Asia-Pacific
Economic Cooperation

APEC Feature Report on SME New Paradigm of Digital Resilience

Small and Medium
Enterprises Working Group

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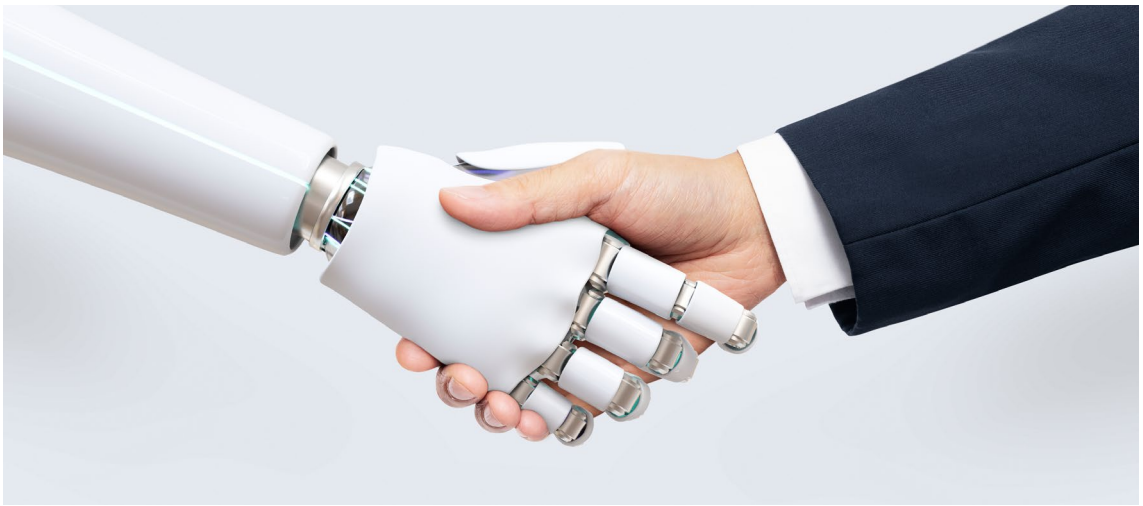
Introduction

According to the Organization for Economic Cooperation and Development's 2021 Economic Outlook report, the digital transition of economic operations is key to the revitalization of various economies. In addition, the APEC Regional Trend Analysis by APEC's Policy Support Unit in 2021 notes that many businesses were able to continue their operations during the pandemic through the use of zero-contact platforms as well as remote and intelligent operation technologies. The 2022 APEC Regional Trend Analysis also emphasized the numerous new opportunities from digitalization, itself one of the key economic drivers of APEC's Putrajaya Vision 2040.

Business continuity planning of all APEC economies, including plans formulated in response to the pandemic, mostly address information security risks when it comes to digital issues. Few APEC economies have formulated a business continuity planning methodology that addresses topics such as SME digital



optimization, e-commerce participation, narrowing the digital-divide, and public-private partnerships in response to rapid social and economic changes.

In light of this, Chinese Taipei have implemented "APEC SMEs New Paradigm of Digital Resilience" initiative to promote the continuous digital optimization of SMEs' internal operations and external connections in response to pandemic-related shifts. The initiative also aims to enhance APEC SMEs' business continuity and their competitiveness against changes in the business environment in real time.

This report is the output of the initiative mentioned above. It contains a detailed analysis of four SMEs that have introduced digital tools to enhance their sustainability in the post-pandemic period. These companies are in the fields of PCB manufacturing and assembly, logistics, vacuum molding, and bath and kitchen retail, respectively. Three key universal suggestions were drawn from these four companies' case studies: 1: Utilize IoT and intelligent business systems to improve corporate resource planning efficiency; 2: Optimize production processes and supply chain management; and 3: Deploy public-private partnerships to foster business transformation.

With the publication of this report, Chinese Taipei hopes to increase understanding among SMEs, start-ups, and stakeholders of business continuity strategies for companies undergoing digitalization. Additionally, the report aims to disseminate related information and help SMEs in the APEC region develop long-term strategies and capabilities for digital transformation.

Chapter 2

Cases

Shin Puu Technology Co., Ltd.

Background

Founded in 2001, Shin Puu Technology is a printed circuit board (PCB) manufacturing and assembling company. A PCB is a board with chips and wires connecting different components to transmit both power currents and signals, enabling the proper function of machines. PCBs are made of different materials depending on the demand of the end products: rigid PCBs are used in televisions or computers; flexible PCBs are used in touch screens; and IC substrates are used for graphics or logic chips. In other words, PCBs are the foundation of all electronics; without them, electronics would not function properly. Shin Puu focuses on a high-end market, including producing graphics and logic chips for military and aerospace use.

In the PCB industrial chain, equipment and materials suppliers are the upper stream, while PCB manufacturers and clients (representing various electronic

product needs) are the middle and lower streams, respectively. Generally, a client will ask several manufacturers to provide product samples. After evaluating the samples, the client will award their order to the manufacturer whose sample has been approved. Therefore, manufacturers usually provide samples to clients for free to increase the chance of being considered. Because it is time-consuming to switch between the manufacture of different product types, manufacturers usually reserve their capacity for clients, such as those in the gaming industry, who order more than 10,000 PCB boards. Other kinds of companies, such as semi-conductor and optical companies, generally do not exceed orders of more than a few hundred, and therefore their orders tend to be delayed. This means clients with smaller needs often have to wait months to get a sample.

In the PCB industry, large companies are not willing to develop a new mold just for a small order. Smaller companies, with their limited number of machines, cannot meet complex orders and demands. In light of this, Shin Puu serves the clients that neither large nor small manufacturers can satisfy. Its target clients are those who place smaller orders and are therefore ignored by other manufacturers. Though Shin Puu charges clients for producing samples, these clients receive their samples much faster, thereby allowing them to accelerate their start to production. In contrast to large manufacturers that mainly serve clients seeking a large quantity of a limited variety of products, Shin Puu mainly serves clients who need a small quantity of a wider variety of products. Shin Puu has also entered the market for special production processes and materials. This market has higher technical requirements with lower demands. Large manufacturers generally do not want to manufacture such products, while smaller manufacturers generally do not have the technology to do so.

In serving this market, Shin Puu works with a wide array of more than a thousand companies and industries in fields such as communication, aerospace, and military. Each month, Shin Puu processes more than one thousand part numbers (design numbers). This unique business model gives Shin Puu an important advantage: such diverse manufacturing experience exposes it to a wider range of products, allowing it to meet client demands quickly by referencing old

parameters for the few novel products that Shin Puu has never manufactured before.

Business Challenges

The market is desperate for professional manufacturers that can satisfy smaller quantity orders of a wider variety and offer a quick turnaround in fulfilling complex and high-value orders with quality products. Each client has unique needs, whether they require a limited product variety in a large quantity or a wide product variety in a small quantity. As noted, it takes time and money to switch among the manufacture of different products on the production line. Therefore, the ability to produce a wide variety of products is what sets Shin Puu apart from other competitors.

However, there are challenges for manufacturers. As demand for chips continues to grow for 5G and electric vehicles, the market's demand for PCBs has become more complex and diverse. As these demands diversify, it becomes more complicated to understand clients' needs and to design and provide mock-up samples. Therefore, Shin Puu is under pressure to transform to smart manufacturing.

Shin Puu, along with the entire PCB industry, is struggling with the lack of experienced workers and inconsistent QC. At any point there are twenty to thirty manufacturing processes in PCB production lines, and each process relies on experienced workers to operate and adjust the parameters. Therefore, the short supply of experienced workers makes it difficult to boost production capacity, which in turn affects product yield and QC consistency.

Digital Resilience

By participating in the "SME Smart Manufacturing Digital Transformation Program" promoted by both public and private sectors, Shin Puu received professional consulting and education on digital and smart manufacturing, manufacturing optimization, innovative application services, IoT capability, data collection and analytics, and a manufacturing execution system. Further, Shin Puu secured smart equipment to optimize manufacturing and further integrate smart manufacturing in production lines. Integration of these tools has enabled Shin Puu to better address common pain points such as labor shortages and complicated manufacturing demands. Shin Puu, its partners, and other stakeholders have thereby gradually built a data sharing and value co-creation system to facilitate digital and smart manufacturing solutions.

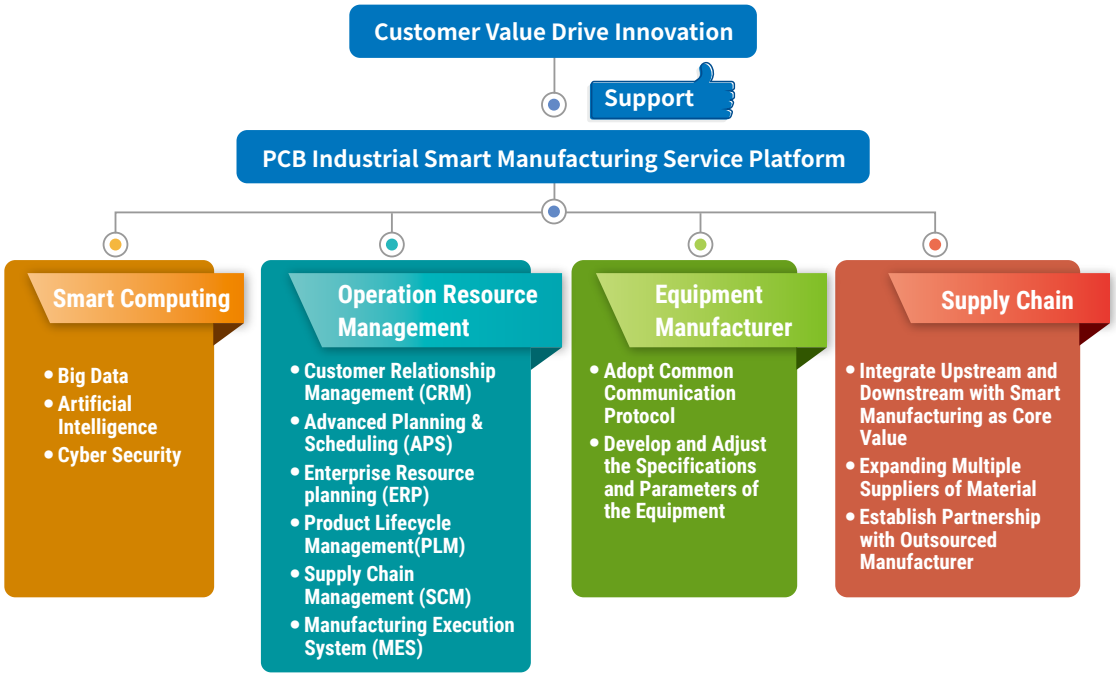


Figure 1. Innovation driven by customer values

Source: Compiled by this report

❶ Optimized Internal Operations

All machines inside Shin Puu's factories are equipped with tablets that run scheduling and timesheet systems. With innovative IoT technology, these systems transmit the manufacturing information to the war room, allowing employees to identify and understand the manufacturing processes and more easily follow the pre-defined parameters and requirements on the production line. Through the use of the SME Smart Manufacturing Digital Transformation Program, Shin Puu has experienced tangible results, such as more efficient manufacturing, better product quality, and higher product yield. Further, there are intangible improvements, such as shorter communication times, optimized manufacturing schedules, and increased factory efficiency. As Shin Puu has successfully introduced digital tools to its smart manufacturing, the company has also founded a subscription service to help other SMEs with similar needs to model Shin Puu' s successes in adopting smart manufacturing.

❷ Strengthened External Connections

As Shin Puu continues to enhance its internal operations, Shin Puu is also working to strengthen its external connections. Shin Puu focuses on providing one-stop PCB manufacturing and assembly service with short turnaround and high-quality, high-end, and diverse small-batch products across electronics, communication, medicine, and other industries. Therefore, Shin Puu needs to respond rapidly to market trends to sustain its business model. To enhance connections with upper, middle, and lower stream companies as well as with its clients, Shin Puu has partnered with the China Productivity Center of Chinese Taipei to establish a sales and service platform for smart manufacturing. This platform combines smart computing, operational resources management, and supply channels, and provides nine services, including comprehensive inquiry management, order tracking, technology support, and R&D collaboration (see Figure 1). Clients can upload their designs to the platform, which uses big data and AI to analyze a given design's materials and processes and then produce a quote, an estimated production schedule, a list of required materials, and other

information. Shin Puu does not simply manufacture clients' designs; but also provide innovative design solutions based on its diverse manufacturing experience across various fields.

Achievements

With these newly optimized internal operations and enhanced external connections, Shin Puu has enjoyed a fifteen percent bump in overall production efficiency and a ten percent improvement in product quality. Thanks to a higher product yield, the company has saved approximately USD $620,000 in defective product costs. Shin Puu's new digital tools have optimized the company's internal communications, additionally sparing us from time-consuming confirmations and the inconvenience of meetings and other communication delays.

Noveltek Industrial Manufacturing Inc.

Background

In recent years, the COVID-19 pandemic, along with international political shifts, have resulted in drastic changes in the global business environment for small and medium-sized enterprises (SMEs). Supply chain disruptions have generated an awareness of the need for software and hardware solutions to accelerate automation and smart transformation. Here, this report uses the example of Noveltek, a material-handling equipment manufacturer, to analyze how the company fully upgraded its warehousing, transporting, and distribution with the help of big data analytics and AI technologies. Noveltek has also implemented digital technologies to successfully optimize its internal operations and enhance the resilience of its external connections such as those with local and international vendors.

Forklifts, ubiquitous small industrial vehicles, have been utilized in automobile manufacturing in Industrial 2.0 (electrification and mechanization). Forklifts are recognized as the prototype for the automated guided vehicle (AGV) and autonomous mobile robot (AMR) which are the alternative for human operators of a factory in industrial 4.0 (smart factory and smart logistics). Demand continues to increase for forklifts used in loading, unloading, and moving products in manufacturing facilities and warehouses. According to Global Information's 2022 market report, it is estimated the global forklift market will reach USD$154.3 billion by 2030, with an anticipated CAGR of 12.8% between 2022 and 2030. Developed economies are expected to command sixty percent of this market, with the remaining forty percent shared among emerging economies.

Business Challenges

The global oil crisis in the 1970s brought fluctuating energy prices and spotlighted the reality of the world' s limited oil reserves. In the same era, Ford began deployment of electric forklifts in place of standard gas-powered models. Such trends made clear that traditional forklifts would soon become obsolete.

Many manufacturers that stuck with diesel forklifts were eventually acquired by other companies as they lost independent R&D capabilities. After its founding in 1990, Noveltek, watching other manufacturers succumb to either obsolescence or acquisition, opted to design and manufacture diversified models of semi-automatic, fully automatic, and manual hydraulic forklifts as well as trailers, lift tables, and other warehousing and handling equipment. Many manufacturing companies did not have sufficient time to transition ideally from automation to digitalization in response to the shifting market trends. Increasing environmental awareness meant that handling equipment manufacturers had to develop their technologies to transition to digitalization in a short period of time.

In addition, current labor shortages resulting from the COVID-19 pandemic as well as rising demands for labor-saving material handling in factories mean that unmanned and electric transport vehicles are desperately needed. This has prompted Noveltek to conduct their own R&D and utilize external resources to keep up with industrial trends.

Digital Resilience

The electric forklift, Noveltek's flagship product, went through many iterations including diesel-powered, electric, laser-guided, and magnetic-guided, and formed an entire value chain supply system that includes transportation, maintenance, and ordering. Noveltek's forklifts went from being diesel-powered to electric, then became smart forklifts, and were finally upgraded to a cloud/IoT connection; each transformation was the result of public and private partnership.

While going digital, Noveltek worked with Industrial Technology Research Institute (ITRI) and other industrial, government, and academic organizations to introduce their R&D results. At the same time, Noveltek began working with new information and communication technology suppliers to utilize key manufacturing technologies and components, promote smart machinery, and build a smart production line with smart transportation and clean energy.

One example of Noveltek's successful application of their R&D results is that of fruit and vegetable wholesale markets. In the past, diesel transport vehicles were used in these markets. Noveltek has gradually replaced these diesel vehicles with electric counterparts, which have a load capacity of 3.5 tons and are quieter, cleaner, and more powerful. Recently, Noveltek worked with ITRI and other technology companies in launching super capacitor transport vehicles to reduce carbon emissions in agricultural transportation. These super capacitor transport vehicles use graphene electrodes in place of active carbon electrodes, shortening the charging time from eight hours to just 44 minutes. Since the battery itself is lighter, the vehicle's load capacity has increased by 400 kgs, which translates into a transportation efficiency boost of more than thirty percent.

Image 1. Transport vehicle in a fruit and vegetable wholesale market

To save time and labor costs from transport vehicles going back and forth between factory and warehouse, Noveltek introduced autonomous and magnetic track-guided transport vehicles, which follow wherever magnetic tracks are laid. These magnetic track-guided transport vehicles can easily switch between human-driven and self-driving, which adds flexibility in use. Its price is only twenty percent of its laser-guided counterpart, drastically reducing both the cost and technological barrier of digital transformation. In response to the labor shortages, jammed harbors, and container transport issues resulting from the pandemic, Noveltek worked with ITRI to develop a container transport vehicle that can move forty-foot containers. It is simple enough for even a novice to operate, offering more flexibility for container repositioning and transport.

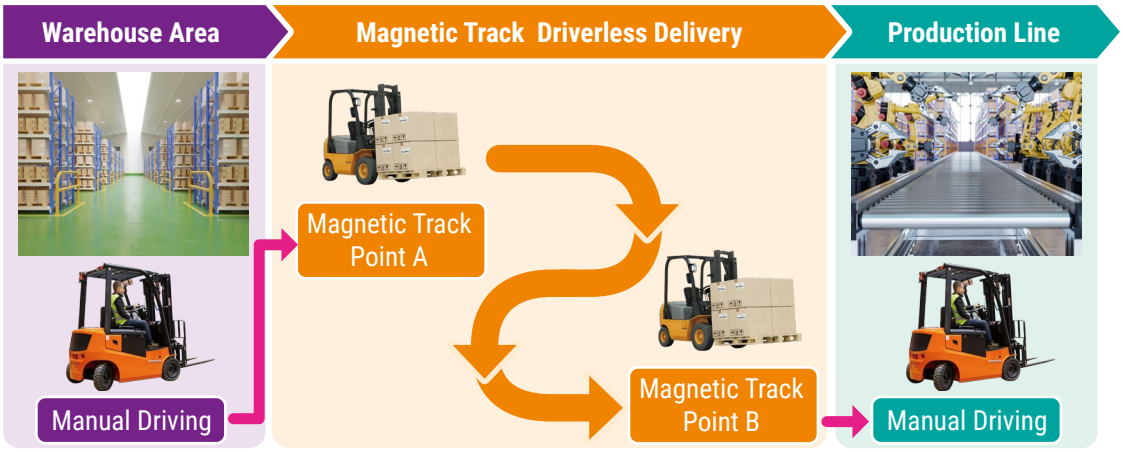


Image 2: Magnetic track guidance illustration

Production of forklifts or any handling equipment requires thousands of parts from more than seventy upstream and downstream suppliers, both domestic and abroad. In the past, workers would have to spend time confirming part numbers, items, quantities, and specifications. When suppliers delivered the parts, workers would need to manually record the delivery numbers, adding to communication costs and increasing the potential for mistakes made through manual confirmations. To connect distributors and supply chains, and to enhance factory operations, customer management, and supply chain management,

Noveltek introduced value chain system from China Productivity Center of Chinese Taipei. This "Smart Manufacturing & Warranty Service" combines a supply chain system with cloud maintenance operation management, which means factory logistics, client warranty demand management and supply chain management are all connected to the cloud. Maintenance technicians can simply scan a QR code on a client's repair order to compare the quantity and inventory of the parts needed for the repair. For parts suppliers, the cloud-based order and repair order system drastically improves their inventory management as well as workers' efficiency and quality.

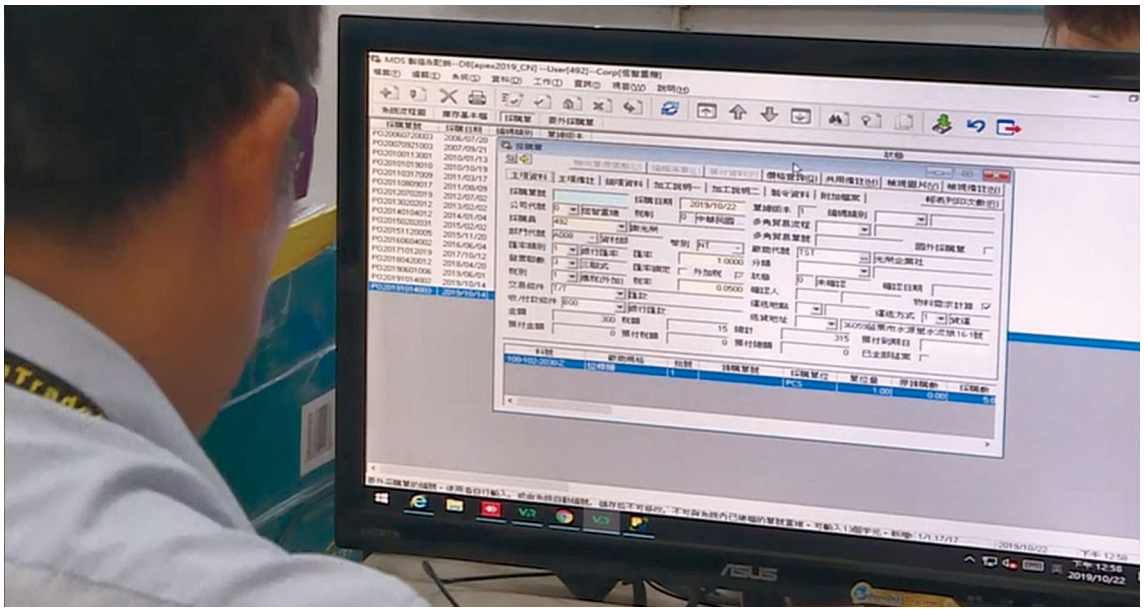


Image 3. Smart Manufacturing & Warranty system

Achievements: Optimized internal operation and enhanced external connections

Thanks to the Smart Manufacturing & Warranty Service, Noveltek began managing R&D, manufacturing, sales, repair, and maintenance in a single system, which in turn prompted the establishment of the company's value supply chain system. This value supply chain system helps Noveltek implement standard

processes from a manufacturing execution system (MES) and warehouse management system (WMS) to more easily manage the information of all clients, 72 local and overseas suppliers, and 22 satellite plants. Noveltek can effectively review and track orders, improve production efficiency, ensure order fulfillment and delivery accuracy, and even increase safety stocks in case of supply chain disruptions due to the pandemic.

Prospects

With the adoption of the automatic guided transport system and smart warranty service, Noveltek's next step is to engage in digital transformation with AI. Noveltek will use its advantage in track-less guided handling equipment to work with Coretronic, a projector manufacturer, in image recognition software, lidar maps, and machine learning. In the future, Noveltek hopes to work with robotics companies to further integrate AGV and AMR and create unlimited business opportunities from cross-industry alliances in the smart manufacturing field.

Hong Zu Mould Enterprise

Background

Hong Zu, a vacuum forming mold maker, was founded in 1987 and has been innovating in the industry ever since. Hong Zu's primary market has always been food packaging, and the company provides the latest technologies in a one-stop client service that includes design, manufacturing, assembly, and certification. Hong Zu pursues continuous improvement in manufacturing efficiency, tool quality, and product innovation. The company has laid a solid foundation for the East Asia market and is currently expanding its services worldwide.

Vacuum forming is a process wherein a thermoplastic sheet is trimmed to a given dimension and then heated to a pliable forming temperature. A vacuum on both sides of the sheet stretches the sheet over a mold. Once it has cooled

down, the formed plastic is taken off the mold and trimmed. This process is suitable for manufacturing plastic packaging, clamshells, thin plastic shells for pastry boxes, egg boxes, and cups. Vacuum forming is the most commonly used thermoforming process, with the lowest cost molds. A mold can be produced with a production cycle of five to seven days from a design diagram. The production cycle is suitable for manufacturing a large variety of products in a limited quantity or for customized products; further, these molds help lower the high production costs associated with small batch manufacturing for clients in the development and growth stage.

Business Challenges

For decades, the traditional manufacturing industry has supported the development and technological innovations in most economies. However, more recent market trends demand large product variety in small quantities as well as customized products. Therefore, the traditional manufacturing industry is exploring digital transformations that boost competitiveness.

In the mold industry, producing a mold requires many parts and processes. A manufacturing plant often faces untimely information problems, such as late quotes, difficulty with material tracking, supply chain management challenges, and a disconnect between information technology and operation technology.

Another complex challenge is the lack of flexibility in production. Strict production schedules and tight operation management mean that issues such as finding suitable manufacturers, manual rather than automated production scheduling, rush orders and rush order insertion, poor manual testing quality, and low manufacturing capacity utilization can increase product R&D costs and extend the R&D process, which results in higher labor and equipment costs.

Most employees in the mold industry are technicians unfamiliar with systematic integration. To improve production efficiency, achieve better quality

control, and fulfill orders on time, the traditional manufacturing industry (and the mold industry in particular) must overcome this unfamiliarity as well as the other issues described above.

Digital Resilience

After noting the challenges faced by the traditional mold industry, Hong Zu, in addition to its current digital system, has introduced the "Online Smart Scheduling System" under the government's guidance. This system utilizes big data to standardize and modularize the manufacturing process and reduce communication time along supply chains. It also helps each supply chain participant to obtain timely information, which boosts industrial chain development. The system works as follows:

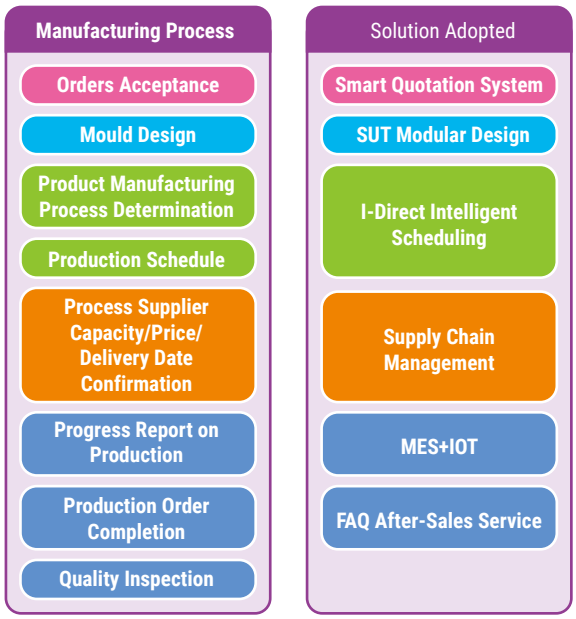


Figure 1. Hong Zu's solution for each step of the manufacturing process

❶ Smart Quoting System

In the plastic mold industry, clients usually have particular specifications or needs. Therefore, the process from understanding a client's needs to producing a quote is complex. However, seventy percent of potential clients compare quotes from various manufacturers and then choose only one. In other words, seventy percent of quotes that Hong Zu provides do not turn into sales despite the time and resources devoted to the quoting process. In light of this, Hong Zu has collected and analyzed past quote data and built a modular system accordingly. Clients can use this system remotely and choose a product module that is closest

to what they need, and then get an approximate quote from the system. After placing an order, clients can reach live salespeople to get a more accurate quote.

❷ Modular SUT Design

It takes fifty hours to produce a customized mold from scratch. Manufacturing widely differentiated products in limited quantities consumes a lot of manufacturing resources. In light of this, Hong Zu has modularized past mold designs and imported them to the digital system. Once a client inputs their product needs and chooses a module, the system will generate a module draft design, which is then refined and adjusted manually.

❸ Supply Chain Management

The supply chain information stream allows Hong Zu to receive suppliers' feedback instantly via the cloud supply chain management platform, keeping Hong Zu up to date on manufacturing progress and the available capacity of outsourced suppliers.

❹ Manufacturing Execution System (MES) Integration with IoT

To effectively stay up to date on the operation of production line machines and related information, Hong Zu has installed data collectors on these machines to read power signals and the machines' tricolored indicator light signals. The data collected is imported to the MES to document each machine's status and information, which is then shown on a display panel with the MES timesheet system to help Hong Zu keep track of production line operations in real time.

Achievements

The solutions above have helped Hong Zu eliminate approximately fifty percent of non-buying customers who have requested a quote. The smart system has helped Hong Zu stay up to date on the company's costs and gross margin, which contributes to much more accurate quotes. Further, the modularization of SUT designs has optimized the design process and resulted in R&D and design manpower savings of fifty percent while shortening the design process by 35 work

hours. Additionally, the supply chain management system has replaced manual management and automated the management process. As a result, work hours are conserved and accuracy is improved. In short, the solutions above have helped Hong Zu conserve manpower, save time, and increase efficiency.

Asia Excel Pte. Ltd.

Background

Founded in 2001, Asia Excel is a bathroom and kitchen products retailer and distributor. At the emergence of e-commerce in the early 2000s, Asia Excel was hesitant to enter the online marketplace, fearing that customers would be unwilling to purchase bathroom and kitchen products on the internet. As such, the company focused on physical stores for more than ten years after its founding. In 2015, when an e-commerce platform approached Asia Excel for collaboration, Asia Excel was initially uncertain. However, as sales grew with the online shopping boom (later accelerated by the pandemic), the company

Mr. Ray Rajagopal, founder of Asia Excel

was convinced. Asia Excel has embraced e-commerce platforms and digital technologies, becoming the largest home appliances store on two major e-commerce platforms for four years in a row. Currently, revenue from online channels accounts for eighty percent of the company's total sales. Like so many other small and medium-sized enterprises (SMEs), Asia Excel decided to intensify its digitalisation efforts during the pandemic, which helped it maintain market competitiveness despite the harsh challenges brought about by pandemic-related economic volatility.

Business challenges

Going online has generated new business opportunities and increased demand for Asia Excel. The company realised the need to improve its backend processes as it continued to scale; a chief pain point arose from Asia Excel's manual system of tracking and processing of orders from multiple online platforms and offline sales channels. Employees had to manually track more than 1,300 products in its inventory across six warehouses simultaneously, an approach both manpower-intensive and error-prone. As a result, customer service quality and efficiency were compromised.

Like many other SMEs with limited resources, Asia Excel was unsure which digital tools could improve their company's efficiency. Without in-house IT personnel, they also faced challenges in implementation and adoption. To overcome these obstacles, Asia Excel first worked with professionals to introduce easy-to-use digital solutions that supported and streamlined their original manual workflows. Seeing the digitalisation benefits, employees became more open and receptive to new technologies.

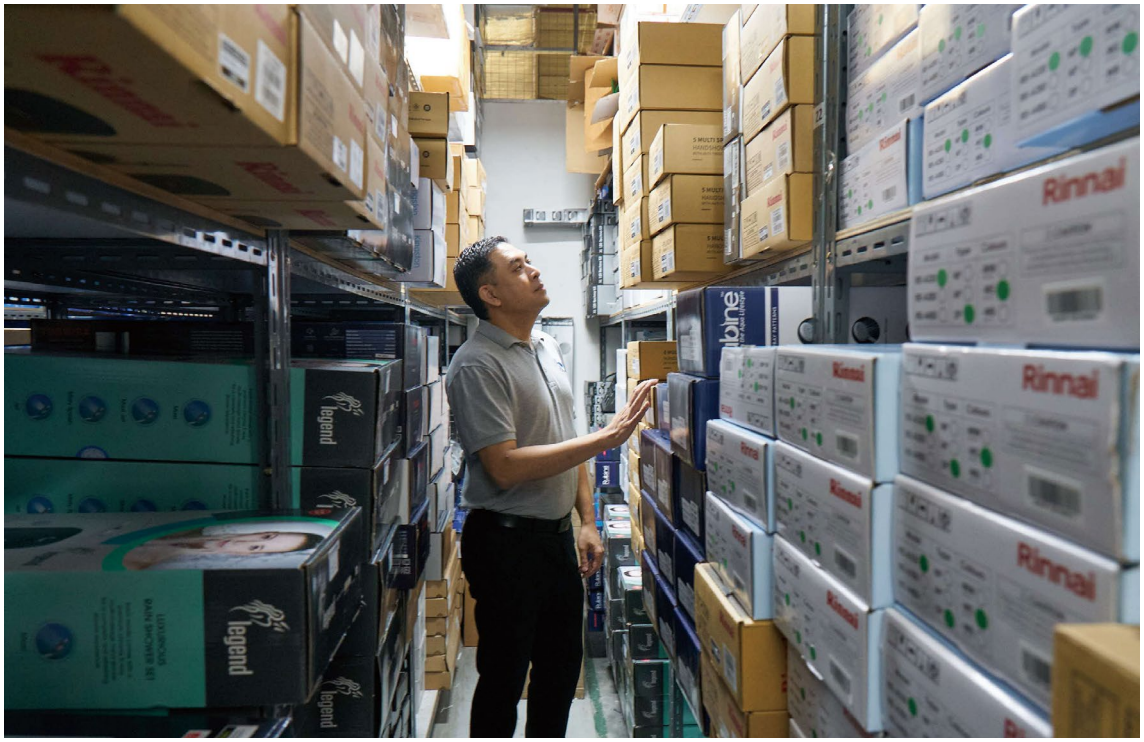
Despite early issues, digitalisation has helped reduce manual processes to save time and manpower, and improved overall order management and customer service.

Digital Resilience

The change of mindset prompted Asia Excel to seek assistance from both the public and private sectors in its digitalisation efforts. Asia Excel opted to access the "SMEs Go Digital" programme developed by Singapore's Infocomm Media Development Authority (IMDA). The programme offers a "Chief Technology Officer-as-a-Service" (CTO-as-a-Service) platform under which qualified SMEs can enlist professional support from digital consultancy partners Accenture or Stone Forest. These partners provide in-depth digital advisory and project management support services at no cost. The consultant first evaluates a company's digital readiness before recommending suitable digital solutions that are market-proven, cost effective, and pre-approved by IMDA for grant support.

Through the digital consultancy service, Stone Forest's digital consultant evaluated Asia Excel's digital readiness to determine their digital capabilities and explored suitable solutions to address their pain points. After understanding Asia Excel's operational challenges, the Stone Forest team recommended Asia Excel to adopt an "omni-channel solution." This single platform would allow Asia Excel to consolidate efforts across their multiple on and offline channels to process orders, purchases, sales, and inventories, as well as to manage its social media accounts, online activities, communications, and customer service. Integrating customer service and sales allowed employees to focus on improving transaction rates and customer service quality, and provided Asia Excel with an accurate overview of their operations and current performance for management reporting and strategic business planning.

In addition, the Asia Excel team explored approaches to expanding their online presence both locally and abroad through the consultants' advice on digital risks management. Leveraging Stone Forest's value-added resources, including ready-to-use IT policies, cybersecurity and data protection best practices, and checklists, Asia Excel is now more assured in cementing a strong foundation for future digital growth.



Achievements

By adopting solutions recommended by the digital consultants, Asia Excel has effectively automated most of its workflow. For instance, the processing of 500 orders that previously required 3 working days now takes only 30 minutes. In addition, employees dedicated to order processing can be reassigned to the customer service department to deal with growing customer demands. Having introduced digital tools to optimise its internal operations, Asia Excel is planning to expand its market overseas. It will access support from IMDA to develop a virtual showroom to showcase its offerings to the world.

Chapter 3

Findings

Findings

Solution 1: Utilize IoT and smart business systems to improve corporate resource planning efficiency

Generally, order management includes the administration of inquiries, quotes, incoming orders, and inventory updates; the confirmation of manufacturing progress, availability, and remaining capacity with suppliers or commissioned manufacturers; the scheduling of general orders, urgent orders and rush orders; and the confirmation of delivery data, shipping, delivery, and other steps.

The case studies in Chapter 2 all have something in common: the companies featured must deal with more than one thousand components and parts in a single project, sourced from suppliers domestically and abroad. Some companies aim to serve customers who need small batch production in a wide variety of products, and for whom order management is time-consuming, labor-intensive,

and mistake-prone if it relies only on manual labor and record-keeping for order tracking and confirmation. If these companies encounter any force majeure, such as the COVID-19 pandemic, they struggle with personnel assignment. If any of the steps in order management is hindered, the manufacturing process and even the efficiency of the entire supply chain is jeopardized. A one-stop platform incorporating digital manufacturing solutions to provide sales, warranty, repairment, smart scheduling, and marketing is the innovative digital solution that helps SMEs stay on top of the entire process from quoting to delivery, and to handle any situations that requires immediate attention.

Manually processing all incoming inquiries and quotes is time-consuming and wasteful of labor and resources, particularly as most quotes do not generate actual orders. In light of this, Hong Zu, a plastic product mold manufacturer, introduced its "online smart scheduling system." The system accesses a database of past quotes and orders, offers customers several suitable combinations based on their needs, and then automatically prepares an estimated quote. Customers who accept the estimated quotes are then directed to Hong Zu staff for more accurate quotes. This quote process eliminates at least fifty percent of non-buying customers, which reduces workload for this task by half. Shin Puu Technology, a PCB manufacturer that provides customers with a wide variety of small batch products, has introduced a sales and service platform for smart manufacturing to manage customers with diverse needs and complicated requirements. This platform utilizes big data and AI to analyze customers' blueprints and produce estimated quotes and delivery dates; this method saves both cost and time in the back-and-forth of the quotation and communication process.

A common challenge in providing wide-variety small batch products is dealing with a broad array of customers in different fields with unique requirements. A manufacturer must confirm part numbers, keep track of inventory in real time, and monitor and adjust the manufacturing process. Shin Puu has introduced a sales and service platform for smart manufacturing that combines order tracking and parts tracking as well as enhances the connections between upstream and

downstream suppliers. Noveltek, a company that designs and manufactures material handling equipment, usually manages more than a thousand component parts in a single order. The company also works with suppliers domestically and abroad. Its "Smart Manufacturing & Warranty Service" uploads all orders and maintenance applications to the cloud, allowing Noveltek's factories, parts suppliers, and mechanics to stay on top of the parts they need as well as the current inventory, allowing them to deliver accurately.

Even though the service industry does not involve a massive and complicated manufacturing process, there exist a wide variety of distribution avenues, and orders can flood in from both offline and online channels; management of these avenues and channels requires more than simple manual tracking and inventory confirmation. To establish digital resilience, companies need a one-stop solution that combines orders from all distribution platforms. Asia Excel, with its omni-channel solution, manages incoming orders, purchases, sales, deliveries, and inventory management on one single platform, a method which has provided digital optimization for the company's internal operations.

Solution 2: Optimize production processes and supply chain management

Whether the end product is plastic product molds or PCBs, companies that offer a one-stop small-batch wide-variety production service comprising design, manufacturing, assembly, and verification frequently need to switch among the manufacture of different products on the production line. As products diversify, there are time and cost increases when switching among products on the production line, resulting in much more complex management of materials and parts supply, as well as complicated machine parameters.

With sufficient manpower, a company can mobilize to manage the production line and assign engineering staff to various sections of the manufacturing process. Experienced engineering staff can troubleshoot malfunctioning machines or adjust

machine parameters based on their experience. However, there are two potential risks with this approach. First, insufficient manpower can lead directly to declining production line efficiency and poor management. Second, it takes time for engineering staff to accumulate and share experience. Therefore, a loss of senior engineering staff can impact production capacity.

As AI and big data continue to be deployed in the production process, machine learning can speed up experience sharing by senior engineering staff at the production lines, and can also make up for insufficiencies of traditional labor. For example. Shin Puu Technology has collated and inputted the parameters for products it has manufactured in the past; the company uses AI to change machine settings faster as the production line switches among products. Hong Zu also uses big data and AI to accelerate the quoting process for customized products.

As mentioned above, production lines for batch production of varied products have complicated information flows, which makes production management a challenging task. Both Shin Puu and Hong Zu have responded to this challenge by integrating manufacturing execution systems and IoT. Their systems collect information from machines on the production line and analyze it before uploading it to the dashboard in the war room, helping management to gather necessary information faster, monitor how the machines are working, and adjust production strategy as needed.

When incorporating smart manufacturing, upstream and downstream suppliers as well as equipment suppliers also adjust their products and operations in response to the needs of companies undergoing digital transformation. For example, Shin Puu, in order to simplify production lines and reduce equipment investment, purchased multi-function machines. In response, equipment suppliers developed a single panel that integrates multiple functions as well as modular design systems so that the machine parameters can be adjusted to the product being manufactured without much manual operation.

In addition, upstream and downstream suppliers are also integrated into the smart manufacturing service platform, sharing production, inventory, and other information to optimize supply chain management. Hong Zu and Noveltek, as with Shin Puu, have integrated upstream and downstream supply chain information into their smart manufacturing service platforms, allowing manufacturers to stay on top of the supply chain inventory or commissioned manufacturers' capacity while material suppliers can adjust their inventory based on manufacturers' orders.

Solution 3: Deploy public-private partnerships to foster business transformation

With limited funding and scale, any digital transformation decision and execution can become a challenge for a company's business continuity. Therefore, with the assistance of government entities, research institutes, and foundations, businesses are better able to address their pain points and overcome costs associated with digital transformation.

The "SME Smart Manufacturing Digital Transformation Plan" discussed in this report incorporates resources from the aforementioned organizations. This

plan has helped Hong Zu and Noveltek to implement digital technologies. "SME Go Digital" of Singapore has also helped Asia Excel overcome the pain point of management for cross-border e-commerce orders and to embrace digital transformation.

Under the "SME Smart Manufacturing Digital Transformation Plan," government entities worked with foundations and invited experts in relevant fields and industries to evaluate businesses' readiness, production line process, and existing resources, and to propose suitable solutions for them. For SMEs in the manufacturing industry, obtaining solutions suited to individual manufacturing modes and securing continuous guidance are necessary for successful digital transformation. Therefore, targeted consulting and tailored mentoring through government entities and foundations is an essential step to understanding SMEs' needs and proposing viable solutions during the process of digitalization.

Similarly, through the government-developed smart manufacturing service platform, research institutes and foundations provide a stream of inventory and production information to both upstream and downstream suppliers in the supply chain. The foundations also utilized AI and big data to develop a webpage module, which helps businesses to introduce an optimized customer service portal. Shin Puu, for example, has used the module to build their sales and service platform, which uses AI to provide inquiries, order tracking, product materials and structures, quality reports, and other information to reduce overall work hours.

Singapore's "SME Go Digital" is a program that utilizes public-private partnerships to help businesses evaluate their digital readiness, determine pain points, and explore feasible solutions. The Singapore government has established an online platform where SMEs can apply to join the program. The program works with private companies and hires professional consultants who explore the needs of a business and then offer solutions and guidance throughout the consultation process.

Chapter 4

Conclusion

Conclusion

As digital technologies such as IoT and AI continue to develop, the digital optimization of SMEs is essential to their viability. As a result of the COVID-19 pandemic, the introduction of digital technologies and empowerment through digital knowledge have become keys to SME's business continuity planning and development strategies.

This report, in its introduction, notes that a common shared pain point among SMEs is the lack of digital resilience in business continuity planning. This report examines four companies: a PCB manufacturer, a logistics company, a vacuum molding company, and a bath and kitchen product retailer, to show how the introduction of digital tools as well as digital resilience enhancement have helped

these companies overcome challenges, optimize internal operations, and enhance external connections.

After analyzing the four cases above, this report also discusses findings from the perspectives of improving corporate resource planning efficiency, optimizing production process and supply chain management, and activating digital transformation via public-private partnerships.

This report discusses ways the manufacturing industry works with a wide variety of parts and suppliers to improve corporate resource planning efficiency. The case studies of Hong Zu and Shin Puu Technology highlight the "Online Smart Scheduling System" as well as a smart manufacturing sales and service platform, both of which simplify the complete quoting process, reduce communication costs, and enhance the connection between upstream and downstream suppliers. Similarly, Asia Excel's "omni-channel solution" allows the company to manage orders, purchases, sales, and other processes to further reduce labor and communication costs.

With regard to production process and supply chain management optimization, Hong Zu and Shin Puu both integrate their manufacturing execution systems with IoT technologies to address the challenges of manufacturing management. Additionally, Hong Zu and Noveltek integrate upstream and downstream supply chain information and optimize supply chain management via the smart manufacturing sales and service platform.

Finally, this report notes that, due to limited funding and challenges with scaling themselves up, SMEs often lack financial resources or technological know-how when formulating a business continuity plan with digital elements. Through the assistance of government entities, consulting institutions, and other organizations, SMEs can facilitate digital optimization and even transformation through public-private partnerships, thus enhancing their digital resilience as an effective solution for sustainable business.

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Produced by
Small and Medium Enterprise Administration,
Ministry of Economic Affairs
Email: ischung@sme.gov.tw
Tel: (886) 2 2366 2237 Fax: (886)2 2367 7484

Co-authored by
TIER(CT), China Productivity Center(CT), Enterprise Singapore(SG)

For
Asia-Pacific Economic Cooperation
35 Heng Mui Keng Terrace, Singapore 119616
Tel: (65) 68919 600 Fax: (65) 68919 690
Email: info@apec.org Website: www.apec.org