulatory adaptation and talent cultivation. The MOTC will establish a cross-departmental smart logistics legal regulation coordination working group to integrate administrative resources, coordinate regulations, and resolve bottlenecks in cross-border trade. It will also promote industry-academia collaboration to comprehensively improve the expertise and capabilities of professionals.

Figure 10 The applications of smart logistics

Artificial Intelligence

IOT and Big Data

SMART LOGISTICS

Talent development, industry transformation and upgrades

Regulatory coherence for UAS and robots

New retail
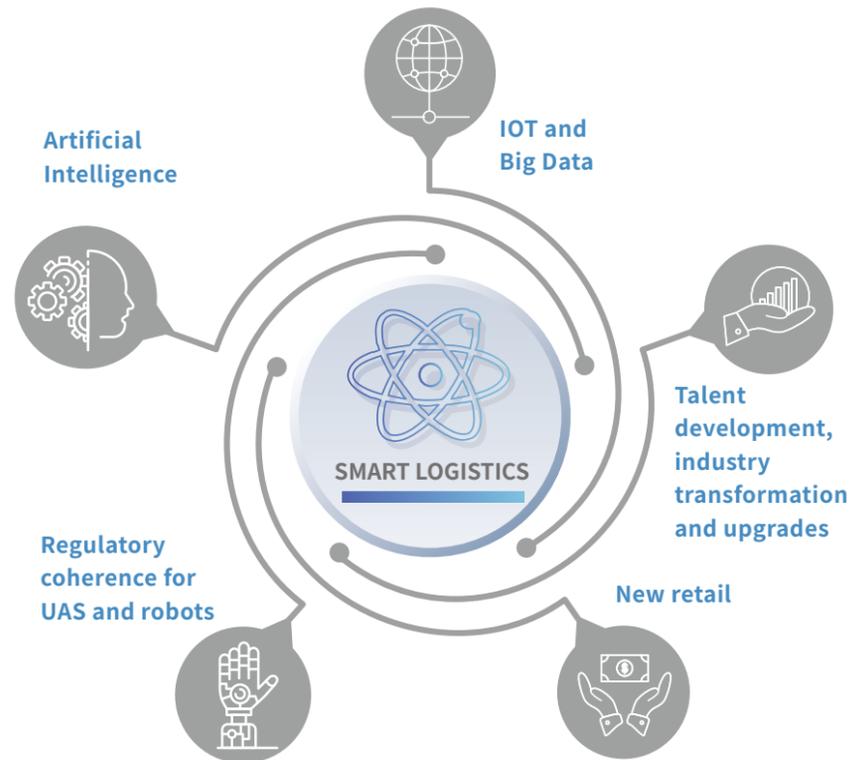
ii
Key Issues

(i) Create an environment of smart logistics and improve the efficiency of convenient logistics services

The U.S.-China trade war has greatly impacted the global supply chain. As traditionally labor-intensive industries move out of China, supply chains have become shorter and more localized. At the same time, high-tech supply chains have been transferred to Taiwan, Korea, and other countries due to IT safety concerns and order transfer trends. Facing these changes, we hope to create a favorable logistics development environment by increasing logistics land, introducing technological facilities, and promoting standardized application services. We also hope to enhance the convenience and international connectivity of passenger and cargo transportation and transportation services around the air, sea, and postal parks to attract enterprises to invest in Taiwan and further promote the development of related industries such as aviation maintenance, transportation, processing and manufacturing, e-commerce, and cold supply chain in Taiwan, which will also further enhance the efficiency and convenience of domestic logistics services.

(ii) Follow logistics industry development trends to drive industry transformation and upgrading

Following the development of innovative technologies such as AIoT, Big Data analysis, Automation Guided Vehicles (AGV), and UAS (as shown

in Figure 11), the logistics industry is going through transformations to support the development of Omni-channel new retail services. The logistics industry has had relatively insufficient technological and digital capabilities in the past, so it is an important issue to determine how to use suitable mechanisms to incentivize and guide the adoption of innovative technologies, equipment, and services, in order to improve overall logistics profits and performance, and assist the logistics industry with accelerating its upgrade and transformation.

Figure 11 Schematic diagram of smart logistics equipment (UAS)

(iii) Faced with new challenges in regulatory coherence and talent cultivation when the logistics industry adopting new technologies

Development of the logistics industry involves customs, ports, trade, products, finance, and technology, as well as communication and cooperation for cross-border transport. Besides cross-industry (cross-department) coordination, when implementing new technologies to integrate and link services together, it is also necessary to coordinate and update regulations for each industry, and establish a complete industry-academia collaboration mechanism for talent cultivation, in order to comprehensively improve the expertise and capabilities of domestic logistics talent.

iii
Development Strategy

(i) Connect the airport, port and postal logistics industries, plan the forward-looking logistics park, and use AIOT and Big Data logistics technology to improve overall service efficiency

In order to link up the logistics industry development opportunities through the cooperation of the port, airport, and postal parks, and to plan the future development of the forward-looking harbor-airport logistics parks, conduct tender bids at locations such as the Taipei Port logistics park, and international commercial ports and postal parks in Northern, Central, and Southern Taiwan. This will serve to promote industrial investment and encourage the integration of Big Data analysis mechanisms to create an ideal development environment for smart logistics and enhance the overall service efficiency.

(ii) Promote automation technology and shared platform services, understand industry demands to provide proper guidance, and drive the transformation and upgrade of the logistics industry

In order to encourage the logistics industry to introduce new technology applications, actively expand the application of UAS technology in rural areas, establish relevant pilot sites and trial databases, and expand the scope and locations of i-mailbox sharing services to enhance logistics revenue and efficiency, thereby helping the logistics industry transform and upgrade.

(iii)Strengthen industry-academia collaboration in the logistics industry, cultivate diversified logistics talents, and integrate resources to establish a regulatory adjustment platform

As the logistics industry looks to integrate new technology, professional talent cultivation and regulation coordination will be important issues to tackle. Therefore, an inter-ministerial working group on the adaptation of smart logistics regulations will be established to assist in the coordination of regulation, and to actively promote various industry-academia collaboration projects to cultivate the diversified talents required for logistics services.

iv
Implementation Measures

(i) Developing and planning of the forward-looking logistics park development plan

Medium-term and long-term:

Begin the advanced planning for the Taoyuan International Airport New Cargo Park and Free Trade Zone II, plan and build the industrial zone at Taichung International Airport, improve the air freight zone at Kaohsiung International Airport, and promote the development plan of the A6 logistics storage area behind Container Terminal No.6 at Kaohsiung Port.

(ii) Connect the tender process for the port, airport, and postal parks to accelerate growth through industrial clustering

Short-term:

Promote the construction and investment of postal smart logistics parks, the expansion plan of the Taoyuan International Airport Freight Park (including express e-commerce, Free Trade Zone, and cold chain logistics), the tender for the Taipei Port Smart Vehicle Industry Demonstration Park and logistics storage area, and the investment of the Taichung Port Logistics Zone.

(iii)Promote the standardized application of logistics technology services to fully make use of smart logistics synergy

Short-term:

Build a standardized digital address delivery database and improve the cold chain logistics environment and standard operating regulations.

Medium-term and long-term:

Promote the standardized application of smart warehousing and logistics in the Taoyuan International Airport Free Trade Zone.

(iv) Leverage logistics data, information technology and facilities to improve demand forecasting, tracking management and security performance

Short-term:

Promote the MTNet2.0 FTZ management subsystem, improve FTZ cross-zone migration monitoring and control system promotion.

Medium-term and long-term:

Use FTZNet statistics to carry out volume flow and flow analysis, use blockchain technology to enhance port logistics workflows, enhance the necessary software and hardware facilities and manpower needed to improve cargo clearance.

(v) Construct a pilot site of automated technology logistics to serve for the application of future logistics technologies

Short-term:

Promote demonstration programs for UAS technology in remote areas.

Medium-term and long-term:

Establish pilot sites for the application of automated sea, air, and postal logistics technologies (robots, trucks, etc.).

(vi) Develop the logistics services and information sharing platforms to expand and enhance logistics revenue and efficiency

Short-term:

Expand i-mail services and application areas.

Medium-term and long-term:

Investigate the establishment of a mechanism for sharing and analyzing information in an air logistics platform.

(vii) Continue to promote consultation services and incentives to help industries use technology in their transformation and upgrading process

Short-term:

Promote investment offsets and counsel the logistics industry on measures related to the introduction of innovation and technology.

Medium-term and long-term:

Set up an air, sea, and postal innovative work environment to grasp consumer needs and guide industry players to develop additional logistics services and cross-domain innovative operating models to expand the value of logistics services.

(viii) Promote talent education through industry-academia collaboration to increase the number and professional capabilities of logistics talents

Short-term:

Provide guidance to colleges and universities or associations to organize professional training courses on smart logistics, promote certification mechanisms for logistics, expand industry-academia collaboration internships or observation programs in land, sea, air, and postal logistics, conduct international benchmark case studies, and hold regular seminars on the development and application of new concepts and technologies in logistics.

Medium-term and long-term:

Improve the talent cultivation mechanisms for the land transportation industry.

(ix) Promote the inter-ministerial smart logistics regulation coordination working group

Short-term:

Use the inter-ministerial intelligent logistics coordination platform to effectively solve the issues in the development of the logistics industry, study and revise the feasibility of existing labor regulations for drivers in the automobile container freight industry, and promote the smart service platform for collaborative postal and inspection operations.

IX.

Policy for the transportation big data technology industry

Big data may contain precious and important information that has not yet been discovered, such as market trends and policy direction. Hence, specialized fields have attached greater importance to big data mining and analysis in recent years, and countries in Europe and America are using big data analysis results to support government decision-making. Existing intelligent transportation systems and transportation facilities have already collected a massive amount of traffic data in Taiwan, and can serve as the foundation for developing big data analysis and related applications. By accelerating the integration, analysis, and research of public and private sector data, the data is further converted into effective information to support traffic supervision and management, service innovation, and decision-making, providing the basis for public policy, traffic management measures, and traffic application services. Important issues that must be prioritized are clarified below based on observations of the current status and the vision and objectives. Future development strategies and implementation measures are further outlined on this basis.

i
Current Status and Development Vision

Since the government began promoting open data in 2016, the MOTC has successfully integrated over 900 categories of standardized transportation big data, including that for buses, TRA, THSR, MRT, airlines, bicycles, tourism, traffic conditions, weather, road code, air quality, and maps. The value-added application services developed using this data have become an integral part of government administration and people's daily life. Following the development of autonomous vehicle, IoT, AI, and big data applications, the data economy has become an important factor for the transportation technology industry to create new value and enhance its core competitiveness. Private sector data with high commercial value will not only drive industry transformation and innovation through complete market mechanisms for data access and circulation, but also create immense business opportunities for the industry.

The MOTC is currently sitting on a gold mine of transportation data belonging to the public sector, and will focus on integrating and using public and private sector data in the future. Implementation of the policy for the transportation technology industry combined with the industry's energy and

creativity will create unlimited business opportunities for the data industry (see Figure 13). The MOTC therefore plans to invest a total of NT$900 million in the development of transportation big data through the "Intelligent Transportation System Development Plan" and "NGIS Digital Development Plan" over the next 5 years, and will invest NT$1.3 billion in years 6-10. Overall output value will reach approximately NT$4.5 billion in the short-term and approximately NT$11 billion in the long-term, driving and supporting the development and upgrading of Taiwan's transportation data industry. This will create an industry ecosystem that mutually prospers, establish a paradigm for Taiwan's technology transportation industry, accumulate software/ hardware integration experience, and create even more international cooperation opportunities.

Figure 12 Vision for development of the transportation data industry

· **Towards a humanity-oriented-interconnected**

· **creative · safe · sharing**

· **convenient living environment with smart mobility**

Citizen services

- **Mobility as a Service (MaaS)**
- **Personalized travel and transport assistant services**
- **Travel and transport planning service**
- **Real-time traffic condition On-street parking space**

- **Smart parking services • Mobile ticket services • Smart travel services**
- **Transportation mode sharing services (bicycle/motorcycle/taxi) • Smart bus services**
- **Smart station services • Smart vehicle services • Smart safety services**
- **Driverless bus services • Seamless transit across modes of transportation**
- **Smart airport services • Robot/voice assistant services**

Industry development

- **MaaS industry**
- **Smart parking industry**
- **Smart V2X industry**
- **Smart voice assistant industry**
- **Transportation AI industry**

- **Transportation IoT industry • Smart public transportation industry • Car navigation industry**
- **Map information industry • Smart signage industry • Telecommunications data industry**
- **Smart road industry • Smart traffic control industry • Smart tourism industry**
- **Smart bicycle industry • Smart bus stop industry • Smart vehicle industry**

Traffic data system specifications (system and standards)

Smart transportation big data infrastructure

Strengthen information security environment

Public transportation	Real-time traffic conditions	Parking information	Tourism/ Weather	Spatial information	Tickets	Road safety	Other departments	Smart transportation IoT
Bus, railway, aviation, shipping, bicycles…	VD, CMS, CCTV, eTag, diverse traffic conditions, traffic incidents…	on-street parking space, offstreet parking space, real-time information on remaining parking spaces…	Scenic spots, restaurants, activities, accommodations, weather, rainfall…	Rail/transportation network, land use, geology, traffic facility maps…	Bus, railway, Electronic stored value card and non-electronic stored value card	Accidents, violation, supervision, insurance…	Population, socioeconomic, irrigation, data…	5G, IoT, high definition maps, driverless vehicles, V2X, smart corridor, smart roads, floating vehicle GPS, telecommunications signals…

ii
Key Issues

(i) Data infrastructure – Resource inclusion and sharing

Following the rapid growth in transportation data in the future, cornerstones that support the overall development of the transportation technology industry will include the development of data infrastructure that is immediate, stable, highly efficient, safe, open, mode-sharing, innovative, and meets the needs for sustainable development of the next generation; the establishment of a complete system and specifications; the establishment of a dedicated department responsible for implementation.

(ii) Data industry development – Creating sustainable valuetrial development

The key to the sustainable development of the transportation technology industry in response to the trend of big data is to actively promote public-private partnership. Capabilities of the private sector should be brought together with public and private data to drive the development of the data industry, create industrial value, and increase output value, thus forming a flourishing data industry ecosystem.

(iii) Digital governance practices – Excellence governance performance

Major issues and challenges in the implementation of smart digital governance brought by the development of digital economy include how to rapidly respond to business demand, optimize the quality of decision-making, support business innovation, develop smart daily life services, and thus achieve the objective of e-government to "have a competent government that benefits industries and the people."
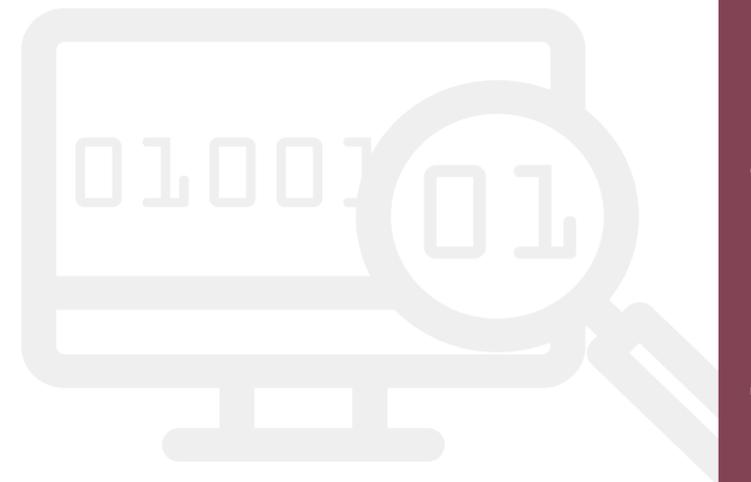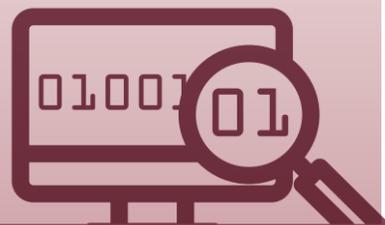
iii
Development Strategy

(i) Promote transportation big data infrastructure and services towards the vision of smarter lifestyles

Integrate data of transportation industries nationwide (public transportation, real-time traffic conditions, parking, tourism, traffic accidents, maps, road safety, tickets, telecommunications, floating vehicles, autonomous vehicle, V2X, taxi, and electric vehicles, see Figure 13) with transportation industry big data at the core, in order to achieve transportation data accessibility and sharing, and provide decision-making support for government and corporations, as well as information services for citizens. This will also accelerate the development of the overall transportation technology industry towards the new vision for smart nation, smart cities.

(ii) Establish complete data circulation management mechanisms, improve the data management environment and circulation regulations

Promotion of the transportation big data industry involves infrastructure building and resource integration, data collection and circulation management, data governance and application, talent cultivation, technology exchange, and international cooperation. Hence, it is necessary to establish good circulation management mechanisms, including dedicated units, dedicated regulations, and circulation regulations, to handle related affairs. Data circulation management regulations which are aligned with the General Data Protection Regulation (GDPR) and suitable for personal data protection and intellectual property licensing in Taiwan must be established, and information security measures must be strengthened for the safety of data.

(iii) Establish a data market and make the transportation data industry more active

Establish a transportation data industry development alliance, integrate resources of industry, government, university, and research institutes, create a data trading market, implement private sector data and technology, promote public-private data exchanges and combination, expand transportation data applications, establish data circulation and application paradigms, use big data applications to drive the development of the domestic transportation data industry, and take on the challenge to output turnkey solutions internationally.
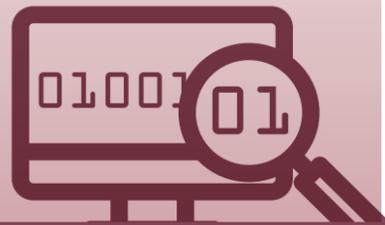
(iv) Strengthen talent cultivation and create value through data economy

Combine emerging technologies such as cloud services, edge computing, machine learning, AI, and blockchain, step up the cultivation of local transportation data technology talent, allow more interdisciplinary professionals to engage in the processing, analysis, and application of transportation big data, and create higher value through data economy.

(v) Strengthen data governance service orientation and develop a smart government

Gain insight on key issues and pain points in transportation through the analysis of transportation big data, develop a data governance service-oriented smart government, establish policy governance priority programs, strengthen responsive management decision-making and analysis abilities, and help the transportation industry improve its operational performance; integrate data and digital services of the transportation operation units, optimize mobile transportation services, combine the industry's mobile data analysis ability, and create a transportation data service industry.

Figure 13 Schematic diagram of public and private data development under 5G and IoT
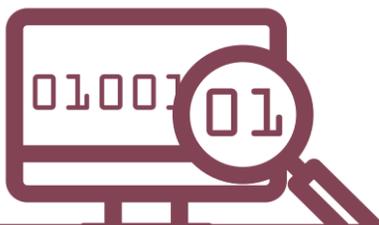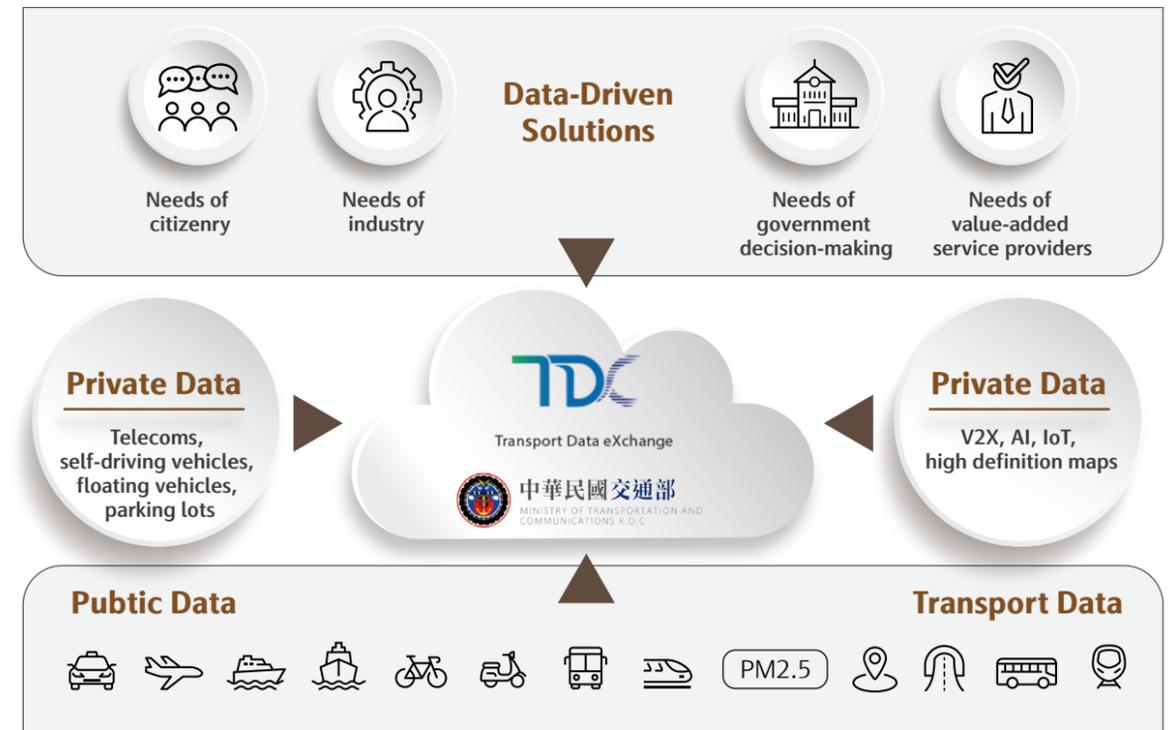
iv
Implementation Measures

In the schematic diagram of the overall transportation data industry's ecosystem (see Figure 14), implementation measures and short-, mid-, and long-term implementation plans are described below:

(i) Develop a data circulation service platform, expand the scope of data, and aim to provide five-star data services

Short- and Medium-term:

Prioritize the development of a comprehensive transportation data circulation platform for resource inclusion and sharing, and expand the scope of data in each field of the public sector (e.g., imaging, parking) and operation statistics required for governance.

Medium-term and long-term:

Extensively include transportation data (e.g., telecommunications and floating vehicles) generated by emerging technologies of the private sector and smart transportation IoT. Furthermore, continue to standardize and industrialize transportation data, and strengthen transportation linkage data models, in the aim of providing five-star open-data services, engaging in industry-academia collaboration to establish a quality verification and classification system, and driving the development of data applications.

(ii) Establish a transportation big data trading market and accelerate the development of the transportation data industry

Short-term:

Carry out a demonstration of public-private partnership in a data market, and build a data sharing and matching platform for public and private sectors in different industries.

Medium-term and long-term:

Gradually complete mechanisms for "data is valuable," licensing fee collection, and management, establish an industry alliance evaluation, and guide the public and private sectors that have transportation data and technology to enter the sharing and matching platform, in order to strengthen the data trading market and energize the data industry.

(iii) Improve the environment for cultivating technology talent, and increase the output value of data economy

Short-term:

Implement a series of data analysis, AI, and cloud technology education, training, and guidance projects, step up the localized cultivation of transportation data technology talent, support the development of startup teams, train the key practical capabilities of talent in related fields, and develop diverse application scenarios.

Medium-term and long-term:

Collaborate with the industry to provide a complete environment for testing infrastructure and applications, combine industry practices with competitions, and create even more economic output value. Furthermore, transportation data standards must be applied and promoted in the industry (e.g., logistics, bus, driverless vehicles, and smart city related applications), expand the aspects of transportation data applications to not only meet local needs, but also facilitate international output.

(iv) Establish a smart government with digital governance, and establish a new paradigm for mobile transportation services

Short-term:

Implement diverse transportation data governance, introduce governance themes based on the priority of policies, implement core businesses that make a perceivable difference to citizens on a trial basis, and use big data and AItechnology for data mining, analysis, and modeling.

Medium-term and long-term:

Encourage industry-university collaboration and alignment of education with employment, develop an AI data analysis brain, localize data collection and application analysis to domestic industries and competent authorities, conduct evaluations for the development of new large transportation systems or carry out
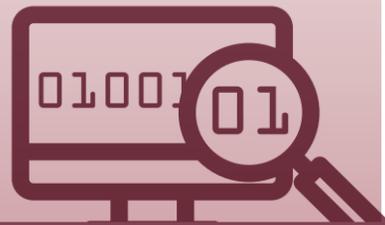
coordination and integration for regional transportation systems, optimize the government decision-making and analysis abilities; integrate the passenger data and digital services of transportation operation units to create the mobile transportation data service industry.

(v) Establish a dedicated unit for transportation big data, and continue to improve data circulation service specifications

Medium-term:

Establish standard operating procedures for related services based on the MOTC's experience with establishing a circulation service platform.

Long-term:

Establish a dedicated unit to oversee transportation big data collection, circulation, talent cultivation, and industrial development, and establish data circulation regulations that comply with the GDPR, personal data protection, intellectual property licensing, and information security. Furthermore, it is necessary to establish complete data circulation standards and specifications for important data each year, in response to the development of the transportation data industry eco-chain and to ensure the fair and effective use of resources. The standards and specifications must be aligned with international standards and continue to be updated to enhance the industry's competitiveness.

(vi) Cross-industry integration of marketing and value-added applications, and realize citizen participation

Short-term:

Strengthen cross-industry (e.g., water conservancy, disaster prevention, police, tourism, real estate agencies, medical care, and financial payment) integrated promotion.

Medium-term:

Organize contests, events, or exhibitions for citizen participation, in order to increase citizens' familiarity and understanding of Intelligent Transportation services. Integrate cross-industry value-added applications for different industries to jointly develop even more applications and create greater value.

Figure 14 Formation of the transportation data industry ecosystem
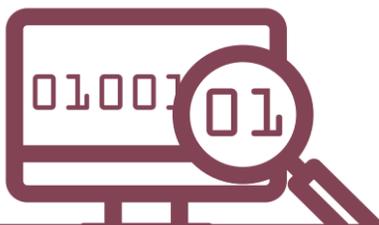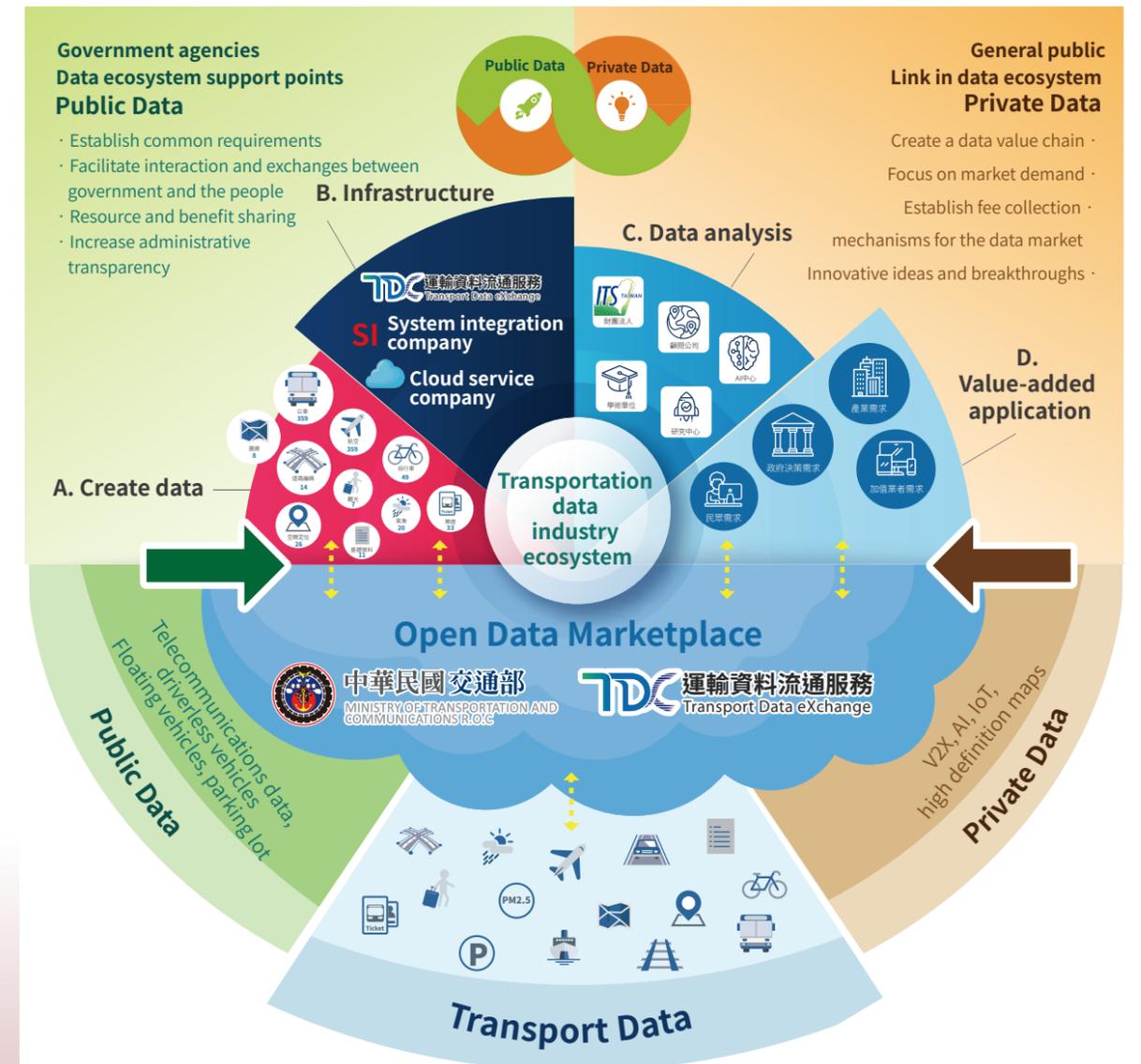
XI.

Policy for 5G smart transportation application promotion

The application of advanced ICT in the field of transportation, e.g., Vehicle-Infrastructure-Person Network (VIP-Network), AI image recognition, and data analysis technologies, has led to the development of many innovative services that are disruptive to their respective industries. These services may create a safer, more inclusive, fairer, more efficient, and more sustainable future. From another perspective, the transformation process has greatly impacted existing laws, regulations, and the transportation ecosystem. Therefore, the government needs to take an active part in the exploration of innovative applications of transportation technologies, and verify the feasibility of related product technologies and services, so that they have a positive impact. Meanwhile, the MOTC must use its policies to help domestic industries further enhance their technological capabilities and competitiveness in the international market. Important issues that must be prioritized are clarified below based on observations of the current status, the vision, and the objectives. Future development strategies and implementation measures are further outlined on this basis.

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Current Status and Development Vision

Transportation is the bloodline that connects daily life and industrial activity, and related industries are engines driving the nation's overall industrial development. Hence, advanced countries are actively engaging in the verification of innovative services provided using smart transportation technologies (e.g., autonomous vehicles, V2X, Mobility as a Service). For example, M-City in the US, K-City in South Korea, and the Centre of Excellence for Testing & Research of AVs – NTU, (CETRAN) are all global benchmarks. Hence, the MOTC plans to invest NT$1 billion in the Intelligent Transportation System Development Plan over the next 5 years for the verification of 5G smart transportation applications and will invest NT$1.5 billion in 6-10 years. The output value of emerging smart transportation services made possible by the experimental field in Taiwan is estimated at approximately NT$5 billion in the next 5 years, and at least NT$12.5 billion in 6-10 years..

First, plan the first field in Taiwan that links daily life situations to the business environment for verification of emerging smart transportation technologies. The field will contain new generation infrastructures, such as optical communications, 5G environment, new generation roadside equipment and sensors, smart traffic controller, and cloud management platform, and can integrate the foundation for innovative service ideas and business trials for emerging smart transportation services, such as autonomous vehicles and V2X. This will remove the barrier to new technologies and services for government departments and citizens, accelerate the launch of related applications in the future, and make Taiwan become a pioneer in the development of innovative smart transportation services.

The MOTC also plans to invite major international companies to participate in specific themes, which will facilitate cooperation between the international leading firms and domestic companies, and help domestic companies enter the international industrial chain. Furthermore, diverse public participation mechanisms allow government departments, residents, service operators, the industrial sector, and startup teams to continue to engage in communication and explore local needs. R&D subsidies and theme-based verification mechanisms promote the service concepts and business models of innovative technology, and also effectively accelerate the development of user-centered solutions.

Lastly, we hope the experimental field's verification results will guide the development of smart transportation-related software and hardware engineering standards, establish experimental data sharing mechanisms, and further provide the basis for competent authorities to adopt related laws and regulations.
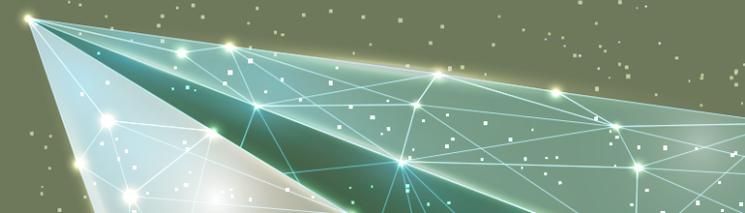
ii
Key Issues

(i) Facilitate cross-industry collaboration in developing new generation transportation services and infrastructure

Facing traffic jams, frequency traffic accidents, shortage of human resources, lack of basic transportation services in remote areas, and changes to existing transportation services brought by emerging technologies, the MOTC aims to develop friendly and better smart transportation systems based on humanity-oriented transportation, providing citizens with a safe, efficient, and sustainable foundation for traveling through smart cities and rural areas.

(ii) Implement emerging transportation industry standards and application verification mechanisms

Link together AI, IoT, and 5G technologies for cross-industry integration, diversify equipment and technologies, expand services across industries, expand the smart transportation industry ecosystem, and standardize sensing and communications equipment, digital content convergence formats, and open platforms, in hopes that verification of emerging applications in the field will serve as the cornerstone for developing smart transportation industry standards.

(iii) Formulate laws and regulations applicable to the experimental field for transportation technologies and emerging servicess

Emerging transportation technology applications are divided into basic research, development verification, and product operation based on the maturity of the technology, which corresponds to preliminary planning, barrier removal, and impacts analysis of regulations, with the aim of assisting in the implementation of experiment results in the smart transportation field through regulatory readiness.

(iv) Promote cross-industry collaboration to jointly create an industry value chain to expand industry benefits

Take the experimental field as a trial ground for emerging technologies and services from proof of concept, proof of service, to proof of business, build connections with localities through an open field, further diffuse experimental results across regions, and drive collaboration between transportation technology related industries in Taiwan and overseas, creating an innovation ecosystem.

iii
Development Strategy

(i) Establish an experimental field to refine emerging transportation technology applications, and develop Taiwan's own solutions

Transportation is one of the most important applications in people's lives. The MOTC plans to refine the development of smart transportation technology in an experimental setting, focusing on the development of manufacturing and service applications and verification of vehicle network standards and smart roads and applications. Focus will also be placed on the benefits generated from validation-derivative industries such as V2X MAP (vehicle-to-everything map) dynamic and static traffic information, emergency vehicle priority signs, vulnerable pedestrian detection, safety or general information dissemination applications, and other applications.

(ii) Show smart transportation technologies and services in line with international standards via verification in daily life scenarios

Innovation verification data from the field should be interfaced with government platforms for information sharing as well as integrated with the corresponding international technical standards to jointly

develop the prototype of a new generation urban traffic control system, V2X network, and smart road system. The planning of data sharing mechanisms should take into consideration trade secrets and security of the prototype system to accelerate the development of innovative equipment and verification of applications.

(iii) Establish an experimental platform and guidance mechanisms, strengthen technology and application verification, and accelerate the upgrade of the transportation industry

Establish guidance mechanisms; from sensors, program interface to transportation users, establish experiment data collection, storage formats, regulations of intellectual property, and information sharing and exchange specifications; establish interoperability verification standards to allow interoperability between industries. Reference European and American specifications when establishing Taiwan's mixed traffic standards and specifications, so that the standards and specifications can be promoted in other countries with similar modes of transportation.

(iv) Establish verification mechanisms and provide legal consultation and assistance

Determine the priority of legal issues through transportation experiments, including compulsory, service, innovation, and daily life application-related regulations. Relax laws in the early stages of innovative mobile devices, approval on a case-by-case basis during the application deployment stage to break through current regulations, and provide guidance for companies to improve their technologies and comply with more thorough regulation in the future.

(v) Formulate service specification, eliminate regulatory barriers, and create a friendly environment for the verification of emerging services

Emerging transportation technologies and innovative application services have flourished in recent years, and have impacted and brought challenges to the current regulatory environment and supervision mechanisms of countries around the world. To drive the
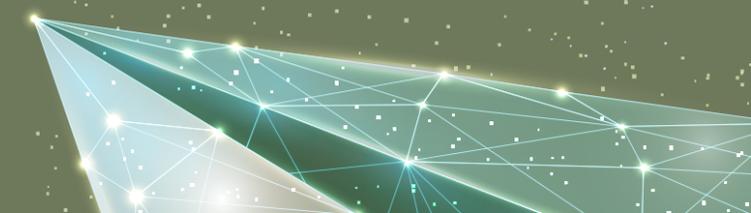
development of emerging transportation technologies and innovative application services in Taiwan, the MOTC will examine current traffic regulations and regulatory barriers, and implement a rolling review mechanism to further amend related regulations and create a friendly regulatory environment for transportation technologies.

(vi) Uncover local demand through public-private partnership and citizen co-creation mechanisms

Explore local demand through contests and subsidy mechanisms, drive local creativity, and uncover application ideas with local features through public-private partnerships.

(vii) Accelerate the formation of an emerging transportation technology industrial chain, develop a domestic smart transportation industry value chain, and further align them with international standards

Examine and adjust domestic management systems or plans through the process of verifying new technology applications and innovative services in the field, and combine the knowledge and capabilities of experts in different fields to accelerate the formation of an emerging technology industrial chain through public-private partnerships. The goal is to align Taiwan's management system and testing regulations with international systems, which will create the opportunity to align Taiwan's industry and market with international standards.

iv
Implementation Measures

(i) Establish an experimental field to refine the exchange platform for emerging transportation technology applications

Short-term:

Use the experimental field to develop prototypes of innovative transportation services, and develop the prototype of an innovative transportation application platform. Work with local governments in establishing platforms for 5G broadband networks, smart roadside equipment, and IoT, and take Danhai New Town as an experimental field.

Medium-term:

Establish safe operating mechanisms and a sharing verification platform, and provide a simulation environment platform to accelerate the development of new applications by service providers.

Long-term:

Establish a subsidy plan and gather together government research projects on transportation applications in the same field, in order to make it convenient for industries to participate in verification and invest in R&D. Emerging transportation technology verification data should be made open and interfaced with government platforms, and share the field's verification resources and practical experience to help local governments accelerate the adoption of emerging transportation services.
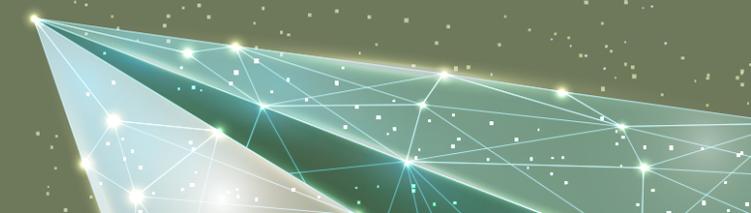
(ii) Combine daily life scenarios and international standards to verify smart transportation technologies and services

Short-term:

Combine the prototype of new transportation services in the experimental field with daily life transportation applications, reference international standards and the needs of domestic industries, and establish a daily transportation digital transformation platform through the establishment of industry standards.

Medium-term:

Facilitate exchanges of the latest transportation technology development results of industry, academia, and research institutes in Taiwan and overseas, and complement or cooperate with each other through experience sharing, observation, and citation.

(iii) Establish an experimental platform and guidance mechanisms, and expand the scope of technology and application services

Short-term:

Use the experimental field to develop prototypes of innovative transportation services, invite industry, academia, and research institutes to propose creative ideas, invite citizens to provide feedback on their experience, and develop an innovative transportation digital transformation platform through rolling updates and upgrades.

Medium-term:

Facilitate exchanges of the latest transportation technology development results of industry, academia, and research institutes in Taiwan, and complement or cooperate with each other through experience sharing, observation, and citation.

(iv) Establish verification mechanisms and provide legal consultation and assistance

Medium-term:

Reference international standards and consider the needs of domestic industries when discussing standards and verification

mechanisms. Improve applicability, competitiveness, and expandability of new products and applications.

Long-term:

Promote cross-industry cooperation with diverse related parties, establish data format standards for the collection, analysis, exchange, and sharing of empirical data.

(v) Formulate service specifications and eliminate regulatory barriers

Short-term:

Invite researchers from heterogeneous fields to participate in the establishment of verification and certification mechanisms for emerging transportation services, such as: AI imaging traffic verification standards, V2X traffic signal and map information (SPaT, MAP) verification standards, and smart road classification standards, etc.

Medium-term:

Take inventory of legal issues found in the experimental field for emerging transportation technology and the impact on transportation companies and consumers, provide competent authorities with legal staff assistance, and provide service operators and companies participating in experiments with legal advice.

Long-term:

Propose regulatory adaptation and amendment recommendations for transportation laws and regulations in coordination with major government policies and legislation. Establish support mechanisms based on authorization provided by the law, continue to observe important laws and policies worldwide, and use it as the basis for subsequent rolling reviews.

(vi) Create public-private partnership and citizen co-creation mechanisms

Short-term:

Use experimental fields to develop prototypes of innovative transportation services, invite citizens to provide feedback on their experience, and jointly plan goals and experiment items of the experimental field.
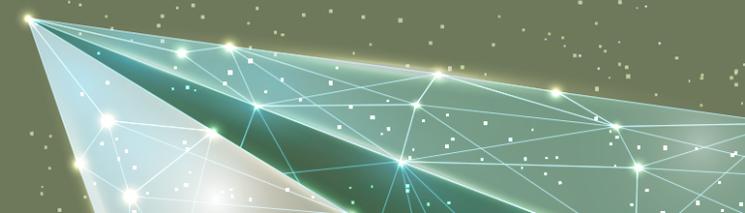
Medium-term:

Establish industry standards and sharing platforms after referencing international standards and considering the needs of domestic industries, support domestic industries to create innovative capabilities through the platform, and drive the existing transportation companies upgrading and transformation. Jointly plan a new generation of transportation services with service operators, and help the domestic industry keep up with the global industry in developing smart transportation solutions that are safe, sustainable, and use green energy based on the core value of "user-centricity."

(vii) Accelerate the formation of an emerging transportation technology industrial chain, develop a domestic smart transportation industry value chain, and further align them with international standards

Short-term:

Use technical validation (e.g., sensor verification, control verification, AI analysis, etc.) and field data analysis as the basis for establishing industry standards, and verify the feasibility and potential benefits of services through the validation of the business model of services.

Medium-term:

Attract international companies to be stationed in featured fields, introduce the latest technologies and application concepts around the world, and facilitate interactions with international benchmark companies to enhance the capabilities of domestic companies.

Long-term:

Integrate application platforms and data interfaces of the experimental field, provide an interface for companies to develop innovative application services, and accelerate the integration and upgrading of technologies between upstream and downstream companies.

XI.

Policy for Harbor and airport green energy industry

Global warming is a critical issue faced by countries around the globe that will continue to boost green energy, which will become a dominant driver for economic growth in the near future. Therefore, the Taiwanese government has included green energy technology as one of the "5+2 Industrial Innovation Plan," committing to achieve the goal of having 20% of the nation's electricity be generated from renewable energy sources by 2025, while gradually and tangibly promoting renewable energy and non-nuclear energy in the spirit of energy security, green economy, and environmental sustainability. Since the harbor and airport industries are an important part of Taiwan's external transportation strategy, they also serve as an important model in demonstrating our determination to implement green energy use. Currently, the government is promoting both the implementation of energy conservation and carbon reduction in harbors and airports as well as linking energy demands from these transportation providers with the broader green energy supply chain to enhance the efficiency of resource utilization and to meet the needs of industrial development. The goal is to develop clean energy and to promote the development of the green energy industries at the same time. Important issues that must be prioritized are described below based on observations of the current status and the vision and objectives. Future development strategies and implementation measures are further outlined on this basis.

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Current Status and Development Vision

Taiwan is blessed with world-class wind farms in the Taiwan Strait, which have made offshore wind power generation an important part in this critical era of Taiwan's energy transformation. To demonstrate the government's determination to promote the offshore wind power industry, the Executive Yuan approved the Wind Power 4-year Plan in August 2017 to build a strong foundation for wind power promotion in the short-term and address fundamental problems for wind power growth in the medium- and long-term. Currently, offshore wind power policies are projected to reach a cumulative installation capacity of 5,730MW by 2025, with an annual generation capacity of 21.5 billion kWh, providing electricity to about 5.91 million households, cementing wind power as the spearhead to lead the growth of the green energy supply chain and sustainable development in Taiwan. The MOTC is fully committed to the development of this renewable energy source and has combined the efforts of various ministries to jointly promote its development. The efforts include the designation of the Changhua Wind Farm Channel, the establishment of the Offshore Wind Farms Channel VTS Center, the training of vessel crews, the establishment of a special zone for the offshore wind power industry, the construction of heavy-loaded wharves, and the training of wind power related personnel, which altogether work towards easing Taiwan's sustainable development using clean energy.

In response to the Reduction of GHG Emissions initiative, the MOTC not only actively promotes green energy development, but also strives to implement energy conservation and carbon reduction. Since 2019, Taoyuan International Airport has implemented an environmental management system that is supplemented by the existing energy management system and greenhouse gas inventory mechanic to monitor and measure various sustainability and environmental issues at Taoyuan International Airport in a systematic manner, so as to be able to continuously improve on relevant metrics according to implemented environmental policies and goals. Due to these efforts, Taoyuan International Airport was awarded the Airport Carbon Accreditation Program (ACA) Level 3 Optimization Label by Airports Council International (ACI) and the first place platinum award in ACI's ACI Asia-Pacific Green Airports Recognition program. The MOTC is committed to sustainable development, environmental protection, and the creation of influence corporate values to continuously move towards low-carbon and green airports in line with international standards.

Figure15 Taiwan's renewable energy policies

2019

46%
33%
7%
15%

2020

45%
33%
9%
13%

2025

20% boost green energy
3%
27% Reduce coal
50% increase Liquefied Natural Gas

Source: Executive Yuan

Coal LNG (Liquefied Natural Gas) Renewable energy Others
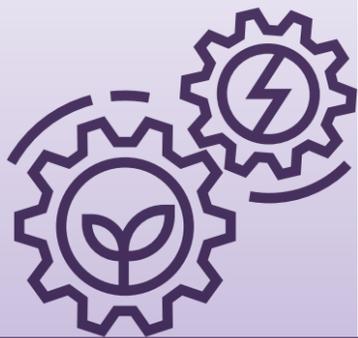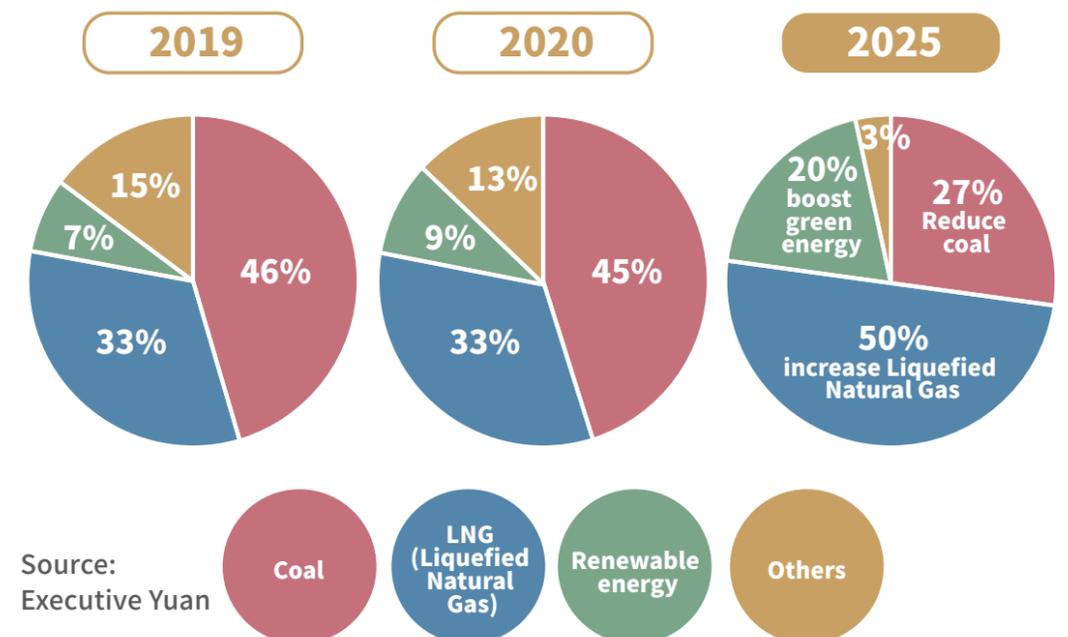
Figure16 ISO carbon and energy management certifications awarded to Taoyuan International Airport

Figure17 Airports Council International Carbon certifications awarded to Taoyuan International Airport
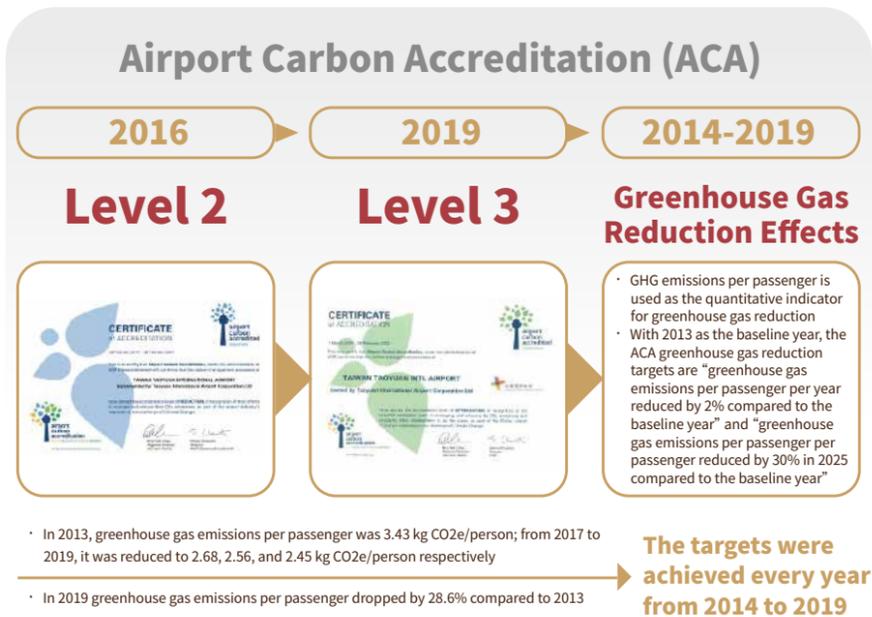
ii
Key Issues

(i) Improve maritime laws and regulations related to the promotion of the green energy industry to ensure vessel navigation safety

In order to protect the safety of vessels navigating in Changhua's offshore wind farm waters while keeping in line with national policies on the development of offshore wind power, relevant maritime laws and regulations and related management mechanisms are being studied and revised, in order to maintain navigation safety and to provide an ideal and safe operating environment for the wind power industry.

(ii) Utilize port and harbor resources to accommodate both maritime transportation and offshore wind power industry development

Taiwan is surrounded by sea, which makes maritime transportation an important economic activity of our country. Therefore, port resources are very precious. For this reason, maintaining existing port operations and activities, while at the same time adjusting port facilities to allow the pre-assembly of wind power components needed by the offshore wind power industry to satisfy the operational demands of the industry is major issues for Taiwan.

(iii) In order to drive the development of Taiwan's offshore wind power manufacturing industry, it is necessary to have a green energy-related industry base at ports, create a wind power production and manufacturing supply chain cluster, and provide a green energy industry manufacturing base at ports to both meet the domestic demand for green energy now, and in the future, become an offshore wind turbine parts and components supply center in Asia.

(iv) Explore the feasibility of floating structure wind turbines in the future

The development of Taiwan's offshore wind power industry is becoming more and more mature, and the installation of wind farms will gradually move towards deeper waters in the future, so it is important to explore the feasibility of floating wind turbines. We should look to explore the feasibility and necessary equipment for floating wind turbines to facilitate the long-term development of Taiwan's offshore wind power industry.

(v) Offshore wind power operation and maintenance model and base planning

Since the life span of offshore wind turbines is about 20 years, the operation and maintenance of wind turbines are very important. Both the regular maintenance of wind turbines and the ability to quickly address issues in case of emergencies to minimize damages are closely related to the operation and maintenance model of the wind farm and the location of the base. The port nearest to the wind farm is naturally the first choice for the operation and maintenance base, but further understanding of the industry is still needed to properly allocate port resources.

(vi) Implement localized talent cultivation for the offshore wind power industry

The offshore wind power industry is an emerging industry; there will naturally be a shortage of professional talents in the offshore wind power industry in Taiwan during the early stages of the industry's development. To assist wind power workers with obtaining international professional training certificates and enhance their competitiveness, customized programs must be developed by consulting offshore wind power vendors on their personnel training needs.

(vii) Improve energy efficiency and reduce GHG emissions

International air transportation has been booming in recent years, and airports are now hosts to various public transportation industry members such as government agencies, airlines, ground staff, duty-free stores, and public transportation services, all working year-round. With such a high intensity of operations, controlling the overall energy usage of airports is vital to achieve low-carbon and green airports.

iii
Development Strategy

(i) In order to improve the management mechanism of wind farm navigation channels, while taking into account the government's goals for facilitating energy development and ensuring vessel navigation safety, it is necessary to develop navigation guidelines for vessels traveling through the Changhua Wind Farm Channel and implement a proper navigation channel separation mechanism. This will allow vessels to follow navigation instructions to cross the wind farm areas safely. In addition, Offshore Wind Farms Channel VTS Center must be established to actively monitor the navigational movement of vessels through radars, so as to be able to notify vessels to avoid wind farm equipment as well as handle maritime accidents.

(ii) Provide critical resources for offshore wind power

It is necessary to plan the construction of heavy-loaded wharves for the pre-assembly of wind turbine components and allocate the lands needed for underwater foundations, cables, and domestic manufacturing of wind turbine components. Currently, the Port of Taichung is considered an important development base for this purpose, while the Port of Taipei is poised to become the manufacturing base for underwater foundations.

(iii) Provide operation and maintenance bases and perfect the existing operation and maintenance services

It is necessary to plan and set up operation and maintenance centers as well as storage and logistics centers in ports near wind farms to facilitate their operation and maintenance. Currently, the Port of Taichung is considered as an important operation and maintenance base for this purpose, while the Port of Taipei and Port of Budai will be developed according to future demands.

(iv) Collect information on floating wind turbines to assess the feasibility of future developments

It is crucial to assess the future feasibility of floating structure wind turbines by having the Board of Transportation Technology Industries'"harbor and airport green energy industry task force" convene meetings, consult wind farm developers on their development needs, and reference the status of Taiwan's third stage of wind farm development policies and industry development dynamics.

(v) Construct low-carbon green airports to enhance Taiwan's green image

Taoyuan International Airport Corporation Ltd. seeks to identify greenhouse gas emissions in the airport through greenhouse gas inventory operations. At the same time, the Airport is inviting partners operating in the airport to engage in education and training, incentive grants, and seminars to reduce their greenhouse gas emissions. Depending on the development of electric vehicles in the market, the Airport will also adjust its vehicle control measures to improve its overall performance.

iv
Implementation Measures

(i) Designate navigation channels in the Changhua wind farms and establish relevant navigation guidelines

Following national energy development policies, the Bureau of Energy announced 36 potential sites for offshore wind power on July 2, 2015 that would affect the navigation channels of vessels passing by that area. In order to maintain vessel navigation safety, navigation channels have been planned in Changhua offshore wind farm waters, while navigation guidelines have also been formulated to serve as the basis for vessel navigation after the construction of wind farms. The MOTC completed the announcement on April 26, 2021, and will follow the regulations defined by the International Maritime Organization (IMO), Maritime Safety Committee (MSC) in Circ. 1060. The announced navigation channels and guidelines will go into effect six months after the announcement.

(ii) Establish the Offshore Wind Farms Channel VTS Center for vessels passing through the navigation channels in the offshore wind farms

Short-term:

The Offshore Wind Farms Channel VTS Center started its trial operation on December 28, 2020. The service uses an Automatic Identification System (AIS) to monitor vessel movements in the Changhua Wind Farm navigation channels 24 hours a day and communicates with vessels using radio communication to enhance navigation safety in the wind farm waters.

Medium-term and long-term:

The offshore wind farm channel VTS system will build two radar

stations, one in Dadu Mountain, Taichung County and another in Mailiao Township, Yunlin County. Construction for the stations is expected to be completed in early 2023. The system will be equipped with AIS and radio communication system to monitor abnormal conditions in real time to actively warn of navigational safety risks to facilitate the safe and orderly passage of vessels, thereby enhancing the safety of vessels navigating in the Changhua Wind Farm Channel.

(iii) Forward-looking layout of offshore wind power port facilities

1. Pre-assembly heavy-loaded wharves:

Taichung Port provides #2, #5A, #5B, #36 and #106, a total of five heavy-loaded wharves as offshore wind turbine pre-assembly bases. The Ports of Taipei, Anping, and Kaohsiung provide land for the wharves and rear land to support underwater foundation storage/manufacturing and assembly. In the future, the use of the wharvess and rear land use will be adjusted in accordance with national energy development policies.

2. Localized manufacturing areas

Industrial Zone (II) of the Port of Taichung is currently designated to be the "Offshore Wind Power Industry Localized Manufacturing Areas." At present, the following companies have begun factory construction in the zone: Century Huaxin Wind Energy Co., Ltd. (towers and transition pieces), Yeong Guan Energy Technology Group Co., Ltd. (hubs), Siemens Gamesa Renewable Energy S.A. (nacelles), and Tien Li Offshore Wind Technology Co., Ltd. (blades). The underwater foundation manufacturing and assembly site is located in the South Port area of the Port of Taipei. Currently, the factory belonging to Century Wind Power Co., Ltd. has already begun manufacturing in June 2020. In the Port of Kaohsiung, companies such as CTCI Machinery Corporation, Ming Rong Yuan Business Co., LTD, and CSBC Corporation Taiwan are already engaged in the manufacturing and storage of underwater foundations. The localized manufacturing areas will continue its tender in accordance with the wind farm localized manufacturing policy.

3. Operation and maintenance bases

Short-term:

TIPC Marine Corporation, Ltd., a subsidiary completely owned by the Taiwan International Ports Corporation, Ltd., will provide
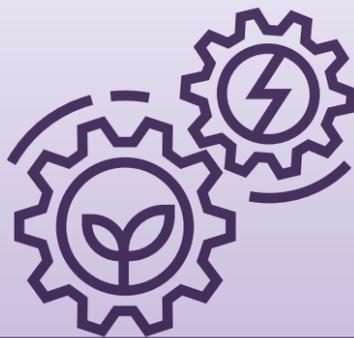
operation and maintenance services (warehouses, offices, and maintenance vessel berths) as well as marine vessel transportation services (transport and maintenance vessels, barges) in the Working boats Wharf at the Port of Taichung.

Medium-term and long-term:

Plan suitable operation and maintenance bases according to the development needs of the wind power industry.

4. Training center

In 2018, Taiwan International Ports Corporation, Ltd. established Taiwan International Windpower Training Corporation Ltd. (TIWTC) as a joint venture with other offshore wind power industry companies. TIWTC has since set up a wind power training center in the Port of Taichung to offer Basic Technology Training courses (BTT) and Basic Safety Training courses (BST) from the Global Wind Organization (GWO). In the future, TIWTC will continue to provide customized training courses for wind farm developers and wind turbine manufacturers to promote the localization of offshore wind power talents.

(iv) Reduce the number of gas-powered vehicles and implement green energy equipment in airports

Short-term:

Actively build charging facilities and provide charging subsidies to encourage the purchase of electric vehicles and service equipment. At the same time, relevant usage data will be collected to increase the overall utilization rate of charging facilities. In addition, vehicle control measures will be established to prohibit fuel vehicles from entering specific areas in order to improve the overall management of mobile GHG emission sources and to accelerate the electrification of vehicles and service equipment.

Medium-term and long-term:

Evaluate the procurement of renewable energy and the introduction of energy storage equipment with smart grid integration technology to balance peak and off-peak electricity demand. Appropriately configure the overall energy use of Taoyuan International Airport to reduce overall GHG emissions from stationary sources. In addition, evaluate the application of unmanned vehicles in some enclosed areas to optimize airport operations and reduce energy consumption.

Figure18 Current offshore wind power promotion efforts of Taiwan International Ports Corporation, Ltd.

OPERATION AND MAINTENANCE (O&M)

| Port of Taichung | ▶ Land-based and water-based O&M base | ▶ Maritime transportation services |
| Port of Budai | ▶ Ship repairing works | ▶ Stevedoring, warehousing, Heavy transportation |

TRAINING CENTER

| Port of Taichung | ▶ Training center for offshore wind power, provides GWO and customization classes |

LOCALIZED MANUFACTURING AREA

| Port of Taichung | ▶ Turbine pre-assembly wharf ▶ Home port for working vessels |
| Port of Anping | ▶ Storage and transshipment of imported wind turbines |

TURBINE PRE-ASSEMBLY AREA

Port of Taichung	▶ Localized manufacturing area
Port of Taipei	▶ Manufacturing base for underwater foundation
Port of Kaohsiung	▶ Maritime engineering support services

XII.

Weather Industry Policy

Recent years have seen humans increasingly impacted by extreme weather events resulting from climate change and global warming, and with it an increasingly urgent need to apply weather and climate information for climate risk management and climate change adaptation. The World Meteorological Organization (WMO) has called on governments to establish inclusive partnerships between public and private sectors, academia, and civil society to promote effective use of weather/climate information and improve the country's resilience to climate change.

According to the National Strategy and Action Plan for Adaptation to Climate Change in Taiwan released by the National Development Council, Executive Yuan, infrastructure, disaster prevention, water resource, agricultural production and biodiversity, public health, energy supply and industry, coastal and marine environment and land use are the eight key areas profoundly impacted by climate change. To fully support the needs of risk management and adaptation strategy for climate change, the government needs to combine the strengths of all stakeholders, including relevant industries, government, academia and researchers. By developing the weather industry and providing climate/weather services, public and private sectors can reduce risks, minimize disaster losses, and even create benefits in the face of the challenges posed by climate change. In this chapter, we will describe the current status of Taiwan's weather industry and the vision for future development, making clear the key issues that need to be immediately dealt with and laying out the strategic and action plans.

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i
Current Status and Development Vision

As catastrophic weather events have increased dramatically in recent years and global warming's impact on human well-being continue to worsen, the World Economic Forum's Global Risks Report 2020 ranked "climate action failure" and "extreme weather" at the top of 10 global risks in terms of "impact" and "likelihood," respectively, meaning that for human activities and socioeconomic development, short-term operation and long-term planning are both affected by climate change. It also highlights the urgent need for effective use and cross-sector application of weather/climate services in response to the impact of climate change.

The value-adding process of the weather industry in the country involves teamwork and partnership between the public and private sectors from the front end (in building weather observation system, collecting and processing data, establishing models, monitoring and forecasting, providing products, disseminating information, etc.) to the back end (in translating information, providing added value, customizing services, consulting, broadcasting, etc.).

According to the Central Weather Bureau's 2020 preliminary survey of the supply and demand of weather services, the total outsourcing demand of weather-related services is about NT$1 billion, of which about NT$800

million comes from the CWB, while the outsourcing demand from the central and local government agencies and the private sector is only about NT$200 million. This shows that the public and private sectors in Taiwan have yet to understand how weather services can benefit their operations and management.

Therefore, a series of policies will be proposed and implemented to promote development of the weather industry and create demands for weather services. This will strengthen the supply-and-demand mechanism and the partnership between public and private sectors (see Figure 1), so as to make more in-depth, wide-ranging and efficient use of meteorological information in various fields, thereby creating more market opportunities and generating more economic value, increasing our capacity for risk management and adaptation in the face of climate change, and increasing the international competitiveness of our weather industry.
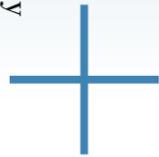
Figure19 Supply and demand and public-private partnership in weather industry
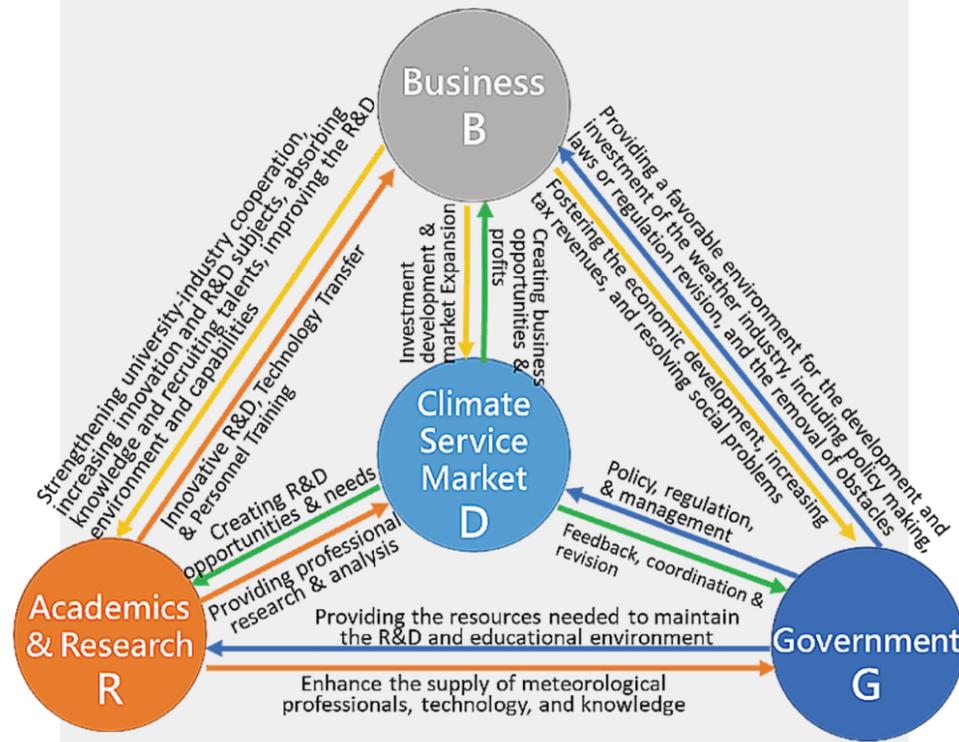
ii
Key Issues

(i) Establishing communication channels, promoting public-private collaboration, and building supply and demand chain

In order to integrate weather service capacity and make collaboration between partners more efficient, building an effective communication channel is a must. Through the interaction and discussion between weather service providers and other participants in public and private sectors, projects can be jointly developed to create a niche for the weather industry and facilitate application of weather information for commercial, public and academic purposes.

(ii) Enhancing data services, improving forecasting technology, and expanding cross-sector applications of weather services

To promote weather services, better adapt to climate change, make more efficient use of weather information, we will learn from the international community and consider further opening up weather data with more reasonable pricing, setting a trial plan to ease the restrictions on data use for associated institutions or companies, and strengthening the promotion and interpretation of weather data. Moreover, we will continue to improve weather forecasting and information application technology, so as to provide enough weather data for cross-sector and value-added applications.

iii
Development Strategy

(iii) Revising laws and policies to create a favorable environment for weather industry development

At present, the government plays a major role in providing weather services in Taiwan, while development of private weather industry is still in the early stages. It would be beneficial to include regulations about promoting and developing the weather industry into meteorology-related laws, and to strengthen academia-industry cooperation by means of deregulation. In the meantime, the government should provide policies to increase employment opportunities and improve the environment for sustainable development of the weather industry.

(i) Establishing a "Taiwan Climate Service Partnership" as a bridge between the public and private sectors

The stakeholders from both the supply and demand ends of the weather service value chain are invited to join the Taiwan Climate Service Partnership (TCSP), where they can interact, connect, and collaborate to create strategies and practical plans for the development of the weather industry, and formulate a cooperative development proposal for applications in the commercial, public, and academic fields can be formulated, so as to integrate and coordinate the supply and demand value chain of the weather industry in Taiwan.

(ii) Conducting research on international weather industries and evaluating supply and demand to establish the value chain of weather industry in Taiwan

The market development and operating models in developed countries or regions such as Europe, USA, Japan, and South Korea are taken as reference to evaluate the supply and demand of stakeholders from upstream to downstream on the value chain of the weather

industry in Taiwan. At the front end, advancements in meteorological technology serve as the backbone of climate services to support the industry. At the back end, expansion of application services, supply-demand matching, and development of demand-oriented services are the keys to broadening the scope of weather services.

(iii) Providing appropriate and sufficient information for applications in relevant fields

With the rapid development of weather observation technology and computing devices, the types and quantities of data such as meteorological observations and numerical forecasts are increasing. More users can explore the potential application value of such data, which can directly or indirectly stimulate the development of the weather industry and increase the economic value. In addition, it is necessary to evaluate the demands for weather data and products in Taiwan and adjust the current supply and pricing accordingly. There is also the need to establish meteorology-related quality standards and certification mechanisms that can facilitate entry into the market by reducing the costs of starting a new business.

(iv) Establishing appropriate data exchange and dissemination channels

In order to make it easier for user to access, exchange, and share weather data, a standard and a platform for data exchange will be established for diversified and convenient data distribution and value-added applications.

(v) Facilitating cross-sector applications and collaborations

Although weather information is closely related to people's lives, most people do not fully understand its scientific aspect. Therefore, it is necessary to enhance people's understanding of the application value of weather science and information, and to build a consensus on cross-sector value-added applications of weather information, such as disaster prevention, climate impact assessment, vulnerability identification, risk assessment, and adaptation planning.
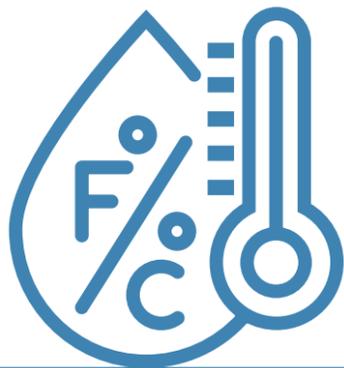
(vi) Revising meteorology-related laws and regulations

Meteorology-related laws and regulations and the pricing standards for weather data should be revised by adding articles that will facilitate development of the weather industry. Relevant complementary measures should also be adopted so that the government, private enterprises, and the general public can be better informed of the value of climate services, thereby creating more market value and business opportunities.

(vii) Creating more opportunities for weather industry development

To create more opportunities for the development of weather industry by public-private partnerships (PPPs), a supply-demand matching mechanism for cross-sector applications needs to be established by assessing room for development in weather information application services in Taiwan. Assistance will also be provided in the form of technology development, cooperation, and awards/grants to boost personnel employment and service opportunities, and expos will be held to increase interaction and cooperation between members in the weather industry.

(viii) Nurturing talents with practical skills

Departments of atmospheric science and related disciplines should receive more assistance in improving weather forecasting courses and practical training, so as to encourage more students to enter the weather industry. It is hoped that through the collaborations between the industry, the academia, and the government, more professionals in weather forecasting and applications will be produced and more employment and internship opportunities will be created, further driving the development of weather industry by manpower supply and demand.

iv
iv Promotion Measures

(i) Establishing the Taiwan Climate Service Partnership to connect the supply and demand in the value chain of the weather industry in Taiwan

Short-term:

By establishing Taiwan Climate Service Partnership, communication and interaction in the meteorology field can be facilitated, and connection between supply and demand for weather/climate information, technology, and services can be strengthened. Participants can set out strategies of weather industry development and reinforce the coordination and connection between the front end and back end in the industry.

(ii) Organizing the Taiwan Weather Industry Forum and building a communication platform for the weather industry

Short-, mid-, and long-term:

An annual Taiwan Weather Industry Forum will be organized as a platform and mechanism to facilitate conversations about weather information, review the status of development in applications of weather information and products, and collect opinions and suggestions regarding the prospects and challenges of the industry by means of cross-sector exchange and consensus building.

(iii) Studying the operating models of weather industries in Europe, USA, Japan, and South Korea

Short-term:

We plan to collect information about development and operations of international weather industries, analyze the current situation and road map in different countries, including the challenges they are facing and the respective government's response to stimulate the development of weather industry. Such data and information can be used for the strategic planning for the development of weather industry in Taiwan.

(iv) Evaluating the service capacity suppliers in the value chain of weather industry in Taiwan

Short-term:

To fully understand the constituents and stakeholders in the value chain of the weather industry in Taiwan, a thorough investigation into demands for weather services and current situation of the industry has to be carried out.

(v) Analyzing the room for weather industry development and the demand for services in order to build connections along the value chain

Short- and mid-term:

Surveys and interviews of weather information users should be conducted, so that analysis of demands and possible challenges can be done accordingly. Past analysis of economic values of weather information applications also has to be integrated to evaluate their market potential, eventually building connections along the value chain.

(vi) Evaluating the weather industry's demands for weather information and products

Short-term:

We plan to investigate and assess the demands for weather data in specific, meteorology-related fields regularly, and launch a "Meteorological Resources Innovative Trial Plan" that will allows users from private enterprises to access not-yet-publicly-available data or techniques upon application.

(vii) Discussing and adjusting the supplying and pricing of weather information and products

Short-term:

Taking the systems in different countries as reference, and taking into consideration the government's open data policy and fair distribution of data, we aim to establish a reasonable pricing standard which meets market expectations and is affordable for start-ups in the weather industry.

(viii) Promoting quality assurance mechanisms for weather data

Short-, mid-, and long-term:

We aim to build quality standards and assurance mechanisms for observation instruments standards (including data quality and stability), instruments calibration standards, data quality standards, etc. When observation data from the private sector is certified and classified through specific procedures, the data can be used as a reference for cross-sector applications or weather forecasts. An objective evaluation mechanism by the private sector can also be established to further improve the data quality.

(ix) Building an information and data exchange platform

Mid- and long-term:

We will assist the government and the private sector in data access, exchange, and consultation services to strengthen data sharing mechanisms, simplify the application process, and encourage the private sector to engage and invest to increase the value of commercial applications. Besides, we plan to build an integrated atmospheric database for users to easily access, exchange, and share weather data for value-added applications.

(x) Building data exchange standards

Short-, mid-, and long-term:

We plan to review the data for basic forecast, exchange, and applications in order to provide a set of Meteorological Data Standards, which will be updated as appropriate to facilitate value-added applications

(xi) Improving the general public's understanding of meteorological science and value-added applications of weather data

Short-, mid-, and long-term:

We aim to promote the general public's knowledge and use of weather products by organizing or co-hosting popular science and disaster prevention events. We also plan to hold practical meteorology workshops and seminars every year for government agencies for disaster prevention, companies with permits to provide weather and marine weather forecasts, disaster prevention teams from the private sector, mass media, and students. By providing climate change awareness classes and climate risk knowledge and

services, we hope to help the general public, government agencies and private enterprises to understand the value of weather services and create commercial opportunities.

(xii) Organizing forums to facilitate cross-sector value-added applications of weather information

Short-, mid-, and long-term:

By actively working with both central and local governments, we hope to improve the interpretation and cross-sector applications of weather information. Annual seminars are held on weather information applications for disaster prevention, weather analysis and forecast, climate services, etc. in order to facilitate cross-sector value-added applications of weather information.

(xiii) Supporting the public and private sectors in cross-sector impact assessment, vulnerability identification, risk assessment and adaptation plans and other climate application services in response to climate change

Mid- and long-term:

In response to the impact of climate change and for environmental sustainability purposes, we can provide climate change adaptation information and consultation services for the public sector and various climate information for the private sector in accordance with the principles and recommendations of Corporate Social Responsibility (CSR), Environment, Social and Governance (ESG), and Task Force on Climate-related Financial Disclosures (TCFD) proposed by Financial Stability Board (FSB).

(xiv) Reviewing and revising the Meteorological Act by including regulations for facilitating development of weather industry

Short- and mid-term:

We plan to collect and review information about meteorology-related laws, policies, and regulations in developed countries, and evaluate the inclusion of relevant regulations in the Meteorological Act of Taiwan to facilitate development of the
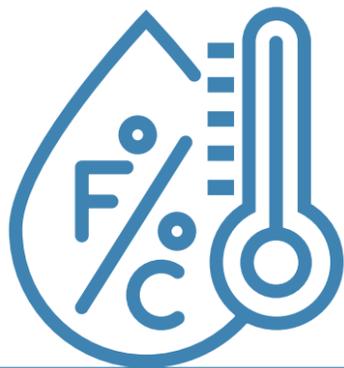
weather industry through policies and laws. Symposiums and expert panel discussions will also be held to discuss the practical needs of weather industry development in terms of laws and policies.

(xv) Amending the Regulation on the Authorization of Forecast Service of Meteorological and Marine Meteorological Phenomena to allow for more private sector engagement in weather industry

Short- and mid-term:

The Regulation on the Authorization of Forecast Service of Meteorological and Marine Meteorological Phenomena will be reviewed to facilitate application for certificate and provide clear guidelines certificate validity and classification to encourage private sector's participation in the industry. Through forums, symposiums, and public hearings, suggestions and opinions will be collected for making the amendments.

(xvi) Reviewing and revising the pricing standards of the CWB's weather information for easier access to such information

Short- and mid-term:

The pricing of CWB's data will be revised to meet market needs and facilitate development of start-ups in the weather industry.

(xvii) Providing assistance in the form of policies, contracts, techniques, collaborations, and grants to provide more employment opportunities for professionals along the value chain

Short-, mid-, and long-term:

We plan to coordinate with relevant government agencies to convene policy discussion meetings and build a consensus on policy framework for innovative applications in different fields, with an aim to maximize the capacity for weather industry development through PPPs. We will also provide industry development consultation services including technical consultation, technology transfer, and awards and grants to encourage creativity.

壹拾貳、氣象產業政策

XII. Weather Industry Policy

(xviii) Holding an industry expo to facilitate interactions and collaborations

Short-, mid-, and long-term:

An industry expo will be held to provide information about supply and demand of weather services for reference by private enterprises, the academia, or the general public, and to provide a space for interactions within the weather industry to accelerate supply and demand matching.

(xix) Assisting universities and colleges in providing more and better meteorological forecasting and application courses and practical training, and coordinating with these institutions to conduct examination for weather forecaster certification and qualification

Short-, mid-, and long-term:

We plan to coordinate with departments of atmospheric science and related disciplines in universities and colleges to design practical courses and run an annual summer internship program to give students more practical experience in weather observation and forecasting. In the future, weather forecasting courses with credits and practical training will be designed and provided in a way that will also help prepare students for examinations for weather forecaster certification and qualification. Thus, by offering courses and training that will make students qualified and ready, and by providing internship opportunities for hands-on experience, it is hoped that more people will be available to join the workforce.
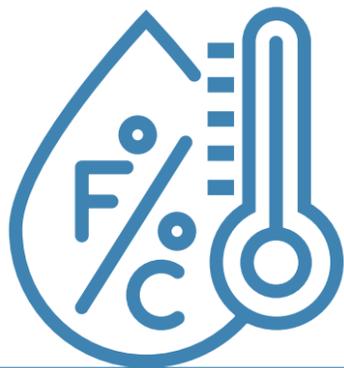
Conclusion

The *White Paper on Transportation Technology Industry Policy* was prepared based on the MOTC's administrative goals and themes, after referring to the transportation technology development and application trends in advanced countries, thoroughly reviewing related issues of the domestic transportation technology industry, and clarifying the current status and development needs. The Board of Transportation Technology Industries and Task Forces convened several times in medium and large forums and discussions, during which the elite in each sector gathered together to provide their expertise and opinions. The white paper was finally completed after cross-departmental communication, coordination, and integration.

This white paper contains 12 major transportation technology industry policies, 42 important issues, 72 development strategies, and 130 implementation measures, which are jointly implemented by 12 departments and local governments. The agency responsible for each implementation measure formulates implementation plans that are carried out each year. After agencies submit implementation reports each year, the MOTC Science and Technology Advisors Office is responsible for the management and evaluation of results and benefits, and convenes cross-departmental coordination meetings based on goal attainment. Implementation results for each year are reported to the MOTC for future reference. Furthermore, the current status and development vision in this white paper should be reviewed as needed, and reviews on a rolling basis of important issues and development strategies should be conducted in response to changes in the domestic and overseas environments, as well as innovative developments in transportation technology.

This white paper combines humanity-oriented developments, technology, and industry in the hope of improving service capabilities and quality through innovative transportation technology, and creating interactive and emotionally inspiring transportation services with people's best interests as the priority. In summary, even though policies for the transportation technology industry under the 12 topics cover an extensive scope, the contents of the white paper can be summarized as follows:

(i) Supporting the development of the domestic transportation technology industry through government investments.

(ii) Jointly planning the blueprint for developing the nation's future transportation together with industry in order to enter the global market.

(iii) Utilizing innovative technologies in response to developments and changes in the environment and industries in Taiwan and overseas and proposing comprehensive transportation solutions.

(iv) Actively adapting regulations, cultivating talent, and guiding industries to adapt to future changes in the environment.

(v) Developing a humanity-oriented, smart, convenient, safe, and sustainable transportation service network to consolidate national strength and benefit citizens.

(vi) Encouraging innovation in transportation governance and transforming the conventional role of control and supervision.

2021

White Paper
on Transportation Technology
Industry Policy

Appendix 1. List of Measures Implemented

I. Railway technology industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Promotion of technological development and testing/ verification to help the industry gain independence	Drive the development of railway technology and related industries through domestic production of trains and electromechanical systems	Prioritize items for localization	Railway Bureau, MOTC	1. Taiwan Railway, MOTC 2. Industrial Development Bureau, MOEA	√	√	√
		Integrate technological development and testing/verification capabilities	Railway Bureau, MOTC	Industrial Development Bureau, MOEA	√	√	√
		Establish national standards	Railway Bureau, MOTC	Bureau of Standards, Metrology & Inspection, MOEA	√		
		Establish a Railway Technology Research and Verification Center	Railway Bureau, MOTC		√	√	√
		Assist academic institutions with cultivating railway talent	1. Taiwan Railway, MOTC 2. Railway operators 3. Railway Bureau, MOTC	Department of Technical and Vocational Education, MOE	√	√	√
Resolving issues with tendering, expanding market scale, and integrating procurement requirements	Increase opportunities and willingness of domestic companies to participate in the railway construction and repair market	Establish railway system procurement guidelines and support measures for localization	Railway Bureau, MOTC	1. Public Construction Commission, Executive Yuan 2. Department of National Spatial Planning and Development, National Development Council, Executive Yuan 3. Departments of Transportation from County/City Governments	√	√	
		Provide repair business opportunities	1. Taiwan Railway, MOTC 2. Railway operators 3. Railway Bureau, MOTC		√		
		Assemble the R-TEAM and develop railway electromechanical system turnkey contractors in Taiwan	1. Railway Bureau, MOTC 2. Industrial Development Bureau, MOEA		√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Utilizing the strengths of Taiwan's ICT industry to promote smart railway transportation	Develop smart railway 4.0 and related industries	Establish a smart railway system structure and incorporate 4.0 technology	Railway Bureau, MOTC	1. Taiwan Railway, MOTC 2. Railway operators	√	√	√

lNote: It is the recommendation of inter-units that promotion measures be included as reference policies.

II. Smart electric bus technology industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Develop electric buses using new technology and implement autonomous driving technology	Implement applications of electric bus designs with new technologies	Integrate the vehicle industrial chain to establish new specifications and develop new products	Industrial Development Bureau, MOEA	1. Directorate General of Highways, MOTC 2. Vehicle Safety Certification Center	√		
		Implement specifications for advanced equipment and systems applied in electric buses and verification	Vehicle Safety Certification Center	Directorate General of Highways, MOTC		√	
		Integrate the ability to independently develop key components and systems of driverless vehicles	Industrial Development Bureau, MOEA	1. Directorate General of Highways, MOTC 2. Vehicle Safety Certification Center			√
Electric buses by 2030	Create an ideal environment for transition to electric buses	Transition to electric buses	Department of Railways and Highways, MOTC	Directorate General of Highways, MOTC	√		
		Establish tax preference items and industry projects	Taxation Administration, MOF	Industrial Development Bureau, MOEA		√	
		Improve the infrastructure to meet power requirements of electric buses	Ministry of Economic Affairs	Taiwan Power Company			√
Develop equipment capabilities for an electric bus verification platform	Enhance key equipment capabilities of the domestic smart electric bus industry	Promote key parts and components and specifications of vehicles	Vehicle Safety Certification Center	Directorate General of Highways, MOTC	√		
		Establish a shared platform for vehicle systems and verification equipment	Vehicle Safety Certification Center	Directorate General of Highways, MOTC		√	
		Enhance technical capabilities and competitiveness of Taiwan's finished vehicles and key parts and components	Industrial Development Bureau, MOEA	Vehicle Safety Certification Center			√
Mutual recognition of certifications with the European Union for compliance of key parts and components and system equipment	Support domestic vehicle safety testing and certification institutions	Build testing and certification capabilities for electric buses	Vehicle Safety Certification Center	Directorate General of Highways, MOTC	√		
		Establish collaboration and mutual report recognition mechanisms with foreign institutions	Department of European Affairs, MOFA	Vehicle Safety Certification Center		√	
		Establish vehicle safety certifications with the EU	Department of European Affairs, MOFA	Vehicle Safety Certification Center			√

III. Smart electric motorcycle technology industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Implement "smart" motorcycle technologies	Promote equipping electric motorcycles with smart technologies such as V2X and safety equipment	Guide and encourage local governments and private companies to develop smart roadside facilities needed to develop smart motorcycles, and develop an integrated cloud service platform	Office of Science and Technology Advisors, MOTC		√		
		Encourage and subsidize companies to engage in the development of smart/safety technologies such as V2X, and apply the technologies in motorcycles available in the market for consumers to choose from	Office of Science and Technology Advisors, MOTC		√		
		Continue to align with international standards by coordinating with the UNECE to implement motorcycle safety and smart technology regulations in Taiwan, making motorcycles safer, smarter, and more high-tech	Department of Railways and Highways, MOTC	Vehicle Safety Certification Center		√	√
		Integrate resources of ICT and ITS industries across departments, jointly establish common industry standards, become aligned with the international market, and enhance industrial competitiveness	1. Office of Science and Technology Advisors, MOTC 2. Industrial Development Bureau, MOEA			√	√
	Encourage the development of innovative application services for motorcycle sharing	Integrate planning of motorcycle information and communications, traffic control system, and smart safe intersections into the traffic management information and communication platform to improve traffic safety	Office of Science and Technology Advisors, MOTC		√		
		Reduce possession and use of private transportation tools in urban areas by boosting the development of innovative application services and industry development of motorcycle sharing	1. Industrial Development Bureau, MOEA 2. Department of Railways and Highways, MOTC	County/City Governments		√	√
		Encourage motorcycle manufacturers to use the turnkey business model for international output	Industrial Development Bureau, MOEA	Ministry of Foreign Affairs		√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Create a friendly "electric" user environment	Conduct rolling reviews of national (industry) standards for electric motorcycle charging/battery swapping stations and battery product regulations	Ensure the safety and quality of electric motorcycle batteries and chargers	Bureau of Standards, Metrology & Inspection, MOEA	Vehicle Safety Certification Center	√		
		Continue to review national (industry) standards for electric motorcycle charging (battery swapping) equipment	Bureau of Standards, Metrology & Inspection, MOEA			√	√
	Increase the penetration rate of electric motorcycle charging/battery swapping stations, and establish an energy and vehicle information management platform	Increase the penetration rate of electric motorcycle charging/ battery swapping stations	Bureau of Energy, MOEA	1. Taiwan Railway, MOTC 2. Railway Bureau, MOTC 3. County/City Governments	√		
		Promote collaboration between motorcycle manufacturers and state-owned enterprises in developing energy solutions and an operations information management platform	Industrial Development Bureau, MOEA			√	√
	Repurposing batteries	Encourage motorcycle manufacturers or operators to establish a battery repurposing model	Industrial Development Bureau, MOEA			√	√
		Continue to implement battery repurposing to achieve source reduction and reuse	Recycling Fund Management Board, Environmental Protection Administration, Executive Yuan	Directorate General of Highways, MOTC		√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Guide the upgrade and transformation of the motorcycle industry	Promote fuel/electric motorcycle co-existence policies	Plan subsidies to replace 1-4th generation gas-powered motorcycles with electric motorcycles or 7th generation gas-powered motorcycles	Department of Air Quality Protection & Noise Control, Environmental Protection Administration, Executive Yuan		√		
		Combine the capabilities of government and corporations to provide guidance and assistance to the industry with transformation in motorcycle manufacturing, marketing, repair, and use	Industrial Development Bureau, MOEA			√	√
	Transform and upgrade motorcycle repair shops	Improve the professional skills of mechanics at motorcycle repair shops, so that they not only know how to repair gas-powered motorcycles, but also have learned how to repair electric motorcycles	1. Industrial Development Bureau, MOEA 2. Ministry of Education 3. Workforce Development Agency, MOL		√		
		Provide guidance to motorcycle repair shops to diversify, increase their sources of revenue, and enhance their competitiveness	Industrial Development Bureau, MOEA		√		
		Encourage electric motorcycle manufacturers to establish a new mode of cooperation with conventional motorcycle repair shops for repair and sales	Industrial Development Bureau, MOEA		√		

|Note:It is the recommendation of inter-units that promotion measures be included as reference policies.

IV. Smart public transportation service industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
New generation smart payment and mobile services	Develop an environment that accepts multiple tickets and payment methods, and strengthen cross-industry integration and value-added applications	Provide guidance to system and equipment companies in developing and manufacturing new generation ticket barrier machines, and establish industry standards	1. Directorate General of Highways, MOTC 2. Office of Science and Technology Advisors, MOTC	1. Taiwan Telematics Industry Association (TTIA) 2. Intelligent Transportation Society of Taiwan (ITS Taiwan)	√		
		Establish a subsidy plan for new generation ticket barrier machines	Directorate General of Highways, MOTC	1. County/City Governments 2. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C.	√		
		Plan an integrated payment and clearing mechanism and standard ticket formats	1. Directorate General of Highways, MOTC 2. Office of Science and Technology Advisors 3. Department of Railways and Highways, MOTC	1. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C. 2. Taiwan Telematics Industry Association (TTIA) 3. Intelligent Transportation Society of Taiwan (ITS Taiwan) 4. Tickets and Payment Vendors	√		
		Implement public transportation reward point discount measures	Directorate General of Highways, MOTC	1. Taiwan Railway, MOTC 2. Railway Bureau, MOTC 3. Tourism Bureau, Republic of China (Taiwan) 4. Institute of Transportation, MOTC 5. Office of Science and Technology Advisors, MOTC 6. County/City Governments	√		
		Develop one-stop integrated public transportation	1. Institute of Transportation, MOTC 2. Office of Science and Technology Advisors, MOTC	1. Taiwan Railway, MOTC 2. Railway Bureau, MOTC 3. Directorate General of Highways, MOTC 4. Tourism Bureau, Republic of China (Taiwan) 5. County/City Governments			√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Digital transformation and governance of public transportation	Accelerate the digital transformation of public transportation, and improve traffic safety and operational performance	Establish information systems on services provided by bus companies and stations	Directorate General of Highways, MOTC	1. Office of Science and Technology Advisors, MOTC 2. Institute of Transportation, MOTC 3. Intelligent Transportation Society of Taiwan (ITS Taiwan) 4. Taiwan Telematics Industry Association (TTIA) 5. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C.	√		
		Plan the installation of technological safety equipment and management systems in public transportation vehicles	1. Department of Railways and Highways, MOTC 2. Directorate General of Highways, MOTC	1. Office of Science and Technology Advisors, MOTC 2. Institute of Transportation, MOTC 3. Information Management Center, MOTC 4. Intelligent Transportation Society of Taiwan (ITS Taiwan) 5. Taiwan Telematics Industry Association (TTIA) 6. Vehicle Safety Certification Center 7. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C.		√	
		Develop smart electrical equipment and systems for vehicles and a public transportation service information platform	1. Department of Railways and Highways, MOTC 2. Directorate General of Highways, MOTC	1. Office of Science and Technology Advisors, MOTC 2. Institute of Transportation, MOTC 3. County/City Governments 4. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C.		√	
		Plan the establishment of professional organizations and institutions for the public transportation service industry	Directorate General of Highways, MOTC	1. Office of Science and Technology Advisors, MOTC 2. Institute of Transportation, MOTC 3. Intelligent Transportation Society of Taiwan (ITS Taiwan) 4. Taiwan Telematics Industry Association (TTIA) 5. The Federation of Highway and Intercity Bus Companies in Taiwan, R.O.C.		√	
		Establish information security specifications and standards for public transportation service systems and platforms	Office of Science and Technology Advisors, MOTC	1. Directorate General of Highways, MOTC 2. Institute of Transportation, MOTC 3. Taiwan Telematics Industry Association (TTIA)		√	

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Rural area transportation system integration and development	Establish micro public transportation systems in rural areas, integrate local resources, and strengthen supply and demand matchmaking	Plan viable integrated business models and shared platform operating mechanisms	1. Office of Science and Technology Advisors, MOTC 2. Directorate General of Highways, MOTC	1. Department of Railways and Highways, MOTC 2. Institute of Transportation, MOTC 3. Intelligent Transportation Society of Taiwan (ITS Taiwan)	√		
		Add specifications for systematic development operations of transportation systems in rural areas	1.Department of Railways and Highways, MOTC 2.Directorate General of Highways, MOTC	1. Directorate General of Highways, MOTC 2. Institute of Transportation, MOTC	√		
		Implement the Rural Area Bus of Happiness Project	Directorate General of Highways, MOTC	1. Institute of Transportation, MOTC 2. County/City Governments	√		

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

V. Bicycle and tourism industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Roaming around Taiwan on a bicycle	Plan cycling routes for in-depth roaming and create a friendly cycling environment	Plan and establish diverse cycling routes	Bicycle Road Network Design Project Steering Task Force, MOTC	1. Directorate General of Highways, MOTC 2. Institute of Transportation, MOTC 3. Tourism Bureau, Republic of China (Taiwan)	√	√	√
	Establish a friendly tour service platform	Provide service information on partnership among tourism and bicycle industries	Tourism Bureau, Republic of China (Taiwan)		√		
	Guide or establish complete bicycle rental locations	Provide public bicycles at major transportation stations or information on bicycle rentals in each county/city	Taiwan Railway, MOTC		√	√	√
	Plan marketing and promotion work	Develop international cycling routes and specialty tours	Tourism Bureau, Republic of China (Taiwan)		√		
Linking together green transportation tools	Well-planned TRA schedule and user-friendly, accessible ticket reservation system	Improve the TRA system and equipment	Taiwan Railway, MOTC		√		
	Encourage bus companies to provide space in the luggage compartment of buses to place bicycles on the bus	Encourage bus companies to replace old buses with qualified bicycle buses	Directorate General of Highways, MOTC			√	√
	Well-planned public transportation for incoming passengers and cooperation from related companies	Improve transfer information at Songshan, Taichung, Kaohsiung, and Taoyuan International Airport for inbound and outbound passengers who carry their bicycles	1. Department of Navigation and Aviation, MOTC 2. Civil Aeronautics Administration, MOTC 3. Bicycle Road Network Design Project Steering Task Force, MOTC		√		

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Involvement of the private sector and future development of the bicycle industry	Promote human-oriented transportation and a livable city	Plan to incorporate cycling route practices into urban road design specifications and dissemination	Department of Railways and Highways, MOTC	1. Road Traffic Safety Committee, MOTC 2. Construction and Planning Agency, MOI	√	√	√
	Continue to review the type and positioning of e-bikes	Continue to review the type and positioning of e-bikes in view of international standards	Department of Railways and Highways, MOTC			√	√
	Promote and supervise e-bike companies to provide qualified e-bikes, in order to ensure consumer rights and cycling safety	Promote and encourage e-bike companies to offer qualified e-bikes	Department of Railways and Highways, MOTC			√	√
	Legalize passenger carrying on bicycles	Implement supporting measures to legalize passenger carrying on bicycles	Department of Railways and Highways, MOTC		√		
	Invite the private sector to jointly promote cycling and provide a cycling-friendly environment	Encourage the private sector to jointly promote cycling and create a friendly cycling environment		1. Industrial Development Bureau, MOEA 2. Department of Air Quality Protection & Noise Control, Environmental Protection Administration, Executive Yuan 3. Directorate General of Highways, MOTC		√	√

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

VI. Smart port and airport service industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Port and airport ICT infrastructure need to be actively and constantly upgraded	Improve the infrastructure of smart ports and airports to create an excellent development environment	Establish the vision and goals for the development of smart ports and airports to formulate a forward-looking and integrated smart port and airport development plan	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC	√		
		Improve the infrastructure of smart hardware and software to create an excellent development environment	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd. 3. Civil Aeronautics Administration, MOTC 4. Maritime and Port Bureau, MOTC	1. National Immigration Agency, MOI 2. Aviation Police Bureau, National Police Agency, MOI 3. Customs Administration, MOF 4. Institute of Transportation, MOTC 5. Directorate General of Highways, MOTC	√		
Smart port and airport technology applications and industrial development are still in the initial stage	Expand the application of smart technology to drive the innovative development of the industry	Provide pilot sites for new innovation/technology industries and services to develop POCs	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC	√		
		Integrate smart technology to improve passenger experience and port / airport management performance	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd. 3. Civil Aeronautics Administration, MOTC 4. Maritime and Port Bureau, MOTC	1. National Immigration Agency, MOI 2. Aviation Police Bureau, National Police Agency, MOI 3. Central Weather Bureau, MOTC	√	√	√
		Establish a Smart Port and Airport Industry Ecosystem	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC 3. Tourism Bureau, Republic of China (Taiwan)	√	√	√
		Promote the introduction of new technologies for enterprises to provide excellent services at ports and airports	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC		√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Smart ports and airports need to be industrialized for stronger competitiveness	Industrialize smart ports and airports from an export-oriented perspective	Reconcile smart technology support measures and administrative resources to facilitate the application of smart technology	MOTC	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd. 3. Civil Aeronautics Administration, MOTC 4. Maritime and Port Bureau, MOTC 5. Aviation Police Bureau, National Police Agency, MOI 6. National Immigration Agency, MOI 7. Customs Administration, MOF 8. Intellectual Property Office, MOEA 9. Personal Data Protection Office, National Development Council, Executive Yuan	√		
	√	Establish a smart port and airport industry alliance to promote the nationalization and autonomy of core technologies and the industry	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC		√	√
		Match companies with business opportunities through diverse channels	1. Taoyuan International Airport Corporation Ltd. 2. Taiwan International Ports Corporation, Ltd.	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC 3. Bureau of Foreign Trade, MOEA		√	√

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

VII. Smart logistics service industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Create an environment for the development of smart logistics and improve the efficiency of convenient logistics services	Connect the air, sea and postal logistics industries, plan the forward-looking logistics park, and use AIOT and Big Data logistics technology to improve overall service efficiency	Advanced deployment and planning of the forward-looking logistics park development plan	1. Civil Aeronautics Administration, MOTC 2. Taiwan International Ports Corporation, Ltd. 3. Taoyuan International Airport Corporation Ltd.			√	√
		Connect the tender process for the port, airport, and postal parks to accelerate growth through industrial clustering	1. Taiwan International Ports Corporation, Ltd. 2. Taoyuan International Airport Corporation Ltd. 3. Chunghwa Post Co., Ltd.		√	√	
		Promote the standardized application of logistics technology services to fully make use of smart logistics synergy	1. Civil Aeronautics Administration, MOTC 2. Chunghwa Post Co., Ltd. 3. Taoyuan International Airport Corporation Ltd.	Department of Navigation and Aviation	√	√	√
		Leverage logistics data, information technology and facilities to improve demand forecasting, tracking management and security performance	1. Maritime and Port Bureau, MOTC 2. Civil Aeronautics Administration, MOTC 3. Customs Administration, MOF 4. Taiwan International Ports Corporation, Ltd. 5. Taoyuan International Airport Corporation Ltd. 6. Farglory Land Development Co., Ltd		√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Follow logistics industry development trends to drive industry transformation and upgrading	Promote automation technology and shared platform services, understand industry demands to provide proper guidance, and drive the transformation and upgrade of the logistics industry	Construct a pilot site of automated technology logistics to serve as a demonstration site for the application of future logistics technologies	1. Chunghwa Post Co., Ltd. 2. Taiwan International Ports Corporation, Ltd. 3. Taoyuan International Airport Corporation Ltd.	1. Department of Navigation and Aviation, MOTC 2. Department of Posts and Telecommunications, MOTC 3. Civil Aeronautics Administration, MOTC 4. Institute of Transportation, MOTC	√	√	√
		Promote the development of logistics services and information sharing platforms to expand and enhance logistics revenue and efficiency	1. Civil Aeronautics Administration, MOTC 2. Chunghwa Post Co., Ltd.		√	√	√
		Continue to promote consultation services and incentives to help industries use technology in their transformation and upgrading process	1. Civil Aeronautics Administration, MOTC 2. Maritime and Port Bureau, MOTC 3. Taoyuan International Airport Corporation Ltd. 4. Taiwan International Ports Corporation, Ltd. 5. Chunghwa Post Co., Ltd.	1. Department of Navigation and Aviation, MOTC 2. Department of Commerce, MOEA 3. Taiwan Association of Logistics Management	√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
The logistics industry faces new challenges in regulatory coherence and talent cultivation when adopting new technologies	Strengthen industry-academia collaboration in the logistics industry, cultivate diversified logistics talents, and integrate resources to establish a regulatory adjustment platform	Promote the cultivation of talents through industry-academia collaboration to increase the number and professional capabilities of logistics talents	1. Chunghwa Post Co., Ltd. 2. Taiwan International Ports Corporation, Ltd. 3. Taoyuan International Airport Corporation Ltd. 4. Directorate General of Highways, MOTC 5. Industrial Technology Research Institute	1. Institute of Transportation, MOTC 2. Department of Navigation and Aviation, MOTC 3. Department of Railways and Highways, MOTC 4. Customs Administration, MOF 5. Department of Commerce, MOEA 6. Taiwan Association of Logistics Management	√		
		Promote the establishment of an inter-ministerial smart logistics regulation coordination working group	1. Department of Navigation and Aviation, MOTC 2. Maritime and Port Bureau, MOTC 3. Directorate General of Highways, MOTC 4. Chunghwa Post Co., Ltd.	1. Department of Railways and Highways, MOTC 2. Department of Navigation and Aviation, MOTC	√		

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

VIII. UAS technology industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Closely align technological developments in the private sector with domestic demand on UAS applications	Promote UAS testing for multiple applications	Promote the Integrated Pilot Program (IPP)	Ministry of Transportation and Communications	Ministry of Economic Affairs	√	√	
		Implementation of countering UAS measures	Ministry of Transportation and Communications		√	√	√
	Invest in the research and development of key UAS technologies	Promote the UAS sandbox verification program	Ministry of Economic Affairs	Ministry of Transportation and Communications	√	√	√
	Subsidize basic UAS technology research	Subsidize basic UAS research	Ministry of Science and Technology		√		
	Promote UAS air traffic management	Develop UAS tracking and identification technologies and air traffic management rules	Ministry of Transportation and Communications		√	√	
	Establish UAS test sites	Planning and constrction of pilot test sites for UAS technology	1. Ministry of Science and Technology 2. Ministry of Economic Affairs	1. National Development Council 2. Ministry of Transportation and Communications	√	√	√
	Accelerate the introduction of UAS for public service applications	Promote the IPP and replace Made-in-China UAS	Ministry of Transportation and Communications	1. Ministry of Science and Technology 2. Ministry of Economic Affairs	√	√	
	Form the U-Team	Establish an inter-ministerial collaboration mechanism to form the U-Team	Ministry of Transportation and Communications		√	√	√
	Plan innovative UAS service operation and management	Plan UAS-related operations, services, rights, responsibilities, insurances, and cyber security	Ministry of Transportation and Communications	1.Ministry of Economic Affairs 2.Ministry of Science and Technology	√	√	
	Strengthen international marketing	Organize domestic and international seminars and exhibitions	Ministry of Transportation and Communications	Ministry of Economic Affairs	√	√	

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Accelerate the establishment of management systems and talent cultivation in Taiwan	Harmonize regulations and management methods	Harmonize regulations and management methods	Ministry of Transportation and Communications		√	√	
		Implement UAS Certification	Ministry of Transportation and Communications		√	√	√
	Cultivate UAS R&D and management professionals	Devise UAS courses and teaching materials	Ministry of Education		√	√	√
		Organize the UAS Innovative Application Contest	Ministry of Transportation and Communications		√		
	Public outreach and promotion	Raise awareness for UAS-related laws and regulations and organize UAS Innovative Application Contests	Ministry of Transportation and Communications		√	√	

Note 1: Currently, organizers and co-organizers have been divided based on preliminary policy plans. Actual responsibilities and titles may be changed depending on implementation progress and inter-departmental coordination results.

Note 2: It is the recommendation of inter-units that promotion measures be included as reference policies.

IX. Transportation Big Data technology industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Data infrastructure – Resource inclusion and sharing	Promote transportation Big Data infrastructure and services towards the vision of smarter lifestyles	Develop a data circulation service platform, expand the scope of data, and aim to provide five-star data services	Information Management Center, MOTC	1. Taiwan Railway, MOTC 2. Freeway Bureau, MOTC 3. Directorate General of Highways, MOTC 4. Railway Bureau, MOTC 5. Institute of Transportation, MOTC 6. Maritime and Port Bureau, MOTC 7. Tourism Bureau, Republic of China (Taiwan) 8. Civil Aeronautics Administration, MOTC 9. Central Weather Bureau, MOTC 10. Taiwan International Ports Corporation, Ltd. 11. Taoyuan International Airport Corporation Ltd. 12. Chunghwa Post Co., Ltd. 13. County/City Governments	√	√	√
	Establish complete data circulation management mechanisms, improve the data management environment and circulation regulations	Establish a dedicated unit for transportation Big Data, and continue to improve data circulation service specifications	Information Management Center, MOTC			√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Data industry development – Creating sustainable value	Establish a transportation data market and make the transportation data industry more active	Establish a transportation Big Data trading market and accelerate the development of the transportation data industry	Information Management Center, MOTC	1. Department of Information Management, National Development Council, Executive Yuan 2. Industrial Development Bureau, MOEA 3. Office of Science and Technology Advisors, MOTC 4. Taiwan Railway, MOTC 5. Freeway Bureau, MOTC 6. Directorate General of Highways, MOTC 7. Railway Bureau, MOTC 8. Institute of Transportation, MOTC 9. Maritime and Port Bureau, MOTC 10. Tourism Bureau, Republic of China (Taiwan) 11. Civil Aeronautics Administration, MOTC 12. Central Weather Bureau, MOTC 13. Taiwan International Ports Corporation, Ltd. 14. Taoyuan International Airport Corporation Ltd. 15. Chunghwa Post Co., Ltd. 16. County/City Governments	√	√	√
	Strengthen talent cultivation and create value through data economy	Improve the environment for cultivating technology talent, and increase the output value of data economy	Information Management Center, MOTC		√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Digital governance practices – Excellence governance performance	Strengthen data governance service orientation and develop a smart government	Establish a smart government with digital governance, and establish a new paradigm for mobile transportation services	1. Information Management Center, MOTC 2. Office of Science and Technology Advisors, MOTC	1. Department of Railways and Highways, MOTC 2. Department of Navigation and Aviation, MOTC 3. Department of Posts and Telecommunications, MOTC 4. Road Traffic Safety Committee, MOTC 5. Institute of Transportation, MOTC 6. County/City Governments	√	√	√
		Cross-industry integration of marketing and value-added applications, and realize citizen participation	Office of Science and Technology Advisors, MOTC	Information Management Center, MOTC	√	√	√

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

X. 5G smart transportation application promotion

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Facilitate cross-industry collaboration in developing new generation transportation services and infrastructure	Establish an experimental field to refine emerging transportation technology applications, and develop Taiwan's own solutions	Establish an experimental field to refine the exchange platform for emerging transportation technology applications	Office of Science and Technology Advisors, MOTC		√	√	√
	Show smart transportation technologies and services in line with international standards via verification in daily life scenarios	Combine daily life scenarios and international standards to verify smart transportation technologies and services	Office of Science and Technology Advisors, MOTC		√	√	
	Establish an experimental platform and guidance mechanisms, strengthen technology and application verification, and accelerate the upgrade of the transportation industry	Establish an experimental platform and guidance mechanisms, and expand the scope of technology and application services	Office of Science and Technology Advisors, MOTC		√	√	
Implement emerging transportation industry standards and application verification mechanisms	Establish verification mechanisms and provide legal consultation and assistance	Establish verification mechanisms and provide legal consultation and assistance	Office of Science and Technology Advisors, MOTC		√	√	√
Formulate laws and regulations applicable to the experimental field for transportation technologies and emerging services	Formulate service specification, eliminate regulatory barriers, and create a friendly environment for the verification of emerging services	Formulate service specifications and eliminate regulatory barriers	Office of Science and Technology Advisors, MOTC		√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Promote cross-industry collaboration to jointly create an industry value chain to expand industry benefits	Uncover local demand through public-private partnership and citizen co-creation mechanisms	Create public-private partnership and citizen co-creation mechanisms	Office of Science and Technology Advisors, MOTC		√	√	√
	Accelerate the formation of an emerging transportation technology industrial chain, develop a domestic smart transportation industry value chain, and further align them with international standards	Accelerate the formation of an emerging transportation technology industrial chain and develop a domestic smart transportation industry value chain	Office of Science and Technology Advisors, MOTC		√	√	√

INote:It is the recommendation of inter-units that promotion measures be included as reference policies.

XI. Harbor and airport green energy industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Improve maritime laws and regulations related to the promotion of the green energy industry to ensure vessel navigation safety	In order to improve the management mechanism of wind farm navigation channels while taking into account the government's goals for facilitating energy development and ensuring vessel navigation safety, it is necessary to develop navigation guidelines for vessels traveling through the Changhua Wind Farm Channel	Designate navigation channels in the Changhua wind farms and establish relevant navigation guidelines	Maritime and Port Bureau, MOTC		√		
		Establish the vessel transportation service (VTS) center for vessels passing through the navigation channels in the offshore wind farms	Maritime and Port Bureau, MOTC		√	√	
Utilize port and harbor resources to accommodate both matitime transportation and offshore wind power industry development	It is necessary to plan the construction of heavy cargo terminal ports for the pre-assembly of wind farm equipment and allocate the lands needed for underwater foundations, cables, domestic manufacturing of wind farm equipment, and talent cultivation.	Port of Taichung provides #2, #5A, #5B, #36 and #106, a total of five heavy-loaded wharves	Taiwan International Ports Corporation, Ltd.		√	√	√
Promote the development of green energy-related industrial bases in ports, and create a wind power production and manufacturing supply chain cluster		Industrial Zone (II) of the Port of Taichung and the South Wharf District in Taipei Port are currently designated as "Offshore Wind Power Industry Localized Manufacturing Zones"	Taiwan International Ports Corporation, Ltd.		√	√	√
Implement localized talent cultivation for the offshore wind power industry		In 2018, Taiwan International Ports Corporation, Ltd. established Taiwan International Windpower Training Corporation Ltd. (TIWTC) as a joint venture with other offshore wind power industry companies	Taiwan International Ports Corporation, Ltd.		√	√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Offshore wind power operation and maintenance model and base planning	It is necessary to plan and set up operation and maintenance centers as well as storage and logistics centers in ports near wind farms to facilitate their operation and maintenance	TIPC Marine Corporation, Ltd., a subsidiary completely owned by the Taiwan International Ports Corporation, Ltd., will provide operation and maintenance services in the Working boats Wharf at the Port of Taichung	Taiwan International Ports Corporation, Ltd.		√	√	√
Explore the feasibility of floating structure wind turbines in the future	Collect information on floating wind turbines to assess the feasibility of future developments	The "harbor and airport green energy industry task force" under the Board of Transportation Technology Industries will convene member meetings and consult wind farm developers on their development needs	Taiwan International Ports Corporation, Ltd.		√	√	
Improve energy efficiency and reduce GHG emissions	Construct low-carbon green airports to enhance Taiwan's green image	Actively build charging facilities and provide charging subsidies	Taoyuan International Airport Corporation Ltd.		√		
		Evaluate the procurement of renewable energy and the introduction of energy storage equipment with smart grid integration technology	Taoyuan International Airport Corporation Ltd.			√	√

XII. Weather industry

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Establishing communication channels, promoting public-private collaboration, and building supply and demand chain	Establishing a "Taiwan Climate Services Partnership" as a bridge between the public and private sectors	Establishing the Taiwan Climate Services Partnership to connect the supply and demand in the value chain of the weather industry in Taiwan	Central Weather Bureau, MOTC		√		
		Organizing the Taiwan Weather Industry Forum and building a communication platform for the weather industry	Central Weather Bureau, MOTC		√	√	√
	Conducting research on international weather industries and evaluating supply and demand to establish the value chain of weather industry in Taiwan	Studying the operating models of weather industries in Europe, USA, Japan, and South Korea	Central Weather Bureau, MOTC		√		
		Evaluating the service capacity suppliers in the value chain of weather industry in Taiwan	Central Weather Bureau, MOTC		√		
		Analyzing the room for weather industry development and the demand for services in order to build connections along the value chain	Central Weather Bureau, MOTC		√	√	

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Enhancing data services, improving forecasting technology, and expanding cross-sector applications of weather services	Facilitating cross-sector applications and collaborations	Evaluating the weather industry's demands for weather information and products	Central Weather Bureau, MOTC		√		
		Discussing and adjusting the supplying and pricing of weather information and products	Central Weather Bureau, MOTC		√		
		Promoting quality assurance mechanisms for weather data	Central Weather Bureau, MOTC		√	√	√
	Establishing appropriate data exchange and dissemination channels	Building an information and data exchange platform	Central Weather Bureau, MOTC			√	√
		Building data exchange standards	Central Weather Bureau, MOTC		√	√	√
	Providing appropriate and sufficient information for applications in relevant fields	Improving the general public's understanding of meteorological science and value-added applications of weather data	Central Weather Bureau, MOTC		√	√	√
		Organizing forums to facilitate cross-sector value-added applications of weather information	Central Weather Bureau, MOTC		√	√	√
		Supporting the public and private sectors in cross-sector impact assessment, vulnerability identification, risk assessment and adaptation plans and other climate application services in response to climate change	Central Weather Bureau, MOTC			√	√

Important Issues	Development Strategy	Implementation Measures	Organizer	Co-organizer	Promotion Execution Date		
					2020 to 2022	2023 to 2025	2026 to 2029
Revising laws and policies to create a favorable environment for weather industry development	Revising meteorology-related laws and regulations	Reviewing and revising the Meteorological Act by including regulations for facilitating development of weather industry	Central Weather Bureau, MOTC		√	√	
		Amending the Regulation on the Authorization of Forecast Service of Meteorological and Marine Meteorological Phenomena to allow for more private sector engagement in weather industry	Central Weather Bureau, MOTC		√	√	
		Reviewing and revising the pricing standards of the CWB's weather information for easier access to such information	Central Weather Bureau, MOTC		√	√	
	Creating more opportunities for weather industry development	Providing assistance in the form of policies, contracts, techniques, collaborations, and grants to provide more employment opportunities for professionals along the value chain	Central Weather Bureau, MOTC		√	√	√
		Holding an industry expo to facilitate interactions and collaborations	Central Weather Bureau, MOTC		√	√	√
	Nurturing talents with practical skills	Assisting universities and colleges in providing more and better meteorological forecasting and application courses and practical training, and coordinating with these institutions to conduct examination for weather forecaster certification and qualification	Central Weather Bureau, MOTC		√	√	√

Appendix 2 Important Milestones

Date	Event	Organizer
2019/9/5	MOTC Smart Electric Bus Technology Industry Panel Discussions	Department of Railways and Highways
2019/9/6	MOTC Board of Transportation Technology Industries Inaugural Conference	Ministry of Transportation and Communications
2019/9/11	MOTC UAS Forum	Institute of Transportation
2019/9/17	MOTC Panel Discussion	Ministry of Transportation and Communications
2019/9/18	Trans-SMART The Pilot of the New Future	Ministry of Transportation and Communications
2019/9/19	Smart Public Transportation Service Technology Innovation Seminar Session III	Institute of Transportation
2019/10/5	Bicycle and Tourism Task Force 2020 Bicycle Advocacy Camp	Tourism Bureau
2019/10/14	Smart Logistics Service Task Force First Consultation Meeting	Department of Navigation and Aviation
2019/10/17	R-Team Railway Technology Industry Inaugural Conference	Railway Bureau
2019/10/21	Smart port and Airport Service Task Force First Meeting	Department of Navigation and Aviation
2019/10/25	Smart Electric Motorcycle Technology Task Force First Consultation Meeting	Department of Railways and Highways
2019/10/25	Smart Public Transportation Service Task Force First Consultation Meeting	Directorate General of Highways
2019/10/30	Transportation Big Data Task Force First Consultation Meeting	Information Management Center

Date	Event	Organizer
2019/10/30	5G Transportation Experimental Field Task Force First Consultation Meeting	Office of Science and Technology Advisors
2019/10/30	Bicycle and Tourism Task Force Second Consultation Meeting	Tourism Bureau
2019/11/1	Smart Logistics Service Task Force Second Consultation Meeting	Department of Navigation and Aviation
2019/11/5	Cross-border Omni-channel Innovative Smart Logistics Forum	Department of Navigation and Aviation
2019/11/5	Smart Electric Bus Technology Task Force First Consultation Meeting	Directorate General of Highways
2019/11/5	Transportation Big Data Task Force Second Consultation Meeting	Information Management Center
2019/11/6	UAS Technology Task Force First Consultation Meeting	Institute of Transportation
2019/11/7	Railway Technology Task Force First Consultation Meeting	Railway Bureau
2019/11/7	Taiwan UAS Application Demand Conference	Institute of Transportation
2019/11/8	Smart Electric Motorcycle Technology Task Force Second Consultation Meeting	Department of Railways and Highways
2019/11/8	Smart Public Transportation Service Task Force Second Consultation Meeting	Directorate General of Highways
2019/11/11	UAS Technology Task Force Second Consultation Meeting	Institute of Transportation
2019/11/11	Railway Technology Task Force Second Consultation Meeting	Railway Bureau

Date	Event	Organizer
2019/11/13	5G Transportation Experimental Field Task Force Second Consultation Meeting	Office of Science and Technology Advisors
2019/11/13	Bicycle and Tourism Task Force Third Consultation Meeting	Tourism Bureau
2019/11/15	Smart Electric Bus Technology Task Force Second Consultation Meeting	Directorate General of Highways
2019/11/15	Smart port and Airport Service Task Force Second Consultation Meeting	Department of Navigation and Aviation
2019/11/21	Board of Transportation Technology Industries Second Meeting	Ministry of Transportation and Communications
2019/11/22	Board of Transportation Technology Industries Smart Public Transportation Service Industry Forum	Institute of Transportation
2019/11/25	MOTC Transportation Technology Industry Policy Meeting	Ministry of Transportation and Communications
2019/11/28	MOTC Ten Task Force Integration Meeting	Ministry of Transportation and Communications
2019/12/3	National Transportation Technology Industry Meeting	Ministry of Transportation and Communications
2020/7/2	Board of Transportation Technology Industries Third Meeting	Ministry of Transportation and Communications
2020/7/3	UAS Technology Task Force Third Consultation Meeting	Institute of Transportation
2020/8/20	2020 R-Team Meeting	Railway Bureau
2020/8/25	Smart Electric Motorcycle Technology Task Force Third Consultation Meeting	Department of Railways and Highways

Date	Event	Organizer
2020/9/1	Panel Discussion on the Promotion of the Nationalized Domestic Light Rail Construction Project	Railway Bureau
2020/10/7	The First Taiwan Weather Industry Forum and the Third Climate Service Workshop	Central Weather Bureau
2020/10/16	Promotion of the Nationalized Domestic Light Rail Construction Project - Vehicle and Power Supply System Group Panel Discussion	Railway Bureau
2020/11/17	U-Team Press Conference	Institute of Transportation
2020/11/26	Technology Forum on the Smart and Safe Sharing Features of Electric Motorcycles	Office of Science and Technology Advisors
2020/12/11	Promotion of the Nationalized Domestic Light Rail Construction Project - Power Supply System Group Panel Discussion	Railway Bureau
2020/12/14	New Industry Cooperation in the Post-Epidemic Era: A Forum on the Port of Taipei, Taoyuan International Airport and the Postal Park	Department of Navigation and Aviation
2020/12/17	Policy for the Implementation of the Nationalized Light Rail Construction Project - Signal System Group Panel Discussion (no.1)	Railway Bureau
2020/12/21	Board of Transportation Technology Industries Fourth Meeting	Ministry of Transportation and Communications
2020/12/21	2020 Remote UAS Forward-looking Seminar	Civil Aeronautics Administration
2020/12/22	5G Transportation Experimental Field Task Force Third Consultation Meeting	Office of Science and Technology Advisors
2021/1/5	Convenient Mobile Payment for Pioneering Buses Press Conference	Directorate General of Highways
2021/1/6	Traffic Data Distribution Service Award and Outlook Forum	Information Management Center

Date	Event	Organizer
2021/1/26	Policy for the Implementation of the Nationalized Light Rail Construction Project - Signal System Group Panel Discussion (no.2)	Railway Bureau
2021/1/28	Smart Electric Motorcycle Technology Task Force Fourth Consultation Meeting	Department of Railways and Highways
2021/2/18	2021 Electric Bus Development Results and Prospects Forum	Directorate General of Highways
2021/2/22	2021 Weather Industry Development Advocacy Symposium	Central Weather Bureau
2021/3/17	Harbor and Airport Green Energy Industry Task Force First Consultation Meeting	Taiwan International Ports Corporation, Ltd.
2021/3/22	The Smart Logistics Service Task Force First Consultation Meeting took place in 2021	Department of Navigation and Aviation
2021/3/24	UAS Innovation and Application Symposium	Institute of Transportation
2021/3/26	The Smart port and Airport Service Task Force First Consultation Meeting took place in 2021	Department of Navigation and Aviation
2021/3/31	UAS Technology Task Force Fourth Consultation Meeting	Institute of Transportation
2021/4/30	Smart Public Transportation Service Task Force Third Consultation Meeting	Directorate General of Highways
2021/8/13	Motorcycle-friendly Sharing Environment Advocacy and Commercial Service Promotion Event	Office of Science and Technology Advisors
2021/8/16	Smart Electric Bus Industry Linkage Promotion Event	Office of Science and Technology Advisors

Date	Event	Organizer
2021/9/17	Railway Technology Industry Issues Research Conference and Supply and Demand Matching Event	Office of Science and Technology Advisors
2021/10/7	Drones—MOTC UAS Promotion Results Presentation	Institute of Transportation
2021/10/13	Harbor and Airport Green Energy Industry Task Force Second Consultation Meeting	Taiwan International Ports Corporation, Ltd.
2021/10/18	The Second Taiwan Weather Industry Forum and the Fourth Climate Service Workshop	Central Weather Bureau
2021/10/27	5G Smart Transportation Application Promotion Task Force Fourth Consultation Meeting	Office of Science and Technology Advisors