Asia-Pacific
Economic Cooperation

APEC Cross-Domain Innovation Ecosystem Guidebook

A New Growth Path for SMEs through Digital Platforms

APEC Small and Medium
Enterprises Working Group

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Introduction

Chapter 01

Introduction

I. SME Development Challenges

Following a year of overwhelming financial setbacks, global economic performance has rebounded in 2021, owing in part to increasing vaccination coverage rates among most Asia-Pacific Economic Cooperation (APEC) member economies, as well as to proactive pandemic mitigation policies. According to the World Economic Outlook Report published by the International Monetary Fund (IMF) in October 2021, global economic growth is expected to reach 5.9% this year. East Asia, part of the APEC region, shows the most outstanding economic outlook with 6.8% growth, followed by North America (6.0%), New Zealand and Australia (3.8%), and Southeast Asia (2.6%). However, with its announcement of the composite leading indicator (CLI) also in October 2021, the Organization for Economic Cooperation and Development (OECD) raised concerns that the pace of global economic rebound and expansion was slowing. The OECD report decisively indicates that the business continuity of small- and medium-sized enterprises (SMEs) and recovery of APEC economies cannot solely rely on this economic rebound, but must also proactively face the challenges highlighted by the pandemic, including ensuring digital preparedness and addressing the digital gaps within or between regions.

The United Nations Conference on Trade and Development (UNCTAD) Digital Economy Report 2019 points out that the rise of digitalization and the platform economy have contributed to rapid changes in business models and widened the digital gap among companies. SMEs should therefore pivot to conducting digitalization and collaborative innovation with a goal toward a robust and sustainable business environment. The UNCTAD Digital Economy Report 2021 draws further attention to the imperative of this digital transformation in light of the COVID-19 pandemic. The Final Review of the Boracay Action Agenda Study Report also outlines the insufficiencies in digitalization among SMEs and highlights the need to strengthen related digital capacity-building programs. The report suggests fortifying SMEs' competitiveness in the digital era and fostering an environment that enables SMEs to join global value chains. In addition, the APEC Policy Support Unit's 2020 report Supporting MSMEs' Digitalization Amid COVID-19 not only lists the benefits of digitalization, including managing transactions at a distance, delivering goods efficiently, facilitating access to financial services, and engaging with new and existing customers, but also identifies accompanying risks, such as cybersecurity and data privacy concerns, exposure to digital fraud, online misinformation, asymmetric market power and

platform dominance, and persistent digital divide and infrastructure-related issues.

In sum, the goals of a series of APEC Cross-Domain Innovation Ecosystem initiatives implemented in 2020-2021 are: (1) to strengthen SMEs' digital capability to interconnect industrial clusters and business ecosystems and enhance SME participation in the digital economy; and (2) to generate digital know-hows specifically needed for the establishment of cross-domain innovation ecosystems. Overall, this guidebook aims to identify innovative strategies and business models that can be adopted by SMEs, and propose cross-domain innovation ecosystems as a solution to the volatile, uncertain, complex and ambiguous (VUCA) business environment.

II. Creating Development Opportunities through Collaborative Innovation

As noted in the 2021 APEC SME Ministerial Meeting Statement, the pandemic has accelerated the process of digitalization and collaborative innovation, and digital solutions have inevitably become imperative for enterprises. Thus, APEC economies have developed respective strategies towards this common goal that will be elaborated in the following pages.

(1) Large Enterprises to Assist Small Enterprises in Cross-Domain Contexts

Chinese Taipei's scholars have proposed an “Industry 3.5” strategy which proposes that, as SMEs undergo digital transformation and upgrades, concurrent support from larger enterprises results in mutual benefits and inclusive growth. Under the strategy, SMEs are assisted in certain transformation stages when they cannot achieve goals solely with their own resources. For example, larger firms assist in the optimization of data utilization and the adoption of IoT or big data in order to improve manufacturing processes and further build basic digital capabilities. The Philippines promotes a partnership model between micro-, small and medium enterprises (MSMEs) and start-up enterprises. In the model, MSMEs can adopt digital solutions provided by start-up enterprises to enhance their operational efficiency, productivity, and market expandability; startups then can enlarge their customer base, consolidate their reputation, and break through business bottlenecks by providing digital services to MSMEs.

(2) Open Innovation and Capacity Building

In order to promote SMEs' post-pandemic digital transformation, Singapore has begun encouraging the adoption of digital tools to enhance business operation performance, such as the application of food and beverage delivery platforms and the facilitation of simultaneous development of brick-and-mortar and e-commerce operations. This initial approach is being followed by a two-year Digital Leaders Programme, a digital transformation plan that coaches enterprises in how to create an in-house core

digital team, chart a digital transformation roadmap, and develop new digital products and services, among other initiatives. Another objective is Better Data-Driven Business, implemented by instructing enterprises to efficiently and responsibly manage and use data to reach business targets and enhance overall competitiveness. Moreover, Singapore wants to fortify collaboration between public and private partners to allow cooperative developments of technology-enabled solutions (such as supply chain digitalization and omni-channel smart commerce) to drive overall digital transformation in industries. As such, Singapore has launched four major projects—Deal Fridays, Open Innovation, Global Innovation Alliance (GIA), and Start-up and Innovation Events. Deal Fridays facilitate video networking meetings with the goal of forging concrete investment deals, co-innovation, and partnerships. Open Innovation is a crowdsourcing platform designed to establish co-creation networks among regional and international solution providers. GIA is an innovation network established for partners from different cities to co-create new business models.

New Zealand's Digital Boost project similarly pursues digital transformation in small enterprises. The project's framework includes providing incentives for small business owners, assisting business owners in digital capacity building, increasing access to digital tools, and embedding digital tools in business operations. Digital Boost outcomes show increases of 9% in the number of enterprises using social media for sales and marketing, 21% in official website creation, and 21% in the usage of e-payment. Also, 70% of the interviewed companies indicated their confidence in advancement towards digitalization.

(3) Ecosystems

Viet Nam launched the project Supporting Enterprises' Digital Transformation 2021-2025, and adopted ecosystem as a strategy for digital transformation. An ecosystem consists of digital platforms, expert consultancy networks, technical support providers, benchmark enterprises, and marketing and public relations events. Thailand also proposed the concept of digital ecosystem, wherein members are basic participants of some markets such as factors of production, specifically financing channels, suppliers, and demand parties. Additionally, digital platforms connect all related stakeholders once customer relationship management and insurance mechanisms are established.

In recent years, Chinese Taipei has implemented a collaborative innovation strategy for SMEs that combines a circular framework and the concept of ecosystem, called the Cross-Domain Innovation Ecosystem Project. The public sector and R&D institutes connect SMEs to conduct synchronized planning, digital creation, smart manufacturing, dynamic logistics, and other value-added activities. The next step is to establish a business ecosystem with a digital core to strengthen industrial resilience, inspire new business models, and build new regional cooperation. The Cross-Domain Innovation Ecosystem Project emphasizes cross-sector

cooperation and linkage with the consumer market. The cross-domain innovation ecosystem cultivates a keystone integrator to maintain shared prosperity among its members. The development of new products and services within the innovation ecosystem offers not only new value but also novel access to new markets.

The COVID-19 pandemic has spurred contraction from a global to a regional scope in consumption, production, and economic trends; cross-domain ecosystems can best respond to this shifting landscape. The ecosystem strategy, which will be elaborated in this guidebook, focuses on people orientation, cross-domain co-creation, and open innovation that serves as a solution to challenges brought about by VUCA factors.

III. Introduction and Literature Review of Cross-Domain Innovation Ecosystems

(1) Introduction to the Ecosystem

Ecosystem (ECO) in this guidebook refers to "Experience-driven" and "Co-creation" based on organic "Open-innovation platforms;" these ecosystems themselves comprise three aspects: the power of innovation, the power of cohesion, and the power of productivity. The power of innovation refers to a brand new holistic solution developed on user experience. The power of cohesion refers to resource-sharing and mutually trustworthy collaboration; that is, a new network relationship is developed during the processes of platform establishment and

Table 01 Comparative Analysis of Different Strategical Thinking

	Enterprise	Supply chain	Cluster		Ecosystem
Feature	Single enterprise	Upper, medium, and lower streams	Geographical proximity (vertical)	Cluster (horizontal)	✔ Symbiosis of supply and demand ✔ Establishment of virtual and physical platforms ✔ Co-evolution of multiple parties
Operation mode	Core competitiveness	OEM	Center-satellite system	Business districts and markets	Platform economy
Main goals and benefits	✔ Revenue ✔ Profit ✔ Growth	✔ Cost ✔ Delivery ✔ Quality	✔ Cost, delivery, and quality ✔ Intelligence exchange ✔ Scale economy ✔ Inbound effect		✔ New customer experience ✔ New solution ✔ Cross-sector integration ✔ New business model ✔ Establishment of a new platform

Source: Calvin Lai (2020). The Innovative Thinking and Development Strategies in SMEs' Cross-sector Ecology. APEC SME Monitor, Issue. 29.

service scope expansion. The power of productivity refers to the forces of multiple-interest stakeholders, such as the private and the public sectors, academia, and research institutes, in which new values of such ecology are created through their collaboration.

Unlike the traditional view of a single enterprise, and again differently from the interconnected relationship of upper and lower streams of supply chains or vertically and horizontally integrated scale economies of industrial clusters, an ECO is viewed as a mutually beneficial organic chain network which includes both physical and virtual relationships. Members of ECO platforms can have multiple roles. The flexibility that exists in these relationships, therefore, can generate infinite possibilities for the ECO.

There are different participants in the ecosystem. Generally, it is composed of the ecosystem leader; the keystone integrator, who creates the basic prototype of the ecosystem platform and acts as the core business that sustains the entire ecosystem; and niche players. These niche enterprises contribute their unique resources or skills to co-shape the values of the ecosystem.

It is important to note that the current benchmark cases studied in this guidebook are different from ecosystems built by multinational companies and process other roles in the ecosystem, namely as supporters and facilitators. For instance, the limited scale and development pace of SMEs compared to large enterprises requires crucial public sector support, whether financial or reg-

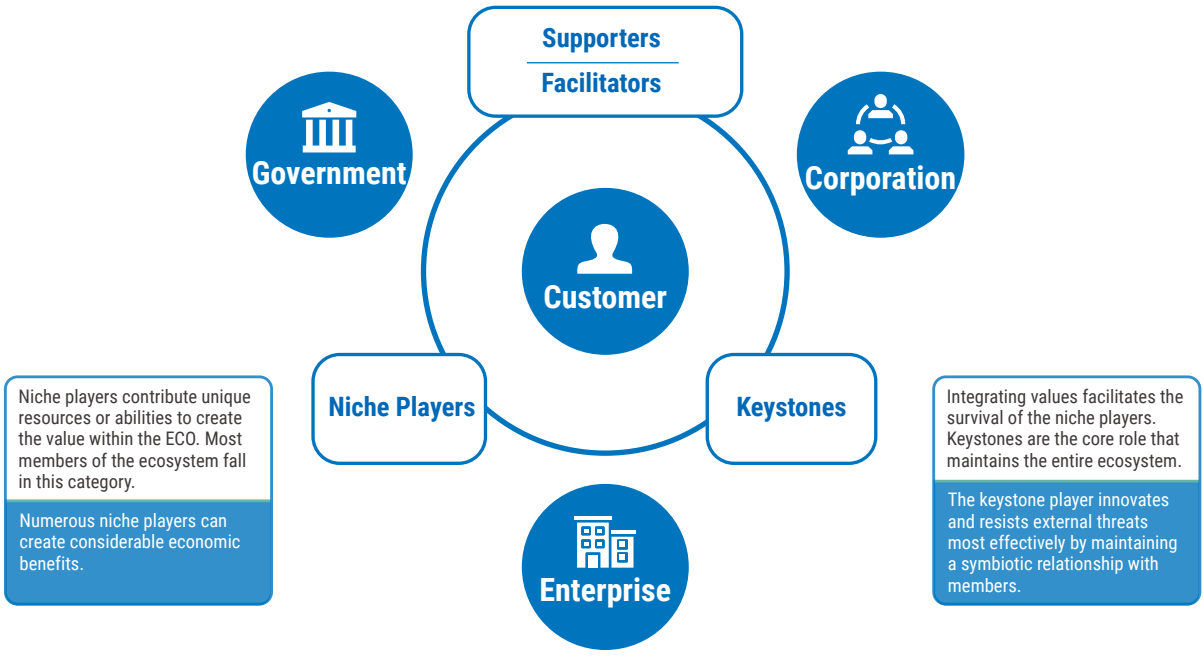

Fig. 01 Players in the Ecosystem

Source: Calvin Lai (2020). Cross-domain Innovation. APEC SME Monitor, Issue 29.

ulatory, at the early stages of ecosystem development. Furthermore, corporations and academic and research units act as facilitators who assist in drafting a business model, making connections between different industries, introducing new technologies beneficial for ecosystem development, and improving ecosystem sustainability.

(2) Literature Review

The concept of ecosystem has received considerable attention from both academic and applied fields, resulting in a quantity of relevant literature. The OECD defines an ecosystem as "the interaction between different organisms and their environment that generates a cyclic interchange of materials and energy." The OECD has recently begun emphasizing the examination of ecosystem sub-concepts, including digital ecosystem, local ecosystem, and local entrepreneurship ecosystem.

The cross-domain innovation ecosystems discussed in this section include local innovation ecosystems, business ecosystems, digital business ecosystems, and platform economy ecosystems.

A local innovation ecosystem integrates a local context of nature, traditions, humanities, history, and society, with an intent to highlight local features (Se-hwa, Wu, 2009). In contrast, a regional innovation ecosystem, with a basic concept originating from the innovation system, stresses that the distinctiveness of innovation models is caused by different regional features (Ander, 2006; Wessner, 2007; Yawson, 2009).

Moreover, in APEC Local Innovation Ecosystem Best Practices edited by Chinese Taipei through the APEC platform in 2019, the innovation ecosystem mentioned in the publication retains the interpretation of Jackson (2011), namely that the innovation ecosystem is a complex relationship of physical resources and human resources and/or inter-resources of different actors. The purpose of an ecosystem is to achieve not only technological development, but also improved innovation through greater knowledge of competitiveness and business models. Discussions of innovation ecosystems include the introduction of different roles, and the inclusion of integrations and alliance models (Visscher et al., 2021; Boni & Gunn, 2021).

A business ecosystem, in contrast to an innovation ecosystem, is a group of interconnected enterprises that co-create and share values, emphasizing synergies created by the cross-domain integration. Derivations of the business ecosystem include digital business ecosystems and platform economy ecosystems. Digital business ecosystems are based on information and communications technology (ICT), and emphasize the link between technology and society and knowledge networks to achieve open innovations. Platform economy systems consist of a linear industrial evolution into an ecosystem structure of diversified loops that is both market- and customer-oriented (Wei-ru, Chen, 2016).

With regard to the concept of cross-domain innovation ecosystem relevant to this guidebook, cross-border innovation ecosystems (Davies et al., 2020) and cross-sector innovation ecosystems have emerged in discussions of innovative business models (Oskam et al., 2021) over the past few years.

In conclusion, discussions on the ecosystem have intensified in tandem with the rapid pace of change in business environments. It is also clear from the introduction of different ecosystems in this section that the information exchange propelled by rapid technological development has shifted the current trend to cross-border and cross-domain ecosystems. Consequently, knowledge exchanges of cross-border and cross-domain has become indispensable. Further, owing to the development of digital technologies, business models have shifted from customer-driven post-production search to tailor-made solutions based on the customer demand. The shift has led to an increase in cross-border and cross-domain innovations, a crucial proposition for which SMEs can prepare and even discover new business opportunities.

Chapter 2

Case study

Chapter 02

Case study

This chapter presents studies on the following three ecosystems: a yacht-leisure smart service ecosystem, a high-quality interior decoration ecosystem, and an oyster shell high-value circular ecosystem. The following subsections of the aforementioned cases include: 1) Market demand – this section identifies bottlenecks of current business operations, such as limitations of existing business models, products, or services; 2) Ecosystem operation – what are the roles of keystone integrators, niche players, supporters (the public sector), and facilitators (foundations)? What assistance can they provide? 3) Ecosystem performance – what are the number of enterprises that have received assistance, and what are their innovative business models, products, or services?

I. Yacht-related Sector Smart Service Ecosystem

(1) Market Demand

Chinese Taipei is the fifth-largest yacht manufacturing economy in the world, yet the yacht tourism industry missed the early adoption period in the local market. Another reason for the slow local market growth was that leisure yacht activities were considered

high-end luxury consumption with limited service items.

As the marine recreation economy has blossomed in recent years, yacht manufacturers have gradually turned to yacht leisure services, and have begun cultivating innovative integration of a high value-added yacht leisure industry that connects actors of distinct fields, including urban development, pier construction, business venues, luxury leisure clubs, water sports centers, and others. The resulting business opportunities include those in the conference and exhibition industry, hospitality industry, and other business services. Moreover, traditional yacht manufacturing, repair, maintenance, and rental services have transformed into a holistic industry that includes yacht leisure activities and urban tourism services.

(2) Ecosystem Operation

The ecosystem aims to educate the general public on the ocean and to further

promote yacht leisure industry development. This includes yacht-centered versatile application services promoted by one-stop service for marine leisure customization. It consists of manufacturing, management, sales, rental services, tourism, supply, repair and maintenance, and other services. It aims to mobilize a complete linkage between the upper and lower streams of the industry with international high value-added markets.

❶ Facilitator – Keystone Integrator

The facilitator of this ecosystem, Metal Industries Research & Development Centre (MIRDC), has assisted the keystone integrator in setting up an Information and Communication Technology (ICT) digital platform for access by ecosystem members through smart service management technology. Consumers can register on the platform and obtain a one-stop leisure service solution. Additionally, through the use of data analysis, MIRDC is able to identify consumers' preferences and budget, establish an individual records for existing members, and systematically address individual customer needs. All data is stored for future reference to enhance service quality.

Additionally, by analyzing consumer records, the digital platform can further screen feasible, attractive, and affordable solutions for customers, and recommend different experience solutions based on current ecosystem member satisfaction, such that cooperation among members reaches mutual prosperity within the ecosystem.

❷ Keystone Integrator - Niche Player

Argo Yachts Development Co., Ltd., the keystone integrator of the yacht leisure smart service ecosystem, aims to connect all peripheral industries, suppliers, and enterprises. A set of comprehensive service systems can therefore be built once the ecosystem linkage between providers is established. The development of Argo drives the growth of all associated parties and indeed the evolution of yachting lifestyle and culture.

Integrating and shaping the participation of all marine and onshore tourist leisure service providers and marketing channels is fundamental to increasing economic benefits; such providers include club service, pier operations, vessel rentals, vessel and yacht sailing, ship escrow and chartering, yacht sales, diving, sightseeing, dining and catering, hospitality, wedding and other celebratory activities. This promotes a complete and comprehensive yacht leisure service chain of industry, increasing employment opportunities and generating business opportunities for yacht leisure smart service venues. The following diagram illustrates the relationship among the ecosystem members.

Based on customer service records shared within the digital platform among ecosystem members, niche players can formulate thematic solutions in accordance with the preferences and needs of specific customers, or water activity packages that meet high-end needs for customized, one-stop yacht leisure services. Such a setup

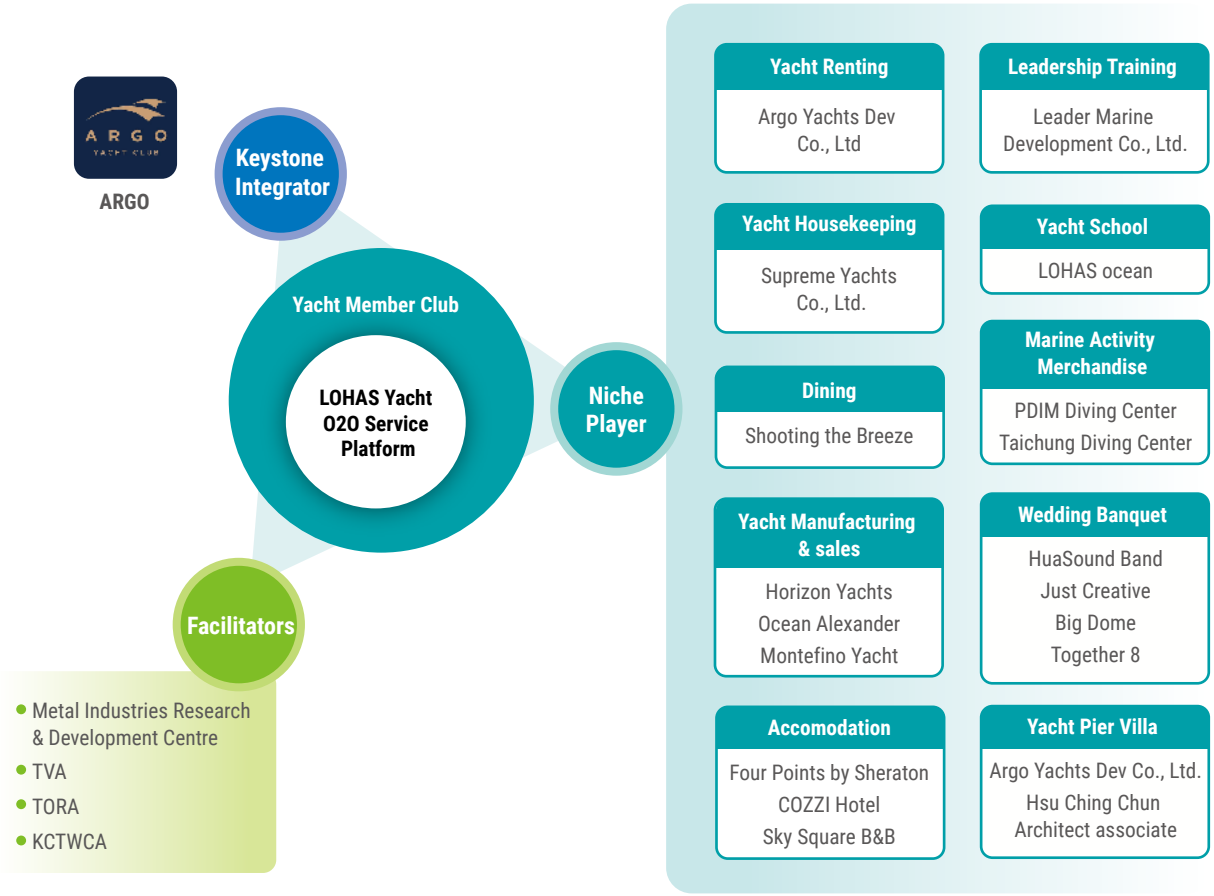

Fig. 02 Yacht-related Sector Smart Service Ecosystem

attracts more niche players to join the ecosystem.

As the platform operation becomes more effective, the peripheral industries of the ecosystem may also flourish. Professional talent and training industries, such as diving instructors and yacht drivers, benefit from the ecosystem. Non-ecosystem industries can also reap benefits as tourist numbers increase; these include yacht maintenance and escrow, dining and catering, accommodation, etc.

(3) Ecosystem Performance

Pandemic prevention measures present specific challenges to immediate development of the tourism industry. As such, Argon Yacht has integrated suppliers of the ecosystem in order to build a new marine tourist package that combines onshore and maritime tourism models – an innovation of the yacht leisure domain. The description of each section is as follows.

❶ Optimizing a yacht leisure activities smart service business model

By utilizing ICT records and big data analysis, marine life and yacht leisure enthusiasts are targeted in order to establish a long-term customer service record management.

❷ Planning customer service preference experience solutions in order to recommend investment domains

Consumers of tourism, dining and catering, wedding services, restaurants, and sports goods are among the targeted clientele. Based on complete records of all online purchases and a set platform service management process, Argon Yacht analyzes big data to interpret the targeted consumers' yacht leisure preferences and behavior trends.

❸ Establishing a yacht leisure smart service operation platform

After an order is submitted, the yacht secretary connects the respective contacts of participating niche players to jointly fulfill the customers' integrated service solutions. The customers' service record management system registers services provided to both domestic and foreign yacht travelers. This attracts other niche players to join the line of high-end customer services, and drives local business opportunities for culture, cuisine, and hospitality.

❹ Constructing a service blueprint to systematically achieve customized service solutions

Based on consumption records of customers, Argon Yacht constructs a journey blueprint of yacht travelers' different experiences, waterways, and leisure services. In this way, the company can meet consumers' various service needs with precision and enhanced customer satisfaction. Through instant consultation service planning, ecosystem members are invited to provide services, orders, and task scheduling. This can

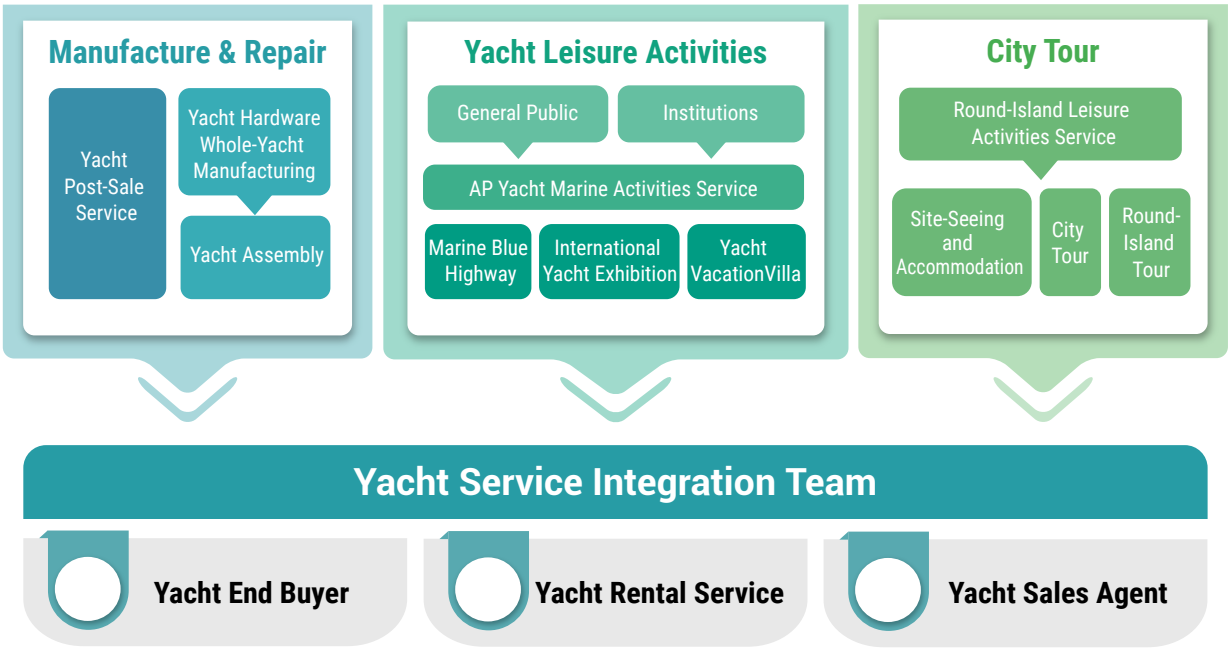

Fig. 03 Schematic diagram of yacht leisure smart ecosystem service integration

achieve faster customer satisfaction, allowing consumers more immediate immersion into marine leisure life.

❺ Recommending suitable offshore and onshore recreation tourism and itineraries based on service records

With a foundation of strategic cooperation, the keystone integrator (Argo Yacht) and a local yacht association have embarked with United Ocean Life Club to meet joint customer service demands by building a service blueprint analysis. With the benefit of long-term client contact, this cooperation also expands the ecosystem into hospitality services on land

II. High-Quality Interior Decoration Ecosystem

(1) Market Demand

In an economy with aging population, the demand for smart lifestyle technology increases year after year. Typically, interior designers only set aside the space for power and cabling during the construction planning stage, and consumers are expected to communicate their customized demands with smart home appliance suppliers independently. During the late stage of decoration, consumers then need to negotiate with the designer or construction team to arrange the construction process and timeline, which leads to conflicts (such as cable exposure) or delayed installation due to a second set of construction processes.

Most small and medium enterprises tend toward paper-based or verbal communication to plan design and decoration engineering, from the client's initial design to the designer's proposals, outsourcing and

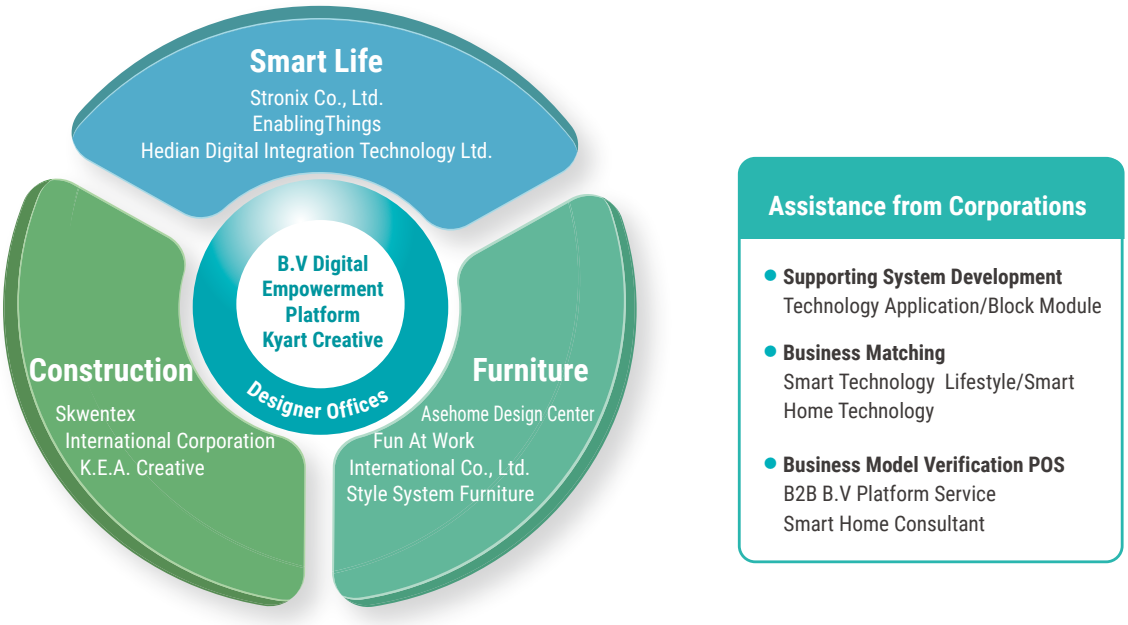

Fig. 04 High-quality interior decoration ecosystem

price consultation, construction quotation, on-site construction reminders, construction outcomes and progress reports, and so on. In fact, digital tools are often only used for communication via messaging apps. On the other hand, designers must deal with multiple projects simultaneously, so communication with the clients is usually intensive during the execution period. This mismatch in communication formats impedes information flow between the designers and the construction teams. In interior design and decoration engineering management, high manpower deployment and recurring repetitive work are common, resulting in high construction management costs and a high incidence of data-input error, often with consequences of profit erosion for both designers and construction teams.

Based on the aforementioned pain points, the focus of this ecosystem is enhancement of the elite service value offered by the interior design and decoration industry. On one hand, consumer lifestyles and behaviors are viewed as the core design locus, in contrast to the traditional, exclusive focus on spatial aesthetics, flowline, and functionalities; this approach highlights the individuality of consumers' lifestyles and allows for diversified use of space. In this way, designers can integrate smart home appliances based on anticipated need, offering consumers a design service which targets quality of life and ergonomic safety. On the other hand, through a platform of co-creation and design and decoration optimization, the ecosystem enables a reduction in design and construction costs, leading to a simplified management cost structure and integrated dynamic communication channels.

(2) Ecosystem Operation

The core members of the high-quality interior decoration ecosystem include keystone integrator KyArt Creative Co. Ltd., and niche players Think Creative, Enabling Things, and interior designers. The facilitators include IoT device suppliers, system vendors, ASE Home Design Center, and others. The Institute for Information Industry, the main facilitator, organizes workshops and business networking opportunities for ecosystem members, compiles interviews on industry demand, and assists in the optimization of design and decoration platforms. The following outlines ecosystem operation by describing the interactive models between different roles

❶ Keystone Integrator – Niche Player

On average, the entire project process, from design proposal to completion, requires a minimum of three months and sometimes more than a year. This process includes the communication of needs, on-site measurement, design drawings, construction drawings, construction quotation, outsourcing, construction and decoration, furniture and furnishing configuration, appliance installation, and so on. All operations during the construction period are time consuming and labor intensive, particularly if the project is in a commercial space. Legal compliance further complicates overall con-

struction and reduces project management efficiency.

With the assistance of the facilitator, the keystone integrator KyArt Creative has established a "design and decoration empowerment platform" based on industry needs. The main functionality is to enhance the efficiency of the different processes, such as communication with the designers, consultation and quotation, outsourcing, cable and pipeline configuration, etc., to save costs. This platform is based on KyArt Creative's B.V platform, with an expansion of collaborative project management modules connecting interior designers and decoration service providers, as well as providers of furniture and furnishing, utilities, air conditioning, lighting, smart home appliances, and smart IoT devices. The purpose is to promote cross-domain collaborations in the interior design and decoration industry.

Within the modules, all service providers have online tasks integrated. Each service role has its own entry point during the process, and designers push providers to use the modules within the platform. This enhances the adaptability of and adherence to the platform, increases the number of new cases, and decreases internal management costs and time. Consequently, a cross-domain and cross-industry collaboration mechanism, specifically with smart

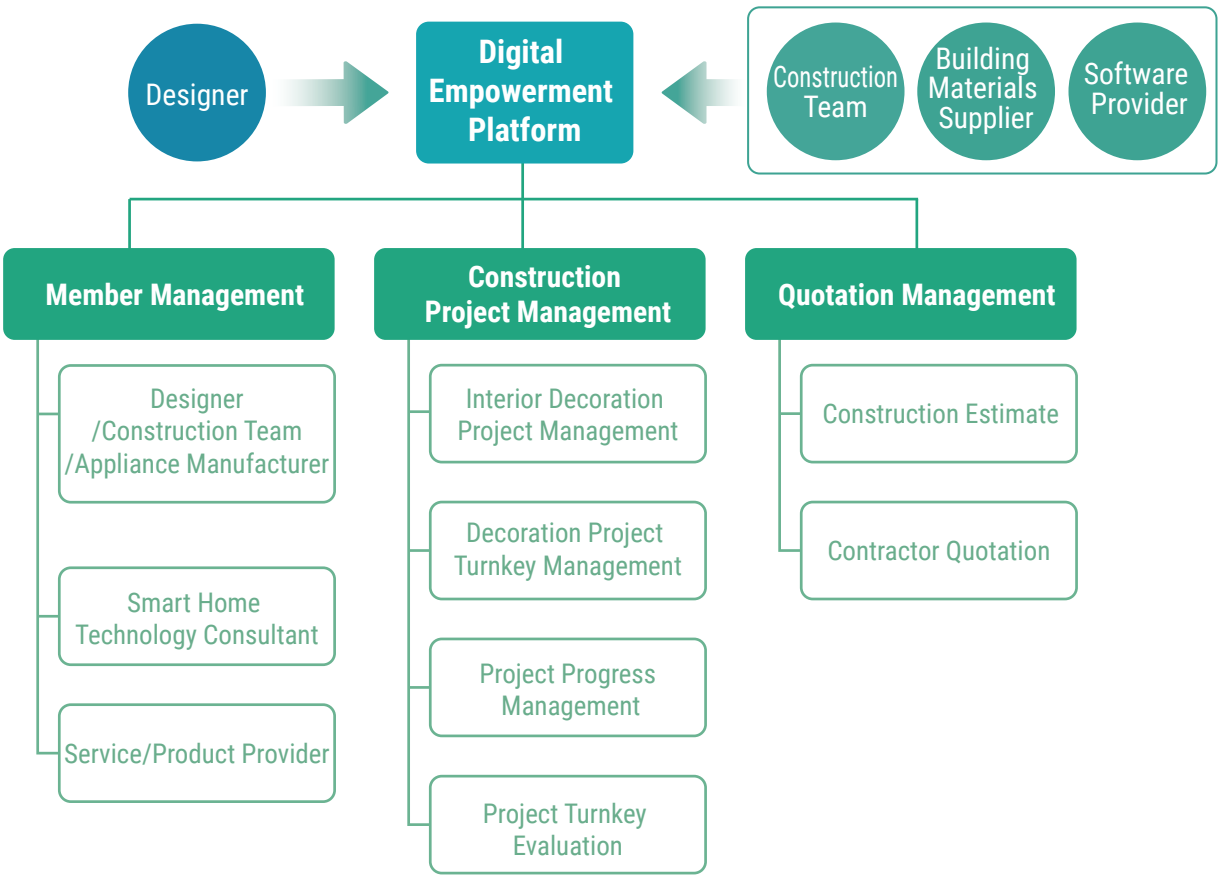

Fig. 05 Schematic diagram of design and decoration empowerment platform

technology lifestyle providers, is created for the interior design and decoration industry.

The construction and optimization of the modules is a dynamic process. As more users join and access the platform, the facilitator collects user feedback for the keystone integrator as a reference for system interface optimization and convenience improvements, so that the platform adjusts to fit the needs of the niche players. This further attracts designers, decoration providers, home appliance providers, and others to join the ecosystem, incentivizing them to introduce digital tools in turn. Additionally, the facilitator holds workshops, networking events, forums, conferences, and other opportunities to promote the platform and attract new ecosystem participants.

❷ Facilitator – Niche Player

In response to an evolving smart technology lifestyle and an aging society, the facilitator acts as a market prospect analyzer and promoter, attracting enterprises to join the ecosystem as they embrace smart technology lifestyle development trends. The facilitator also stimulates the advancement to digital transformation with the introduction of digital tools. The smart technology lifestyle is thus embedded via these two major channels in consumers' cognition, further encouraging them to adopt smart technology lifestyle solutions.

Of initial importance is the use of experience scenarios to gain insights into consumer needs. To gain insight into consumer needs, the facilitator works with the niche players to create experience scenarios for the elderly demographic. As smart home appliances and smart IoT devices are popularized, targeted consumer data on preferences and interactive modes are collected from on-site interactions, helping designers better understand consumer needs and lifestyle. Consumer needs are then incorporated into the design process through the empowerment platform, allowing designers to create greater product differentiation and establish a mechanism for industry cooperation and the development of new business models.

A second goal is promotion of smart home services and product co-creation. It is crucial to highlight the importance of value co-creation among cross-domain talents and heterogenous industries within the ecosystem in providing customer service. Thus, the facilitator has joined Think Creative, Enabling Things, and KyArt Creative in a collaboration. KyArt Creative provides the digital transformation platform; Think Creative promotes smart home consultant training; Enabling Things, with its smart home laboratory resources as the core, integrates services with other ecosystem players in a cross-domain cooperation.

Based on smart home market analyses and results of interviews regarding market demands, the supporting teams foster collaboration between the key niche players (Think Creative and Enabling Things) in targeting the elderly demographic, who prioritize home security, and seniors who have a higher willingness to adopt a smart

e-lifestyle. Designers, smart home appliance providers, and IoT device providers are then matched through a cross-domain collaboration in order to innovate and develop smart home services and products and co-create new business opportunities.

The facilitator has fostered a strategic alliance between niche players Think Creative and Enabling Things to fortify their collaboration with the keystone integrator, as well as to address pain points, strengthen products, and enhance service competitiveness. Additionally, the facilitator invites interior designers, decoration service providers, smart home appliance providers, and teachers and students of interior design to join training workshops on topics of smart home appliance applications, home consultancy services, process, and management, and functionalities, configuration, planning, installation, and environmental settings of smart home solutions and products. The goal is for interior designers and decoration service providers to further their understanding of how to take cases, guide and gain insights into customer needs, and deal with planning, application, construction, and setting management. The alliances also stimulate cross-domain development of new products and services as well as long-term cross-domain business collaboration mechanisms with the design industry

(3) Ecosystem Performance

The facilitator's role in collecting information and fostering networking opportunities increases the efficiency of the interior design project management while simultaneously reducing cost. Designers observe consumers' needs in their on-site interaction and then incorporate these needs into design concepts, which increases the degree of adoption of smart home appliances and IoT devices. Designers are then able to offer products with greater differentiation and strengthen their market competitiveness. Backed by the facilitator, thirty professionals from the fields of interior design, decoration services, smart home appliances, and IoT devices can study the market demands, join the ecosystem, and offer their solutions. The performance of this ecosystem consists mainly of the following:

❶ Increasing business operation performance efficiency via the design and decoration empowerment platform

For designers, the digital empowerment platform service solution is a collaboration platform that facilitates project management by integrating the three major parties – the designer, the customers, and the decoration service providers. The digital service enhances management efficiency, simplifies operating procedures, shortens the construction period, and reduces construction cost, all of which increase the industry's operation efficiency and bring the design and decoration industry into the smart field. The functions of the aforementioned collaboration platform also include decoration project management, customer service management, consulting services, and value-added software services. After the deployment of the platform, enterprises are helped through

instructions and training to introduce the relevant services of the platform.

❷ Promoting smart home services and product co-creation

Based on the common demands of ecosystem members, facilitators conduct research and analysis on the targeted customers, such as the elderly demographic and senior groups who prefer the use of electronics and their applications, in order to draft the modules of services. Further, facilitators conduct cross-domain collaboration training, provide courses to train smart home consultants, and have launched a consultancy toolkit that includes service blueprints and tools to help smart home consultants offer high-quality services. Additionally, facilitators host workshops instruct in practical know-how for the introduction of smart home appliances.

❸ Gaining insights into the consumer needs in experience scenarios

Appreciation of the smart technology lifestyle requires actual experience as well as process improvements, so facilitators, together with a home decoration provider, have established a lifestyle experience site. The introduction of smart home experiences in the physical channels not only enables designers to communicate with potential customers, but also to increase new product and service exposure as well as market layout, expanding new market and business opportunities.

III. Oyster shell high-value circular ecosystem

(1) Market demand

Oyster is a common ingredient in global cuisine and a major traditional seafood worldwide; in fact, it has been called “milk of the ocean” (Fisheries Research Institute, COA, 2009) . According to the Report of the Food and Agriculture Organization of the United Nations, global production of oysters in 2018 was 6.1 million tons, resulting in more than 4.3 million tons of discarded oyster shells (Mo et al., 2018) . These piles of discarded oyster shells have generated public health concerns, pollution, and other problems along coastlines, such as seawater eutrophication. The burning of oyster shells is another cause of environmental contamination, producing a foul smell, creating

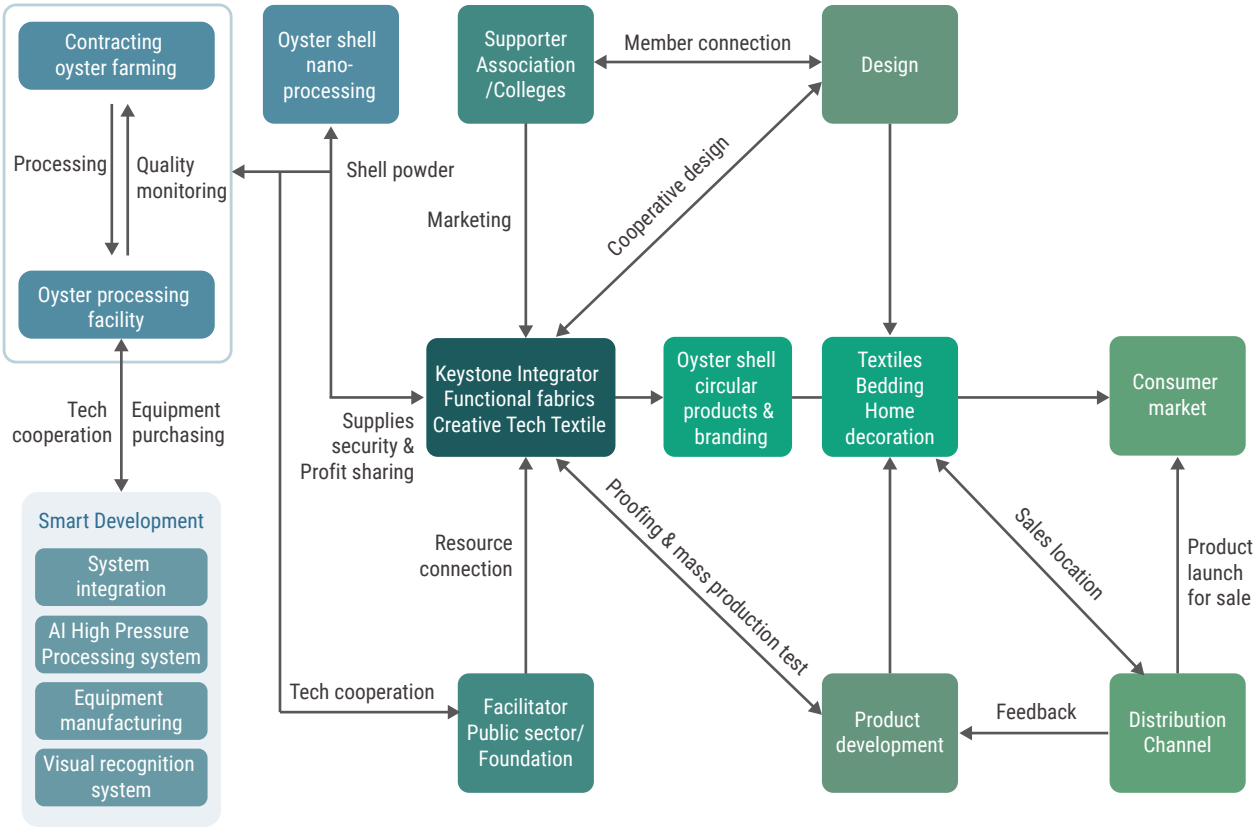

Fig. 06 Relationship diagram and business model of the oyster shell high-value circular ecosystem

breeding grounds for mosquitoes and flies, and generating environmental and sanitation problems. Therefore, the circular use of oyster shells has become an international issue discussed and practiced in the fields of environmental sustainability, circular economy, and digital innovation.

Further, oyster farming, as with other agriculture, fishery and breeding activities, remains in primary and secondary industries, resulting in economic stagnation, inconsistent production quantity and value, and other development dilemmas. In fact, conditions in the oyster breeding industry are even more dire: remote coastal populations require effective solutions for an aging labor force, insufficient manpower, and environmental problems caused by discarded oyster shells. In light of the specific demands and industrial pain points of this particular market, the introduction of cross-domain innovation can not only help the oyster industry transform and upgrade, but also achieve industrial sustainability and inclusive growth with product and service innovations.

(2) Ecosystem Operation

The keystone integrator of the oyster shell high-value circular ecosystem is Creative Tech Textile, who is responsible for value integration of the ecosystem. The key niche players are raw material processing

facilities for oyster shells, smart technology manufacturers, oyster shell grinding plants, and chain brand hotels that serve as platforms and channels for product exposure and sales. Supporters and facilitators include the public sector, the Industrial Technology Research Institute (ITRI), and colleges and universities near the ecosystem. From oyster washing to international marketing of innovative oyster shell powder products, the implementation strategies for the ecosystem development can be divided into three major phases: 1) the introduction of smart technologies and upgrades in material plants; 2) the development of oyster shell powder circular products in collaboration with designers; 3) brand marketing and promotion. The niche players and facilitators in the different phases may differ, so the role of the keystone integrator adapts based on the phases and interactions with other ecosystem members. Further details are presented in the following diagram.

❶ Facilitator – Niche Player

As the facilitator, ITRI, provides technological coaching, including an introduction of AI in-depth learning technology capable of conducting visual recognition and precise selection and sorting of oyster shells, as well as an explanation of technological analysis, evaluation, and verification of the intelligent upgrade. These contributions are accompanied by niche player TOPU Design's key smart technology, which offers services of effective oyster peeling, opening, and low-temperature sterilization to obtain high-quality oyster shell raw materials from the place of origin. As they obtain these targeted materials, niche player MOLI Tech grinds them into nano-grade oyster shell powder. Professional rotary gears are used to speed up the grinding procedure and ensure the quality of the raw materials, establishing an excellent basis for subsequent product innovation.

In addition, based on ecosystem members' demand for resources, facilitators provide networking assistance for manufacturers and designers and promote joint innovation of products. Key material providers and product developers help designers and product manufacturers understand product features by introducing the products, and furthering allowing the players to establish dialogues toward developing novel innovative products.

❷ Keystone Integrator – Niche Player

As the textile integrator and the primary fabric supplier within the ecosystem, the keystone integrator is responsible for connecting niche players such as designers, auxiliary material factories, product developers, distributors, and so on. To build the cooperation network between the keystone integrator and niche players, the former organizes business fairs and talent training so that all players can jointly explore and develop innovative products based on a circular economy model. Concurrently, the keystone integrator connects the public sector in the oysters' area of materials origin with other facilitators, such as colleges and universities, to assist in innovation. In this way, the aux-

iliary material suppliers can jointly conduct oyster shell powder product innovation and creation. The public sector and academia also serve as selection venues for the innovative oyster shell powder products which later become integrated with the cross-domain resources for subsequent activities, exhibitions, and marketing.

The research and development scope of innovative oyster shell products involves a wide range of fields, such as metalworking, crafts, creative life design, bedding, textile, and biotechnology. Functional clothing, bedding, furnishing, and home décor manufactured with recycled oyster shell powder are current product outcomes of the cooperation between relevant enterprises and product designers.

As the operation of the ecosystem stabilizes, the facilitator encourages member expansion into international markets. Currently, however, such a global marketing layout has been interrupted by the pandemic, so market focus has expanded domestically. The chain brand Hotel Day+ has also joined the group of niche players. They take advantage of their distribution channel, offering exhibition areas for new oyster shell powder applications and products. The innovative results of the ecosystem members are exposed and promoted within their domestic branches in the form of product exhibitions.

A new ecosystem chain has been established between suppliers and designers through the introduction of different resources within the industries. This chain allows cutting edge designers to proceed in the development of high value products, including circular resource integration, material sourcing, creative applications, and high-quality channel collaboration, all of which can expand the visibility of the SME brands.

(3) Ecosystem Performance

Overall, the application of smart technology increases industry value, leading to an input of USD$1.785 million in research and development and the creation of 250 job opportunities. As a result of oyster shell economic value increases, the ecosystem achieved a total turnover of USD$3.25 million in 2020 and developed eight total circular oyster shell powder products.

❶ Transforming the value-added positioning of oyster shell powder

The oyster shell high value circular ecosystem cultivated by the keystone integrator enterprise, in collaboration with 30 SMEs, has allowed members to thrive and prosper through the creation of eight novel oyster shell powder products, including innovative antibacterial fabrics, anti-dust and anti-mite face masks, recyclable planting utensils, and antibacterial soaps. The majority of the thirty members in the ecosystem belong to the technical service industry, with the remainder in textile and apparel, furniture, and decoration industries. Mechanical equipment and food industries are also involved, further enriching the diversity of the ecosystem.

Fig. 07 Recycling records of the discarded oyster shells

❷ Expanding the scope of application for the core technology of oyster shell powder

The R&D and application of nano-grade discarded oyster shell powder has obtained several intellectual property rights and international patents. The keystone integrator Creative Tech pioneered the application of the nano-grade discarded oyster shell powder in the development of high-tech textile value-added products. These products are now sold to the United States, Japan, and internationally renowned apparel brands.

This ecosystem offers collaboration models for creating circular oyster shell brands. The ecosystem can expand to share circular concept values with local cultures, apply them to consumer experiences, and access other relevant arenas outside the current ecosystem, creating a symbiotic relationship between design and the environment. Designers can then consider different possibilities at the initial stage of creation for sourcing materials. With circular materials as a selling point, designers can also develop other applications for oyster shell powder and design new commodities, reaching both the aims of sales and promotion.

❸ Developing the circular economy model of the oyster industry

Due to the adoption of smart technologies in key areas, the oyster industry has increased in value at a fast pace. It turns out that high-quality materials are available and the circular oyster powder fabric allows designers and product developers to spark innovation in novel usages of the material.

This creates a symbiotic relationship between design creation and the environment. Furthermore, the shaping of the brand value and the consumer experience enables more people, especially in younger generations, to have a brand-new perspective towards the oyster industry. In this way, it is possible to cultivate young oyster farmers of the next generation, encouraging them to join the circular oyster and smart technology industries, and further harnessing new economic values.

Chapter 3

Analysis of the Key Elements and Policy Measures

Chapter 03

Analysis of the Key Elements and Policy Measures

This chapter summarizes development elements of a cross-domain innovation ecosystem based on operations of the three ecosystems described in the previous chapter. It also discusses potential resources and policy tools that allow the public sector to foster its development.

I. Elements for the Development of a Cross-Domain Innovation Ecosystem

As discovered from the summary of the empirical experiences of innovation in the previously mentioned cross-domain innovation ecosystems, the development process of the ecosystem can be divided into three stages, with a distinct focus at each. The first stage is "increasing value." Key members at the early stage of the ecosystem development will innovate certain products or services and create viable business models, allowing the ecosystem members to get new revenues and benefits. This conforms to the element of power of innovation in an ecosystem.

The second stage is "speeding up." At this stage, a standard operational procedure and mechanism are constructed. The mode of collaboration among ecosystem members and the optimization of the product/service development procedure are all managed systematically to enhance efficiency. Put simply, the key is to construct a system platform which ecosystem members can join, allowing innovation to speed up. This stage conforms to the element of power of cohesion in an ecosystem.

The third stage is "scaling up." By expanding the market, diversifying member types in an ecosystem, increasing their influences, or even gaining cross-border cooperation or exporting products or services, an ecosystem can obtain innovation-driving forces to continue growing. At this stage, an ecosystem should prepare itself to move on to a mature stage. That also means searching for possibilities of expanding its market scale. This conforms to the element of the power of productivity in an ecosystem.

❶ Yacht-related Leisure Sector Smart Service Ecosystem

In the case study of this ecosystem, the supporting foundation-team Metal Industries Research & Development Centre (MIRDC) provides assistance in the introduction of a smart service management system and the

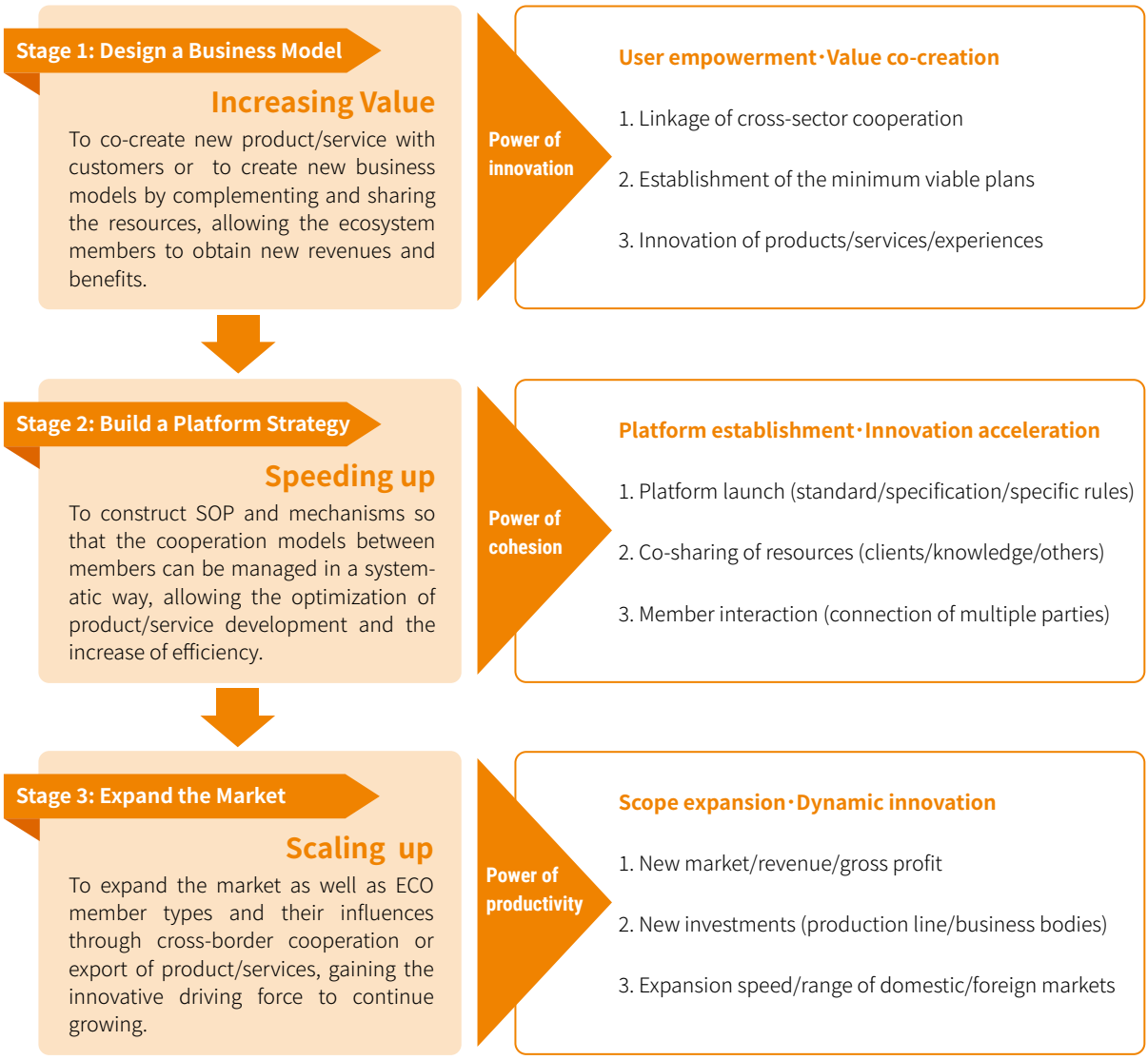

Fig. 08 Three stages of the ecosystem development

establishment of a member database at the increasing value stage, making it possible to conduct in-depth analysis of customers' preferences. This allows the keystone integrator Argo Yachts to systematically note customer needs and have proper management of customers' consumption records. The record management plays a crucial role in subsequent customizing of solutions, recommending the right vendors, optimizing service quality, and increasing the conversion rate of translating customer needs into actual orders.

As the keystone of an ecosystem is established, the smart service management system will attract niche players from different industries to join in so that Argo's yacht-related leisure services can be diversified with the incorporation of boutique vendors, wedding consultancy, the meetings, incentives, conferences and exhibitions (MICE) industry, featured cuisine, sailboat manufacturing, marketing, public relations, professional teams and yacht secretaries, vessel sailing training and certification courses, and other related sectors. It is hoped that

the power of innovation in the development of leisure activities related to the yacht sector can go beyond water and underwater activities. By integrating it with hotels and accommodations as well as nearby sightseeing resources, personalized services can be provided to high-end customers, which could create new demand.

At the speeding up stage, an ICT operating platform is established for this case. It integrates different providers and partners of the ecosystem and further innovates the operation of yacht-related sectors. It enhances the power of cohesion of cross-domain services and creates a series of diversified business models. In addition, profit-sharing with mutual benefits, diversified services, and high-end value-added results can be attained through the yacht-related leisure smart service platform. So far, this ecosystem has attracted more than 40 SMEs that can set yacht-related leisure services in motion, such as yacht maintenance, repair, and cleaning, sailing certification courses, food and beverage, pier rentals, and above-water and underwater leisure activities. Subsequently, at the scaling up stage, more than ten innovative packages and customized solutions have been developed. The new comprehensive service that integrates tourism, water activities, catering, and real-estate industries can gain access to customer groups of all ages after having system management modules expanded, as well as reach the high-end market, which has higher value and more influence, increasing the overall power of productivity of the ecosystem.

❷ High-Quality Interior Decoration Ecosystem

At the increasing value stage, a “design and decoration empowerment platform” has been created by the facilitator Institute for Information Industry (III) together with the keystone integrator KyArt Creative. It offers project management solutions to designers so that they can optimize management efficiency and establish smooth communication channels for designers, construction teams, and customers. Basically, the needs of the industry are met by the power of innovation. By utilizing the platform, the ecosystem members are able to save money and time during the project implementation.

As the cooperation models among ecosystem members become more systematic, it reaches the speeding up stage, in which the power of cohesion of members' functions and features can be exerted. Benefiting from this empowerment platform, designers are able to communicate with their customers at the design phase, allowing them to secure a cabling space for future smart lifestyle and IoT devices. The home appliance and IoT device providers in the ecosystem can

submit quotations through the empowerment platform so that customers can review their options. This will significantly reduce the cost of seeking business opportunities and lower the entry barrier for customers to live a smart life.

At the scaling up stage, the supporter fosters collaboration between two niche players, Think Creative and Enabling Things, which is based on interview results and smart home market demand research. Targeting the elderly group, who prioritize their home security, and senior groups, who have greater acceptance of electronics and smart lifestyle, interior designers, smart home appliances, and IoT device providers are matched for cross-domain collaboration. Due to the ecosystem operation, innovative smart home services and products are being co-created, which in turn brings about new business opportunities and increased productivity. This not only helps consumers to adopt smart lifestyle solutions but also encourages home appliance providers to proceed into product transformation so that they can seize business opportunities of the smart lifestyle.

❸ Oyster Shell High-Value Circular Ecosystem

At the increasing value stage, the keystone integrator Creative Tech Textile has integrated the resources of the facilitator (ITRI) and niche players (TOPU and MOLI Tech) who provide key technologies. First, an AI visual recognition system is deployed to optimize screening and selection of oysters. Then, a high-pressure peeling technology is introduced, followed by a nano-grade grinding procedure, so that high-quality oyster shell powder can be generated. The keystone integrator hence has created a circular oyster shell brand image by integrating the oyster shell powder and PET bottles to become the distinctive SEAWOOL yarn, eco-friendly antibacterial textile, and finished fabrics. The resources of facilitators and the keystone integrator are integrated based on the raw material, which is oyster shell, and are used to co-create new products. The keystone integrator and suppliers of oyster shells have created a profit-sharing mechanism, which is indeed the incentive to improve the quality of the raw material. The previously discarded oyster shells, which would have caused public health concerns, are now in the form of circular-economy products. The "power of innovation" is displayed in each of the phases, from the selection of materials, to the development of products, and the consumer experiences.

At the speeding up stage, the keystone integrator maintains stable supply and produces high-quality oyster shell powder, while the niche players are in charge of innovative product development and design for the SEAWOOL yarn. The fabric is then manufactured into textiles, bedding, furnishings, and other products which are highly competitive in the market and exposed to matchmaking platforms, such as chain hotels' venues, constructed by the facilitator and supporter. At this point, a complete oyster shell circular ecosystem business model is formed, and profit can be generated at each stage. More-

over, to facilitate the establishment of a mutual-trust mechanism for the interactions of different players from the industrial, public, academic, and research sectors, the ecosystem uses the "Formosa Fashion Industry Alliance" as its operating platform, where information and experiences regarding raw material supply, resource integration, promotion platform and creative design are exchanged.

As the ecosystem's key front-end technologies gain more international reputation, such as the nano-grade oyster shell grinding technology and the eco-friendly fabric made with oyster shell powder and plastic bottles, along with obtaining patent rights and international awards, the brand image has become the ecosystem's jointly shared value. Its core technology continues producing high-quality oyster shell powder with a stable supply to maintain the momentum of the ecosystem's operation. Due to the features of openness and resource sharing of the ecosystem, colleges and universities with design departments near the origin of the oyster shells have also joined in the design and development of oyster shell powder products, generating endless and varied creative and innovative perspectives. The aforementioned connections between different parties can sufficiently demonstrate the "power of cohesion" within the ecosystem.

At the scaling up stage, the ecosystem gains access to the smart and circular economy from a single oyster ecosystem, leading to other derivatives, such as textiles, bedding, and furnishings, and brand value. The innovative products made with 100% local materials have not only entered the domestic high-end market but also gained access to the international circular product market of functional textiles with the support of invention awards and new-type patents. For instance, one of the innovative products, "technological antibacterial insulation cotton," won the iF Design Award, launched by iF International Forum Design GmbH, making its way to the United States, Europe, Australia, South America, Japan, Korea, and China. As niche players of the ecosystem tell their stories, the partners work together to attract consumers through high-quality channels. In this way, the ecosystem keeps reaching potential partners and expanding new markets, showing the features of the element of power of productivity through diversified innovation and continual expansion.

❹ Summary

In the view of the aforementioned observations, to obtain initial success in the establishment of an ecosystem, supporters and facilitators must keep the following five key factors in mind: 1) scenario-driven joint experience and vision, such as user-centered design; 2) innovative and creative holistic solutions, including product, service, experience and business model solutions; 3) clear and adequate role positioning of stakeholders, such as keystone integrator, niche player, supporter, facilitator, industry, the public sector, academia, research, and the general public; 4) a keystone integrator who can balance self-interest and altruism, facilitating resource sharing and mutual achievements;

Fig. 09 Keysonte integrator Argo introduces the prospect of ecosystem development to ecosystem partners

5) flexible and open linkage, cooperation or a co-creation platform to ensure quick participation, clear value-added services, specific rights and obligations, evaluable benefits, and a quality management model.

II. Resources and Policy Tools Available from the Public Sector

In the successful cases of cross-domain innovation ecosystems, the public sector's role is to formulate policy guidelines and provide resources that can facilitate an ecosystem's operation. Research and development institutes, working closely with the public sector, offer assistance in information collection, communication, and matchmaking during the formation of an ecosystem. In addition, R&D institutes help recruit niche players or optimize niche players' platform efficiency to reach the scaling up stage when an ecosystem starts operating. The following paragraphs elaborate on how Chinese Taipei's public sector materialized the concept of cross-domain innovation ecosystem through R&D institutes as the facilitators, and its actions implemented and achievements made.

The facilitator of smart service for the yacht-related leisure sector ecosystem, MIRDC, acquires resources by submitting proposals to the public sector and setting up supporting teams to assist the keystone integrator in constructing the ICT digital platform with smart service management technologies, where the ecosystem members can participate and consumers can register for access to one-stop leisure service solutions. In other words, the facilitator helps the keystone integrator deploy smart technologies during the formation of the

ecosystem. Through its core competence in data analysis, the facilitator is able to help the ecosystem members note consumers' preferences, which is meaningful in improving service quality.

In the high-quality interior decoration ecosystem, the facilitator Institute for Information Industry (III) gathers information on the needs of interior design professionals via interviews with the assistance of the public sector, working with KyArt Creative to establish the empowerment platform in the first place. As more users join the platform, III continues collecting users' feedback and providing it to the keystone integrator as a reference for the optimization of the platform. Second, III organizes matchmaking events, workshops, and other activities to promote the platform and ecosystem with the purpose of attracting relevant parties that can scale up the ecosystem. Third, a collaborative relationship is built between the facilitator and the niche players to create experience scenes that can allow designers to have insight into consumers' needs. This will help them achieve market differentiation during the process of product design. Lastly, the facilitator also fosters cooperation among the niche players to co-create smart home packages for smart families by deploying the keystone empowerment platform.

In the oyster shell high-value circular ecosystem, the facilitator, Industrial Technology Research Institute (ITRI), obtains resources from the public sector to integrate niche players, including equipment manufacturers, visual technology developers and system integrators. First, visual recognition technology is deployed in the oyster washing process, which can help upgrade the oyster facilities and improve the quality of the oyster shell supply. Second, the ITRI also has a role in marketing and promotion of the products, branding, and resource docking. Lastly, because the oyster breeding industry is mainly situated in Tainan City and Chiayi County, the local public sector also serves a role as a fundamental facilitator for the operations of the ecosystem. With guidance and aid from the local public sector, resources are introduced to enable the upper, middle, and lower streams of the design industry to interact smoothly with each other. Academic research and innovation achievements are also embraced, enabling connection between the fashion design industry and the oyster shell powder circular products.

As mentioned above, given their limited capital and smaller scale, SMEs certainly face numerous risks and challenges during the process of ecosystem establishment. Thus, with the multi-faceted assistance offered by the public sector and R&D institutes, SMEs are able to overcome different obstacles, such as heavy loading of cost, information asymmetry and matchmaking difficulties during the process of transformation. Based on the experiences of the ecosystem promotions above, the roles of the supporters and facilitators are summarized as follows:

❶ Communicator

The introduction of new technologies into an enterprise does not guarantee suc-

cessful transformation. It requires facilitators and supporters to offer continuous assistance in collecting feedback regarding experience using certain technologies and optimizing the quality of products and services, which increases the incentive to join so that the ecosystem can thrive.

❷ Matchmaker

During the process of transformation and innovation, enterprises must bear the relatively high cost of matchmaking. However, facilitators and supporters who have access to the latest market and industrial information are capable of providing well-paired matchmaking meetings, enhancing the recruitment process for the ecosystem. In addition, at the scaling up stage of the ecosystem, facilitators and supporters can arrange matches for new products and/or services with further development of distribution channels and platforms which can increase their exposure.

❸ Technology provider

It is possible for SMEs to develop new technologies via cross-domain alliance or investment. However, in the face of a low success rate of innovation, high time cost, or high monetary cost, facilitators and supporters need to pool resources in high-potential enterprises through appropriate selection procedures and strategy formulation, helping them acquire new technologies.

To conclude, the roles of facilitator and supporter played by the public sector and R&D units are crucial within the ecosystem. The assistance can be considered an ecosystem development accelerator that provides professional R&D consulting and helps the ecosystem form and thrive with auxiliary measures, such as its role in collaboration and innovation. Based on Chinese Taipei's experience, the overall consulting duration can be two years, and the ecosystem development goals can be achieved in stages. In the first year, a solid cross-domain ecosystem can be constructed with the collaboration of facilitators and supporters, a keystone integrator and key niche players. The following year, it should aim to recruit new members so that the ecosystem can operate independently. Afterward, ecosystem members enter the stage of autonomous operation.

Chapter 4

Conclusion

Chapter 04

Conclusion

The need for ecosystems that can respond to a dynamic environment and develop themselves in a sustainable way has become more urgent in recent years as the industrial environment drastically changes. The development models of innovation can range from closed innovation driven internally to open innovation in an open-end environment. The future paradigm of industrial innovation models may be included in ecosystems with open dynamics, or cross-domain or even cross-border exchanges.

Although current ecosystems are mostly led and developed by the public sector or larger enterprises, APEC's statistical data show that SMEs are still the backbone of economic development in the Asia-Pacific region. Thus, SME empowerment can be strengthened through the concept of the ecosystem, upon which SMEs' innovation and management mindsets can be built. This ecosystem strategy is a way to help SMEs recover from the pandemic and is a solution to the need to strengthen competitiveness.

The SMEs in the diverse fields mentioned previously are not comparable to international corporations that conduct diverse business operations. Nevertheless, SMEs, notable for their quick market re-

Fig. 10 Mr. Erdal Elver, President & CEO of Siemens, addressed the 2020 Cross-Sector Innovation Ecosystem Conference.

Fig. 11 Mr. Chern-Chyi Chen, Deputy Minister of MOEA (from the upper left), Ms. Blesila A. Lantayona, Undersecretary of DTI Philippines declared the opening of 2021 Cross-Domain Innovation Ecosystem Forum.

Fig. 12 2021 Cross-Domain Innovation Ecosystem Forum's virtual exhibition, composed of SMEs from 6 APEC economies

sponsiveness and flexible environmental adaption, can still bring their core capabilities into play. If these enterprises are interconnected, they can leverage each of their advantages in order to achieve the goals of cross-domain innovation, upgrading and transformation of the ecosystem members, and sustainable growth.

To foster SMEs' development in a cross-domain and cross-border ecosystem, which can serve as a reference for the economies and stakeholders in the Asia-Pacific region, this guidebook first describes the composition of ecosystems, including keystone integrators, who are responsible for value integration and mutual prosperity among members, niche players, who contribute their unique resources or capabilities in order to create value benefits, and supporters and facilitators, who assist in the ecosystem development and the fortification of key capabilities. Then, ecosystem operation models, development stages, and effectiveness are illustrated in three case studies of different domains: leisure activities related to the yacht sector, interior design and smart lifestyle, and an oyster shell circular business model.

Five key elements are induced from Chinese Taipei's experiences in promoting the development of cross-domain innovation ecosystems, including shared visions, creative and innovative total solutions, clear and appropriate roles of multiple stakeholders, a niche player who can integrate the value of all parties, and an open and flexible co-created platform. The five elements are proven feasible through empirical observations of three cases in this guidebook.

Lastly, the guidebook also offers suggestions in terms of resources and policy tools that the public sector can provide. As mentioned previously, the public sector plays the role of a facilitator and supporter which is mainly responsible for the formulation of overall policy guidance and resource supply. In addition to the matchmaking platform required by all stakeholders in the early stage of an ecosystem's development, Chinese Taipei also helps keystone enterprises integrate valuable techniques and technologies possessed by niche players through the network and technological capabilities offered by R&D institutes. This will optimize an ecosystem's platform of resource sharing and value co-creation, enabling the ecosystem to immediately respond to market needs and to advance into product, service, and business model innovations. The guidebook also describes the development trajectory of ecosystems, namely the stages of increasing value, speeding up, and scaling up, which can further achieve market expansion, extend the influence of ecosystems and create cross-border collaboration or sales opportunities.

All in all, the concept of collaborative innovation can be implemented in SMEs' cross-domain innovation ecosystems, which can serve as a benchmark model for the future development of SMEs and enhancement of their competitiveness in the APEC region. Ecosystems embracing concepts of innovation, mutual prosperity, and sustain-

able development echo APEC's multiple strategic themes in recent years. It is hoped that the publication of this guidebook can help SMEs in the APEC region effectively respond to business environment changes during the pandemic and challenges brought by the shifting paradigms of business models.

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