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智慧新人才 領航新世紀

Smart Talent, Piloting the New Century

陳良基　勇敢迎接改變，整合資源培育科技新人才

Embracing change and coordinating resources into training new talents

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Zse-Hong Tsai, Executive Secretary of the Office of Science and Technology

過去臺灣憑藉著產業與人才優勢，以先進硬體技術與高品質，為全球高科技產業供應鏈注入源源不絕的活力。但隨著人工智慧與新興科技發展的一日千里，數位轉型的大浪來襲，如何善用新科技，培育未來新人才，成為當前最重要的課題。

為迎接數位經濟時代的來臨，行政院在 DIGI+ 方案中特別規劃「培育跨域數位人才」行動計畫進行人才培育，以支援 5+2 產業創新發展。

本期季刊將從建構智慧國家的核心引擎：人才出發，邀請各領域菁英提出建言，針對當前創新智慧趨勢下，如何透過新人才培力，為產業與國家帶來嶄新的機會。

人才是國家整體競爭力重要指標

改變持續在發生，科技部陳良基部長認為，現階段對政府來說，最重要的工作就是善用既有的優勢，把臺灣的數位轉型帶起來；其中，又以人才培育最重要，因為人才即國力，是國家整體競爭力的重要指標。

想培育更多能因應新挑戰的科技新人才，一方面要深耕國民教育，以培育未來的人才，

In the past, Taiwan has relied on the advantages of its strong industry pedigree and talent to provide advanced and high-quality hardware technology in order to deliver an endless flow of energy into the global high-tech supply chain. But now, artificial intelligence and emerging technologies are advancing at incredible speeds, and the waves of digital transformation are sweeping across industries. How to make good use of new technologies and cultivate new talents for the future has become the most pressing issue.

Getting ready to meet the advent of the digital economy era, the Executive Yuan has specially formulated the "Fostering of Cross-Disciplinary Digital Talent" action plan under its DIGI+ Initiative in support of the 5+2 Innovative Industries development policy.

In this quarterly edition, we will try to piece together the core engine to building a smart nation. Starting with the topic on talent, we've invited luminaries from various fields to shine a light and offer suggestions, talking about how to bring new opportunities to industries and the country by fostering new talent in the current trend of smart innovations.

Talent is a decisive indicator of a country's competitiveness

另一方面則是厚實現今職場人才的實力，打造在職進修、跨域交流的成長機會，幫助產業加速數位轉型。

觀察臺灣過去的成功經驗，全球搜尋引擎龍頭 Google 台灣暨香港工程研究所的董事總經理簡立峰博士認為，隨著現今商業模式的改變，產業思維也必須一同改變，臺灣在既有優勢下培養未來 AI 人才的關鍵，唯有先讓人才走出去，熟悉國際語言、營運模式、市場判斷，再把所學一併帶回臺灣。

身兼臺灣新創產業推手的林之晨也看見了電子商務產業的快速變遷，認為臺灣未來應鎖定人工智慧與區塊鏈技術，尤其是人工智慧在各個生活層面的應用經驗，讓臺灣成為大東南亞與東協的智慧生活領航者。他認為新經濟時代，未來所有的產業都是數位化、每一個工作都需要數位能力，因此數位學習也應該成為基礎教育的一環。

順應趨勢浪潮下的智慧新人才

關注智慧國家的未來發展，以智慧聯網收集數據資料的愛文西門總經理李健榮認為不光是公部門，包括製造、服務與零售產業未來都應利用智慧科技即時監督、反映與預測成本、品質、效率、安全、環保，運用分析調整策略，因此如何將既有產業的知識與經驗和數據人才無縫鏈結，成為提升產業轉型、提升競爭力的關鍵。

培養智慧人才的腳步不停歇，政府與企業也合作找解方。在經濟部工業局「AI 智慧應用人才培育計畫」的推波助瀾下，浸淫健康與

Changes are forever ongoing. Minister of Science and Technology Chen Liang-gee believes that the most important task for the government at this time is to leverage our existing advantages to drive the digital transformation in Taiwan. The cultivation of talent tops the list because "talent translates into power"—it's a benchmark indicator of a country's overall competitiveness.

If we want to train more technology talent who can take on the new challenges, we need to start with our national education to cultivate talent for the future. On the other hand, we must arm the talent of today's workplace with even more strengths and create opportunities for growth through on-the-job training and cross-industry collaborations, consequently assisting industries to speed up their digital transformation.

In retrospect of Taiwan's past successes, Dr. Lee-Feng Chien, managing director of Google Taiwan and the head of the Engineering Research & Development Center in Taiwan & HK, believes that industry players must change their mindset to cope with today's changes in business models. The key for Taiwan to cultivate future AI talent while maintaining its existing advantages is to let the talent go overseas first, get some exposure to international languages, business models, and market strategies, before they return to Taiwan with a new-found perspective.

Jamie Lin, a pioneering promoter of start-ups in Taiwan, also sees the rapid changes in the e-commerce industry. He believes that Taiwan should target artificial intelligence and blockchain technology in the future, especially capitalizing on the experience of applying AI in all aspects of life to make Taiwan a leading navigator of smart life in the greater Southeast Asia region, including ASEAN. He thinks that in the new economy, all industries in the future will be digitalized, and every job will require digital capabilities; hence digital learning should become a part of fundamental subjects in the curriculum.

高齡化市場的衛利公司，也建立起包括電機、資訊、管理、經濟、人文等多元人才的團隊，搶進居家健康照護市場，並成功跨上世界的舞台。

文化與科技領航，迎向臺灣科技人才新未來

回歸到臺灣既有優勢，在科技創新之外還有相當豐富的文化色彩。很早就投入以科技創新推動臺灣創意產業生根的頑石創意林芳吟總經理認為，創意產業的最大價值，就是要當各行各業的魔法棒，點亮話題，而人工智慧打破了傳統框架，為創意產業注入更多活力。她更以臺灣創意、華人題材、國際市場出發，邀請跨界人才一起將臺灣的文化底蘊推升國際。

因應科技新時代，人才創造人才是趨勢。臺中教育大學教育學院院長、同時也是國內數位學習「因材網」創辦人郭伯臣指出，劇烈變動的時代，利用數位科技促進或改善學習，已是目前最主要的教育趨勢，最重要的是老師必須懂得如何將數位科技運用於教學之上，同時，讓數位學習產業克服時間與空間的限制，幫助人才快速學習、以迎接未來變局。

數位浪潮新時代來臨，臺灣面對當前邁向智慧國家的挑戰，或許可以從國際智慧城市的發展中，找尋最新人才培育與城市發展的方向。以新加坡經驗為借鏡，在朝向智慧國家發展中，新加坡全面檢視市民的需求，並在智慧城市架構下協調來自社會、經濟、商業、環境與科技等層面，培訓足以管理多重領域需求與考量的專業人才，為國家永續而努力。

Adaptive new smart talents under the changing tide of trends

Concerned about the future development of a smart nation, sivann general manager Simen Li, whose company is a leader in collecting and analyzing data via smart networks, believes that the smart revolution will not only hit the public sector, but the manufacturing, service and retail industries should also leverage smart technology to perform real-time monitoring, response, and prediction. Whether it's cost, quality, efficiency, safety, or environmental protection, data can be analyzed and used to fine-tune strategies. The key to upgrading industry transformation and boost the competitive edge is to seamlessly connect the existing know-hows and experience with digital talent.

The work of fostering smart talent never stops and the government and enterprises need to cooperate to find solutions. Under the AI Smart Application Talent Development Initiative launched by the Industrial Development Bureau (Ministry of Economic Affairs), Revlis Biotech is staking a claim in the healthcare and aging market by pooling together a team of talent from diverse backgrounds—engineering, information technology, management, economics, and liberal arts. It has made its way into the home health care market and successfully put itself on the global map.

Culture and technology lead the way as Taiwan's technology talent work towards a new future

Going back to Taiwan's advantages, the island is teeming with rich cultural colors in addition to its technological innovations. Lin Fang-Yin, general manager of Bright Ideas Design, has been promoting and pushing for the development of the creative and cultural industry since its early days. She believes the greatest value of the

這些寶貴的建言與經驗，將蓄積成為臺灣培育智慧新人才的豐沛能量，讓科技領航新世紀，擁抱全新未來。

creative industry is being the magic wand for all industries, helping them become the hot topic of discussion. Artificial intelligence breaks the traditional boundaries to breathe new life into the creative industry. She also invites cross-disciplinary talents to highlight Taiwanese creativity and Chinese subject matters and bring Taiwan's cultural heritage to the international market.

In response to the new technology era, talent creating talent is a trend. Kuo Bor-Chen, dean of the College of Education at National Taichung University of Education and the founder of the digital learning platform Adaptive Learning, points out that in the era of dramatic changes, using digital technology to promote or enhance learning is the most significant trend in education. The most important thing is that teachers must know how to apply digital technology inside and outside the classroom. At the same time, digital learning can overcome the constraints of time and space, thereby supporting talent to learn speedily to meet future changes.

With waves of a digital era crashing in, Taiwan is facing the challenge of moving towards becoming a smart nation. Perhaps it is possible to learn from the development of global smart cities to find a direction for the newest approach to talent cultivation and urban development. Borrowing from the experience in Singapore: it takes a comprehensive inventory of the needs of its citizens in the development towards a smart nation, and coordinates the social, economic, commercial, environmental and technological aspects under a robust smart city framework, training sufficient professionals who can manage the demands and challenges in various fields, so as to stay on path to becoming a sustainable nation.

These valuable suggestions and experiences will stack up to provide a constant flow of energy for the cultivation of new talent in Taiwan, allowing technology to pilot us to a new age and embrace the new future.

勇敢迎接改變，整合資源培育科技新人才

Embracing Change and Coordinating Resources into Training New Talent

臺灣憑藉產業優勢，長期供應全世界高科技數位產品與服務，如今我們更應思考如何善用新科技，幫助培育未來人才，推動臺灣產業的數位轉型與創新。

Taiwan has long been relying on its industrial advantages to supply high-tech products and services to the rest of the world. Today, it is essential that we find ways to utilize new technologies to nurture future talent and support digital and innovative transformations in Taiwan's industries.

隨著人工智慧與新興科技發展的一日千里，當前數位轉型已成為國家競爭力的重要指標。

人才是創新與改變的關鍵

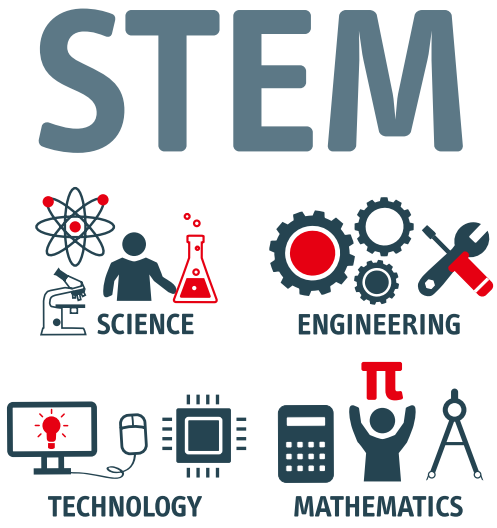
「現在世界各國都把數位轉型視為首要工作，臺灣本來在電腦 IT 與數位科技方面的實力很強，產品行銷全球，但在走向數位時代的進程中，臺灣反而慢下了腳步。」科技部陳良基部長表示，「所以現階段對政府來講，最重要的工作就是善用我們既有的優勢，把臺灣的數位轉型帶起來。」

迎接科技新時代，人才是推動科技創新、提升產業動能的關鍵。陳良基部長認為，「在過去致力工業研發、挑戰科技創新的基礎下，

As AI and new technologies emerge, digital transformation has become the vital indicator for a nation's competitiveness.

Talent is the key to innovation and change

"Countries around the world have recognized digital transformation as the first priority in industrial development. Taiwan used to possess a strong advantage in computers, IT, and digital technology, with products marketed to all corners of the world, but we have slowed down the pace over the course of digital transformation," said Liang-Gee Chen, Minister of Science and Technology. "For this reason, it is of the utmost importance for the government to lead Taiwanese industries in digital transformation, by utilizing the advantages we currently possess."



我們整體的科研能量非常紮實，再加上臺灣人認真肯學的實作精神，讓臺灣的優勢更加明顯。」

擁抱科技帶來的改變，臺灣除了因應新科技的腳步與速度要加快外，陳良基部長認為打開國際連結也同樣重要，因為數位無國界，就像臉書的每一項決策都影響了全球數億人口，臺灣在轉型成為智慧國家的過程，也同樣要用全球化的思維、國際化的視野，聚焦人才培育、鼓勵跨界創新。

智慧當道，臺灣面臨轉型新挑戰

隨著雲端與人工智慧科技浪潮來襲，競爭日益激烈，國家與企業都不得不面對數位轉型，而觀察轉型歷程不難發現，產業當前面對的正是數位化與找出新獲利模式的挑戰。

陳良基部長指出，許多中小企業的現況是，過去的營運模式讓小生意做得還不錯，但沒有能力去升級，可是不導入數位轉型，很快又會被市場淘汰。此外，想要數位轉型，企業內部沒有人會做，誰來進行分析？誰來幫助營運創新？

As we progress into an era of new technologies, talents will be the key to promoting technological innovation and industry upgrades. Minister Chen said: "We have built up strong research capacities through our previous attempts at industrial R&D and technological innovation. The diligence, pragmatism, and curiosity of the Taiwanese people has further enhanced this advantage."

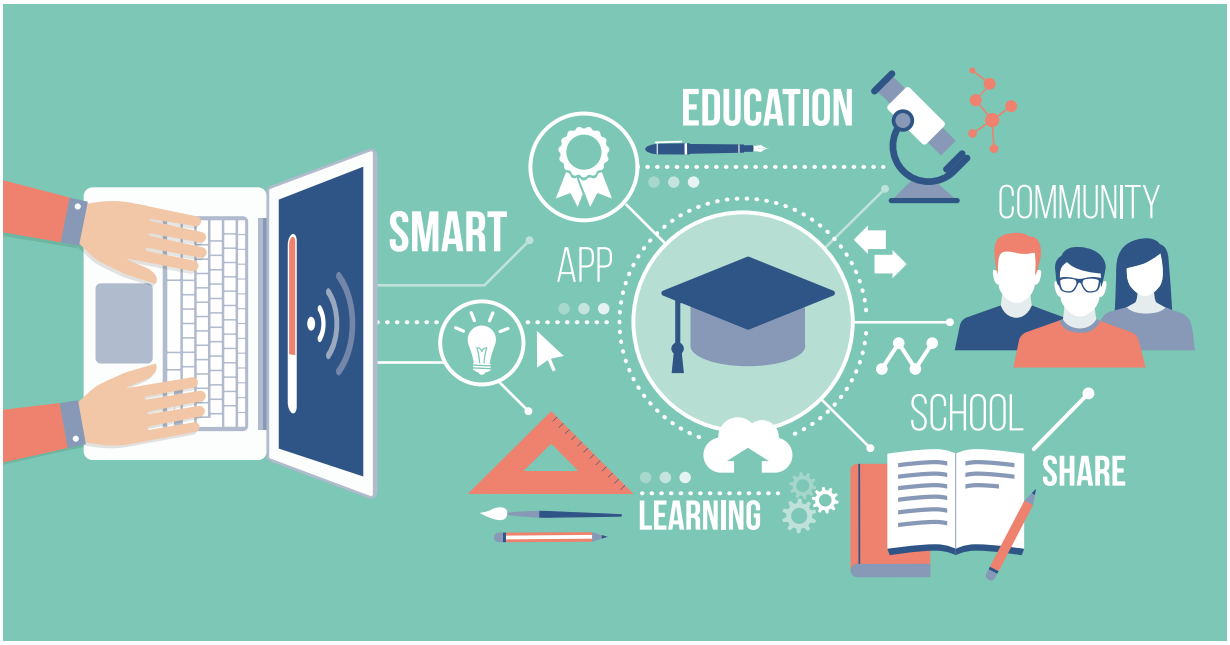
Today, Taiwan not only has to quicken its pace at embracing and adapting new technologies, it is equally important to establish connections with the rest of the world, commented Minister Chen. The world is without borders because of digital technology, and every decision by Facebook affects hundreds of millions of people worldwide; therefore it is essential for Taiwan to plan its transformation into a smart nation from the same global perspective and vision, while at the same time focusing on nurturing talents and encouraging innovations across different fields of expertise.

Taiwan faces transformation challenge in the face of smart technology

The rise of cloud computing and AI brings more intensive competition, forcing countries and businesses to address digital transformation head-on. Based on observations of how businesses have approached the transformation, it is obvious that the greatest challenge lies in finding the right digital solutions and profit models.

Minister Chen pointed out that many SMEs are being presented with the dilemma where their old business models have yielded satisfactory results, but they lack the capacity to upgrade to avoid being eliminated from competition in the future, despite having recognized the importance of it. Besides, how should SMEs plan for digital transformation when there is no one capable of conducting the required analyses? Who can help them bring innovations to the current operations?

"This is the reason why we are gathering resources



「所以我們要導入各方的資源，幫助企業在數位轉型時分擔部分風險，最重要的是：幫企業培訓科技人才。」陳良基部長指出，為此，科技部透過 DIGI⁺ 方案，積極媒合學研能量，持續開發線上課程與專業培訓，滿足企業的人才需求。

新人才策略：厚實現在、培育未來

為了培育更多能因應挑戰的臺灣科技新人才，「我們大致上把它分成兩大塊，一部分培育未來的人才，另一部分則是厚實現在的人才實力。」陳良基部長如是說。

所謂厚實現今人才實力，就是透過新智慧科技為在產業與職場持續努力的工作人，打造在職進修、跨域交流的成長機會，陳良基部長指出：「我們將結合經濟部、勞動部的人才養成與培育能量，為產業培養更多創新科技人才，幫助企業數位轉型。」

關注培養未來的人才，科技部也特別和教育部攜手合作，讓基礎的科學訓練課程，向下紮根，讓孩子從小學就開始親近科學、認識資訊科技；到了中學階段，更導入高等教育的科研能量，幫助學子們及早儲備基礎能力，讓他們進入大學後能快速進入專業領域的學習與探索。

through available channels to help share some of the risks encountered by businesses over the course of digital transformation. The most important goal of our efforts is to help businesses develop technology talent." Minister Chen pointed out that the Ministry of Science and Technology (MOST) has introduced a DIGI⁺ program that integrates resources from the academia and research institutions to support ongoing development of online courses and professional training, and thereby satisfy businesses' talent requirements.

New talent strategy: Nurture tomorrow's talents today

In order to develop technology talent that can help Taiwanese industries weather upcoming challenges, "We have divided our resources into two parts: one for training tomorrow's talent and one for building strength for today," said Minister Chen.

Building the current talent strength involves incorporating smart technologies into the workplace and creating opportunities such as on-job training and cross-industry knowledge exchange for existing workers. Minister Chen said: "We will coordinate with the Ministry of Economic Affairs and Ministry of Labor to train more innovative talent that would help industries and businesses undergo digital transformation."

人才即國力，新人才的培育更需要循序漸進的努力，科技部未來也將整合各部會能量，持續為人才厚植實力。

掌握未來契機，讓創新遍地開花

當科技顛覆典範，創新的腳步卻從不停歇，新興科技工具改變產業樣貌，整體價值鏈也改變，隨之而來的是供應鏈的垂直分工開始和過去大不同。

陳良基部長說：「所以臺灣將來要留意就是，在智慧化數位轉型後，既有的供應形態也會有所改變。當改變發生時，有些價值會不見，有些價值會變大，我們必須早一點發現，並且盡快移到價值鏈比較高的那一端，才能不被打敗。」

為了充分掌握數位變遷過程中的新價值，科技部也積極整合資源、打造創新的環境，鼓勵各種新創事業勇於挑戰產業規則。陳良基部長笑說：「給予新創事業更多的支持與包容，不只是為了找出創新的獲利模式，我們期望讓更多豐富的科技創意，也能在臺灣這片土地上遍地開花。」

As for tomorrow's talents, MOST is collaborating with the Ministry of Education to revise curriculum for basic science, thereby enabling children to develop an interest and understanding of science and information technology from as early as elementary school. As they progress to junior high school studies, more complex scientific knowledge will be introduced to provide them with the foundation needed to advance through tertiary studies and explore technology in greater depth.

Talent makes up the strength of a nation, and nurturing of new talent requires ongoing efforts, for which MOST will coordinate with other departments to contribute to the build-up of the nation's strength.

Anticipating new opportunities and supporting creative ideas

The world never ceases to innovate, and when technology changes an industry's best practices and opens up new opportunities, the entire value chain shifts and gives rise to new vertical specialization unlike any the industry has seen.

Minister Chen said: "What Taiwan should pay attention to is the change in supply pattern from digital transformation. When changes occur, some values will be lost and some values will expand. We must be able to detect these changes early and shift towards the higher end of the value chain as soon as possible to avoid being eliminated from the competition."

To ensure the creation of new values from digital transformation, MOST is actively integrating resources and creating an innovation-friendly environment where new businesses are encouraged to challenge the industry's rules. Minister Chen said: "We should give new businesses more support and tolerance not just to create new profit models, but also to bring more creativity and allow them to flourish in Taiwan."

從優勢出發，軟硬結合為發展契機

Creation of Development Catalysts with the Best of Hardware and Software

在臺灣，到底該如何發展 AI 智慧產業？負責全球搜尋引擎龍頭 Google 台灣暨香港工程研究所的董事總經理簡立峰博士，指出了一個明確發展的方向，那就是從臺灣既有的硬體製造優勢出發，「而且 AI 發展將使得臺灣的硬體裝置變得更加重要，」簡立峰直言。

How should Taiwan develop its AI industry? Dr. Lee-Feng Chien, Managing Director of Google Taiwan and the Head of the Engineering Research & Development Center in Taiwan & HK, indicated that Taiwan should leverage its existing advantages in hardware manufacturing. "AI development will accentuate Taiwan's hardware prowess," said Chien without reservation.

身為國際知名資訊檢索與中文資訊處理專家，向來思緒清晰的簡立峰回顧臺灣科技業發展歷程後指出，臺灣硬體代工產業是全球數一數二，不僅技術精密，且擁有完整的產業供應鏈，從生產工具機設備，到晶圓研發、IC 設計等一應俱全，因而早已發展出強大的 B2B（Business to Business）商業模式，約占臺灣 GDP 產值 9 成比例，僅有 1 成是 B2C（Business to Customer）。

As an internationally-renowned expert in information retrieval and Chinese information processing, Dr. Chien is known for his sharp and clear mind. After reviewing the history of technology industry in Taiwan, he indicates that the island's hardware OEM industry has always been one of the best in the world. Taiwan has established top-notch technological competences and complete supply chains, from machine tools, semiconductor foundry R&D to IC design. Taiwan has developed a strong B2B model, which accounts for approximately 90% of Taiwan's GDP (vs. 10% for B2C).

▲ Google 啟動智慧台灣計畫，全面投資臺灣。Google plans to invest in Taiwan with Intelligent Taiwan.

過去憑藉著為全球大廠做硬體代工撐起了半世紀的臺灣經濟奇蹟，但面對新紀元，臺灣若要發展 AI 產業，勢必要發展軟體，還要直接面對市場與消費者。為了追根究柢提供具體有效策略，簡立峰建議產業與政府應該先回頭思考：為何臺灣的軟體與 B2C，無法跟硬體與 B2B 一樣壯大？

語言隔閡與單一人才背景造成阻礙

仔細探究原因，簡立峰發現主因有二：第一，臺灣慣用語言是中文；第二，臺灣人才背景缺乏多樣性。

以語言角度來看，中文軟體的市場性相當侷限，而且臺灣還得面對中國這個擁有強勢經濟體奧援的競爭對手。同時，軟體商經營 B2C 要自己站到市場第一線面對全球消費者，接應來自全球的電話；回覆來自全球的 e-mail，但語言隔閡促使臺灣廠商很難打造出一支可面對全球、溝通無礙的國際客服團隊。

Serving as an OEM manufacturer for global brands has created the economic miracle in Taiwan during the past five decades. However, if Taiwan wishes to be successful in AI, it is necessary to develop its horsepower in software and tap into the consumer market. To come up with an effective strategy, Chien suggests the government and industry players to reflect why Taiwan has not been as successful in B2C as in B2B.

Language barriers and homogeneous backgrounds of professional talents

Chien believes that there are two main reasons: Chinese as Taiwan's official language and a homogeneous talent pool.

To start with, the market size for Chinese-language software is limited, let alone that the Taiwan market is dwarfed by the market in China. Meanwhile, B2C software vendors serve customers around the world by communicating with emails and calls. The language barrier makes it difficult for Taiwanese companies to be a global player in the software market.

另一項艱難任務是，企業要建構出具有堅強國際力的業務團隊，來說服全球消費者購買產品。不可諱言，以過去臺灣成功的 B2B 模式來看，只要企業擁有一個國際業務力超強的老闆、業務主管，即可帶著整間企業衝向全世界，但這種模式並不適用於軟體業務或 B2C 商業模式的拓展。

更可惜是語言隔閡使得臺灣雖可發展出領先全球的製造技術，卻很難創造或長久經營一個全球買單的科技品牌，如此現象連帶影響臺灣的大學發展，理工學院始終強勢過於管理學院，在此不斷循環之下，因而發展出現今態勢。

秉除語言隔閡，臺灣也是一個單一種族、文化單一的社會，人才很難去理解全球族群融合區域的文化差異與消費思維。說到底，這兩項主因背後潛藏的瓶頸是臺灣人才缺乏國際力，以及臺灣企業欠缺國際營運格局。

Another difficult task with the B2C model is to build a world-class business development team to convince consumers in different countries into buying products. This is in stark contrast with the B2B model where a strong management team can handle customers on a global scale.

In a nutshell, language barriers are such that Taiwan is not able to create a global brand name in the software market. This has sweeping effects on the university landscape, with science and engineering departments dominating over management departments.

Taiwan is also a homogeneous society where professional talents are not able to appreciate different cultures and mindsets. The bottom line is that the local talents are lacking in international horizon and companies in Taiwan do not have a global outlook.

Two-pronged strategy: software / hardware integration and talent mobility

After identifying the fundamental problems, Chien offers two suggestions: (1) combination

▲ Google 在台灣進行有史以來最大規模徵才。Google conducts the largest recruitment activity in Taiwan.

兩方策略：鼓勵軟硬結合與人才流動

抽絲剝繭，找出問題後，簡立峰提出兩項建議：第一，軟硬結合，第二，鼓勵大量人才先走出去，再走回來，人才要有國際流動。

關於軟硬結合，簡立峰舉了一個顯而易見的例子，臺灣路口常設置監視器，目前監視器都只會在車禍、火災發生後，被當成是警消單位搜證的工具，但如果監視器能在車禍、火災發生的第一時間，便立刻自行通報警消單位到場救援，這就是一種 AI 人工智慧的展現。

以上述例子來看，監視器使用的工業電腦是臺灣製造的強項，廠商卻少去思考能否在原有硬體平台上，架構出更先進獨特的軟體，「如果臺灣軟硬體人才能跨業結合，就是臺灣再創高峰的機會點，」簡立峰直言。簡單來說，臺灣若單獨發展 AI 軟體，十有八九會輸給美國矽谷、中國北京中關村，「但結合臺灣硬體製造優勢，便可增加成功機率。」

改變產業思維的同時，簡立峰認為培養未來 AI 人才的關鍵，唯有先讓人才走出去，再走回來。走出去學習國際語言、營運模式、市場判斷，再走回來，把所學一併帶回臺灣。「可惜過去幾年，因為受全球景氣不佳影響，加上臺灣研究所門戶大開，愈來愈少年輕人才願意走出去。」

AI 智慧顛覆人類的想像，而 AI 人才則要不斷打破界線，包括軟硬體設備之間的產業界線，還有國與國之間的學習、工作界線，唯有具備融合概念，AI 產業才能大破大立，創造出更高產值，面對未來發展，簡立峰認為在臺灣的硬體製造基礎上，發展智慧國家的前景相當值得期待。

of hardware and software; (2) promotion of talent mobility, with professionals out first and back later.

Chien provides an obvious example of hardware/software integration. CCTV surveillance cameras are installed everywhere in Taiwan, but they only serve as a tool for police and firefighting departments to collect evidence about fires and car accidents. If the surveillance devices can immediately inform police and fire brigades in the event of accidents and fires, this is what AI is about.

In the above example, Taiwan is known for as the manufacturer of industrial computers for CCTV. However, the manufacturers rarely think about whether they can embed unique and advanced software on the top of the hardware platform. "The opportunity for Taiwan to create another miracle if software and hardware professionals take a cross-disciplinary approach", said Chien. "If Taiwan is only working on AI software, it is very likely to lose out to Silicon Valley in the U.S. and Zhongguancun in Beijing." "The integration of hardware manufacturing advantage can increase the probability of success for Taiwan".

Apart from the change of the industry's mindset, Chien believes the key to the development of AI talents is to guide them to overseas first and then come back. International experience is beneficial to the learning of languages, operating models and business judgement. "Unfortunately, the global recessions and easy access to postgraduate degrees in Taiwan are keeping more and more young people at home."

AI is revolutionizing human imagination. AI talents must constantly break boundaries, crossing over the lines dividing hardware and software, as well as the lines between countries for work and learning. Only with integration can the AI industry create value. Chien thinks that the outlook for Taiwan as a smart country is bright if it can leverage its foundation in hardware manufacturing.

擴大人才培力，為跨境電商注入源源活力

Enhancement of Talent Development to Instill Energy to Cross-Border E-Commerce

順應科技浪潮，網路購物已成為現今人們生活中不可或缺的一環，中國網路巨人阿里巴巴自創雙 11 光棍節、亞馬遜積極發展無人商店，連擁有中西方鉅資力捧的東南亞電商，也積極插旗臺灣市場，臺灣電子商務產業面臨極大競爭。

Online shopping has become an integral part of everyday life. China's online giant Alibaba single-handedly created the Double 11 Singles Day. Amazon has been actively developing cashierless stores. Even e-commerce enterprises from Southeast Asian, backed by China and western countries, are angling for the Taiwan market. This has put great pressures on the players in the domestic market.

「臺灣電子商務產業一直很有競爭力，」TiEA 台灣網路暨電子商務產業發展協會理事長林之晨充滿信心地說。他以實際數字說明，臺灣電子商務產業占整體零售 20%比例，贏過中國的 12%、美國 8%，臺灣電商市場年營業額達到 6 千億、是全球第 9 大；而且，超過百萬件商品在六小時內送達的物流系統，也支援便利商店間收發貨的多元取貨方式，放眼全球，能夠做到的也只有臺灣。

"Taiwan's e-commerce industry has always been very competitive," said Jamie Lin, Chairman of the Taiwan Internet and E-Commerce Association (TiEA). According to statistics, e-commerce industry accounts for 20% of total retail sales in Taiwan, vs. 12% in China and 8% in the US. The annual turnover of Taiwan's e-commerce market is a staggering NT$600 billion, the ninth largest in the world. The highly efficient logistics system delivers over 1 million items to any door in major cities within six hours. Taiwan is the only place in the world that consumers can pick up their orders in convenience stores.

電商跨境出海 大東南亞智慧生活領航員

身兼臺灣新創產業推手、之初創投創辦人的林之晨認為，臺灣在未來十至二十年間應是鎖定人工智慧與區塊鏈技術。他尤其看好人工智慧應用在各個生活層面，比如發展智慧零售、智慧服務、智慧交通、智慧運輸等智慧服務，再輸出至東南亞，成為大東南亞包括東協與臺灣的智慧生活領航者。

在此風潮下，目前已有多家臺灣新創業者在市場上嶄露頭角。比如臺灣最大的特色旅宿訂房平台 Asia Yo，12 月初剛獲得 B 輪融資 700 萬美元、約合 2 億台幣挹注。目前海外市場營收已超過整體 6 成以上的 Asia Yo，將在 2019 年將市場由東北亞一路伸展至東南亞市場，是區域訂房平台中唯一可與 Airbnb 競爭的對手。

此外，目的地行程體驗中的佼佼者 KKDAY 布局亞洲 10 國，在三年前投入多語系客服之後，海外用戶成長快速，其中又以東南亞用戶的增長速度最為迅速，也是林之晨認為極佳的大東南亞智慧生活領航者。

Taiwanese E-commerce Players Spearhead the Smart Life in the Greater Southeast Asia

As an evangelist of start-ups in Taiwan and the founder of AppWorks, Lin believes that Taiwan should zero in on artificial intelligence and blockchain technology over the next 10 to 20 years. He is particularly optimistic about the application of AI in all aspects of life: smart retail, smart services, smart vehicles, smart transportation and many more. More importantly, Taiwan should export these know-hows and pioneer the smart life in the Greater Southeast Asia (including ASEAN).

A number of Taiwanese start-ups are winning a name for themselves in the market. For example, AsiaYo, Taiwan's largest room booking platform, just received a US$7 million (approx. NT$200 million) investment in its B round in early December. Currently, over 60% of AsiaYo's revenues are from overseas markets, and it plans to expand its reach from Northeast Asia to Southeast Asia in 2019. It is the only regional booking platform that can compete with Airbnb.

Another success story is KKDAY, a market leader in travel destination experience with presence in 10 countries in Asia. Its investment in multilingual customer service three years ago is now paying off, evidenced with a rapid growth in customer base overseas, particularly in Southeast Asia. Lin believes that KKDAY is a strong candidate in the shaping of smart life in the Greater Southeast Asia.

"Many start-ups have been making in-roads in Southeast Asia," said Lin, who knows the market very well. Whilst Grab has become the dominating player in ride-hailing services, local kings are yet to emerge in most verticals. According to Lin's observation, the electric scooter company Gogoro will find great business potential in Southeast Asia where scooters are a main means of transportation.

「許多新創都已積極布局東南亞，」林之晨對東南亞市場有深刻觀察，他說，除了少部分領域如 Grab 成為共享叫車服務的霸主之外，大部分行業都尚未出現區域性冠軍。根據他的觀察，由於東南亞國家主要是以摩托車為主要交通工具，電動車業者 Gogoro 的發展空間也相當巨大。

數位人才稀缺 學習力是電商人才必備條件

由於電子商務產業的變動速度非常快，林之晨舉例說，一年前，Facebook 是最有效的行銷管道，但隨著 Facebook 演算法改變，企業行銷現在反而要在 Youtube、Instagram 上與網路紅人合作，甚至還要嘗試導入聊天機器人，可說是三個月一小變、六個月一大變。

但是，既有的教育體系並沒有電子商務專門科系，因此，與傳統高科技業、金融業相比，電子商務產業最重視的反而是人才的學習力、而非即戰力。也因此，電子商務企業的員工平均年齡輕，雖然離職率較高，約達 20 至 40%，但由於求才若渴，薪資水平也高，一位擁有三至五年經驗的商品經理，月薪可達十萬以上。

「政府如果願意花時間培養智慧的人才，國家整體的發展自然就會朝向智慧國家邁進。」林之晨有感而發，在這個新經濟時代，電商產業缺人才若渴，但既有教育體系卻持續產出舊經濟時代的人才，培育有待改善。

教育是當前最應該做的事

林之晨也提出許多彈性的解決之道，例如他在美國求學期間，觀察一流科技公司大都到史丹佛大學找人才。臺灣的高等教育辦學優

Learning is the Solution to Scarcity of Digital and E-Commerce Talents

The world of e-commerce is constantly and rapidly changing. Lin gives the example of Facebook. One year ago, it was the most effective marketing channel. But this is not the case anymore, after the change in its algorithms. Marketers now rely on Internet celebrities on YouTube and Instagram, and even chatbots.

Moreover, no university in Taiwan is offering degrees in e-commerce. In contrast with tech and finance industries, e-commerce companies prioritize learning capability, rather than readiness, of their employees. The average age of employees in e-commerce companies is relatively young, and the attrition rate is high at about 20 to 40%.

Given the talent shortage in the industry, salaries are high. A product manager with three to five years of experience can rake in a monthly salary of over NT$ 100,000.

"If the government is willing to invest in talent development, the country will naturally become smarter," Lin commented. In this era of the new economy, the education system keeps churning out professionals for the old economy.

Education is the Most Important Catalyst for Change

Lin proposes some flexible solutions. During his study in the U.S., he observed how top-notch companies flock to Stanford to scout talents. Taiwan's higher education offers excellent learning opportunities and the tuition is very competitive. The government can attract top students from Southeast Asia to Taiwan for higher education, so that enterprises can locate talents for their endeavors in the Southeast Asian markets.

Since practically every industry will be digitalized, every job requires digital skills.

▲ 積極布局亞洲。Appworks is actively deploying Asia.

秀、學費又有競爭力，可積極開放東南亞一流人才來臺攻讀高等教育，讓企業可以從這群畢業生中找尋未來發展東南亞市場的在地人才。

此外，由於未來所有的產業都是數位化、每一個工作都需要運用數位能力，數位學習應該跟傳統的數學、國文一樣，成為基礎教育的一環。林之晨也看到民間企業的企業社會責任（CSR）領域，在人才教育上下了許多功夫，例如宏碁基金會每年都花費許多預算推動國中、國小學生學習程式教育、鼓勵孩子從小就具備自造者（Maker）的特質。

但民間的力量有限，真正替全民「數位解盲」的工作還是有賴政府。以新加坡為例，新加坡政府從 2015 年開始投入 1.5 億元新加坡幣，整合教育體系幫助國民終身學習人工智慧等新興數位知識。林之晨也呼籲，教育不只是為 7 至 22 歲量產的製造業，而應該改變心態，重新打造成為 0 到 100 歲都能參與的服務業。

Digital learning should become part of the fundamental curriculum, like mathematics and Chinese. Lin is witnessing many companies make great efforts in education as part of corporate social responsibility (CSR). For instance, the Acer Foundation allocates a substantial amount of budget every year to promote the education of coding in primary and middle schools, so that students develop the quality of a maker from a young age.

However, there is only so much private-sectors can do. Digital literacy in large scale requires the government to step up its game. For example, the Singapore government has invested 150 million Singapore dollars since 2015 to consolidate its education system to incorporate life-long learning on subjects such as artificial intelligence. Lin emphasizes that education is not about the mass preparation of 7-to 22-years-old for the workforce. Rather, it is the service industry that welcomes the participation of anyone from 0 to 100 years old.

建構智慧國家的關鍵引擎 培育跨領域人才首當其衝

Cross-Disciplinary Talents as the Key Driver for a Smart Country

為提供民眾更便捷的生活、加速企業的產業競爭力，邁向智慧國家是必然的方向，其中，人才技能是否到位，扮演關鍵角色。

Countries have to become smarter in order to make life easier for its people and enhance the competitiveness of its industries. The availability of talents is the key to this process.

「隨著臺灣成功轉型為智慧國家，『貨出去，人進來，臺灣發大財』再也不是一句口號，而是真實發生在你我身邊的日常。」對於智慧國家的未來發展，愛文西門總經理李健榮充滿期待的表示，不單單是公部門，包括製造、服務與零售等產業都能夠利用智慧科技即時監督、反映與預測「成本、品質、效率、安全、環保」，用數據反映現實，用分析結果調整策略行動，穩扎穩打的提升國家、產業，乃至個人的競爭力。

他認為：「無論是智慧國家還是智慧企業，要想提升競爭力，必須先求真（數據反映現實）、再求善（藉由分析優化決策），進而求美（以高競爭力引領市場）。」

舉例來說，在空氣品質、立法、預算、選舉、

"As Taiwan has successfully transformed into a smart nation, the slogan 'people flood in, goods flow out, Taiwan makes big money' will be a reality for everyone." When asked about the future of Taiwan as a smart nation, sivann's General Manager Simen Li is beaming with hope. This will not only apply to the public sector, but also to manufacturing, service and retail industries. Smart technology empowers real-time monitoring, response and prediction to ensure cost, quality, efficiency, safety and environmental protection. As data reflects the reality, strategic actions adjusted with analytics helps to improve the competitiveness of individuals, companies, industries and countries.

"For a smart nation or a smart enterprise alike, the first key to enhancing competitiveness is to truth (where data reflects reality), followed with goodness (decisions optimized with analytics), and ultimately beauty (market leadership backed with a solid competitive edge)", said Li.

▲ 協助產業與中小企業導入 AI 創新應用。Assisting industries and SMEs to introduce AI innovation applications.

環保到新聞等領域，已經有很多新創、企業投入其中，藉由蒐集與分析數據的方式，深化掌握度，改善現況。隨著臺灣政府與企業對數據即時性與密度的掌握度越來越高，愛文西門也鎖定製造業，積極透過物聯網等技術協助扣具、模具、營造業者高效蒐集數據資料，然後透過精準分析優化營運流程與提升獲利。

異業結盟，培育跨領域人才

打造智慧企業並不是一件輕鬆事，需要透過異業結盟，以母雞帶小鴨的方式，相互成長卓越。李健榮以協助素有螺絲小巨人之稱的世豐螺絲打造智慧工廠為例指出，「專案之所以能成功，跟來自不同領域的團隊攜手合作有關。」

為提升營運績效，世豐螺絲成立專職團隊負責規畫、建構與管理智慧工廠，成功打造無人化倉庫、出貨碼頭自動搬運系統與機器人自動包裝線後，世豐螺絲進一步鎖定智慧產線應用，藉由在場內與跨廠區的機臺設備安裝聯網電腦等方式，有效追蹤、監管螺絲生產狀況以確保訂單的順利達交。

無奈的是，因為廠區因大量金屬設備導致電磁波散射與干擾，無法順利蒐集資訊，為解決該問題，世豐螺絲與愛文西門和工研院資通所的合作，歷經 8 個多月的開會、場勘、測試與修正，方部署上線。

Many start-ups and enterprises have been tapping into the Big Data and analytics to gain insights and make improvements, may it be air quality, legislation, budgeting, elections, environmental protection, and journalism. As the Taiwan government and companies are getting better with data timeliness and density, sivann is targeting at manufacturing industries by assisting producers of fasteners and moldings and construction businesses to effectively collect data with IoT technology and using analytics to optimize operational processes and increase profitability.

Cross-industry alliances to cultivate multi-disciplinary talents

Building a smart enterprise is not an easy task. It requires the forming of alliances across different sectors and grows together, with big players helping small ones. Li used his experience of assisting Sheh Fung Screws Co., a heavyweight in screw manufacturing in Taiwan, to develop a smart factory. He said, "the success of this project is the result of the cooperation of teams from different functions."

To improve its operating performance, Sheh Fung Screws put together a dedicated team for the planning, construction and management of its smart factory. After successful deployment of an automated warehouse, an automated truck loading/unloading system for shipping docks and automated packaging lines, Sheh Fung Screws created smart production lines by installing networked computers for equipment on-site and across different plants to effectively track and monitor the production status, thereby ensuring the smooth delivery of orders.

▲ 世豐螺絲與愛文西門建立深厚互信基礎，不僅有助於提升雙方的產業競爭力，亦有助於跨領域人才的深化。Through this close-knit cooperation, Sheh Fung Screws and sivann have established mutual trust. This helps both parties to become more competitive and encourages the employees to foster cross-disciplinary capabilities.

李健榮指出，世豐的總經理、副總、特助都樂於擁抱智慧科技，常常跟愛文西門交流、傾聽團隊的聲音，同樣的，愛文西門也從中獲益匪淺。「跨領域的異業合作有助於成長，也能激起創新想法，這種母雞帶小鴨的合作模式，對新創公司起了很重要的引導作用。」藉由緊密合作，世豐螺絲與愛文西門建立深厚互信基礎，不僅有助於提升雙方的產業競爭力，亦有助於跨領域人才的深化。

產官學合作，補充新血

李健榮指出，臺灣的技術人力素質很高，不過，想在智慧時代勝出，必須進一步深化在「敏銳度」跟「批判力」的能力：前者，代表人才對數據的掌握度與分析力，後者，則意味著人才俱備判別數據真實性與正確性的能力，更重要的是，可以因應不同的情境或應用決定是否需要導入人工智慧等新科技、辨別使用人工智慧的方式是否合理，以及結論或產出對不對、意義為何等。「簡言之，擁有批判力的人才，才能協助企業與政府，正確理解與判斷出智慧未來的趨勢。」

However, it was difficult to collect data with all the metal equipment causing electromagnetic wave scattering and interference. To solve this problem, Sheh Fung Screws cooperated with sivann and the Information and Communications Research Laboratories at ITRI (Industrial Technology Research Institute). And after more than 8 months of meetings, field surveys, testing and calibrations, the system was finally brought online.

Li notes that the General Manager, Vice General Manager and Special Assistants at Sheh Fung Screws all embrace smart technology. They frequently communicated and shared ideas with sivann and their teams. sivann also learned a lot from this collaboration.

"Cross-disciplinary cooperation helps mutual growth and inspires innovations. These types of joint projects with major industry players are very beneficial to startups," said Li.

Through this close-knit cooperation, Sheh Fung Screws and sivann have established mutual trust. This helps both parties to become more competitive and encourages the employees to foster cross-disciplinary capabilities.

▲ 協助製作專屬物聯網教具。Assist in the production of exclusive IoT teaching aids.

在智慧國家政策的全面規劃下，人才培育需要長時間醞釀與養成，幸好，已有許多學校、基金會、法人或社群以創新手法培育人才，例如臺大電機張進福教授與吳瑞北教授的物聯網導論課程，透過廣招業界具體問題，讓學生以此作為研究專題，實際面對業界需求與問題進行進行演練。李健榮相信，在產官學三方協力的共同努力下，加速人才的培育，「這也是愛文西門長期以來協助老師製作專屬物聯網教具的原因，透過實地接觸產業使用的平臺工具，減少學用落差，培養下一世代的 IoT 人才。」

「等到科技人才如煙花一般散入各行各業，勢必是智慧企業、智慧國家蔚然成形的時候。」對於智慧國家的人才培育，李健榮充滿信心，熱切期待臺灣的再一次蛻變與成長。

Industry-academia-government cooperation to add new blood

Li points out that Taiwan has a pool of high-caliber technical talents. However, it is important to enhance business acumen and judgement in the smart era. Business acumen is the ability to understand and analyze data. Business judgement is the capability to determine how authentic and accurate the data is. More importantly, one must be able to decide whether it is necessary to introduce new technologies (e.g. artificial intelligence), identify whether the method using AI is reasonable, conclude whether the output makes sense by responding to different scenarios or applications. "In brief, only the talents with the ability to think and act critically can help companies and governments unravel and harness the power of a smart future."

Talent cultivation takes time, even with the comprehensive planning and policy framework for a smart nation. Fortunately, many schools, foundations, NPOs and communities have been fostering talents in innovative ways. For instance, professor Chang Jin-fu and professor Wu Ruey-Beei from the Department of Electric Engineering, National Taiwan University are offering introductory courses on IoT. They assign students to work on real-life issues sourced from the industries. Li believes that the joint efforts of the industry, government and academia will accelerate the development of talents. "This is the reason why sivann has been assisting teachers in the production of IoT teaching aids. We believe that by getting students' hands on real platforms and tools from the industry, the gap between theory and practice can be narrowed. This is beneficial to the development of IoT professionals."

"By the time tech talents are finding their ways to different industries, it will be when smart companies and smart nations flourish." Li is optimistic about talent development for Taiwan as a smart country. He is looking forward to yet another transformation and growth of Taiwan.

運用數位跨域人才，從文化底蘊看見臺灣大智慧

Using Digital Multidisciplinary Talent, See Taiwan's great wisdom from cultural

頑石創意總經理 林芳吟 Fang-Yin Lin, General Manager of Bright Ideas Design

數位策展工作，得整合文史藝術、軟體工程和硬體工程師，能夠透過數位展覽發揮強大的策展實力，最重要的是跨界人才。

Digital curation requires experts in culture, history, art, software engineering, and hardware engineering. The key to successful digital curation is multidisciplinary talent.

早在人工智慧不發達、沒有大數據和雲端運算的時代，林芳吟帶領的頑石創意，就左手解讀文史、右手撰寫程式，再結合硬體工程，以跨界合作方式進行數位策展，將多媒體導入故宮博物院導覽系統，最經典一役，便是獲得聯合國教科文組織評選為五大經典範例的數位展覽「大清皇帝的美夢」。

圓明園中豪奢園景、帝后日常、以及各典禮宴飲的場景，清代宮廷題材幾乎是電視劇的收視率保證，當時，林芳吟觀察到華人題材在國際市場上的潛力，著手向世界各國博物館取得流散他鄉的圓明園文物授權，以數位方式重現清代宮廷生活，促成臺灣第一個數位科技體驗展。

「在國際交流的過程中，我更清楚意識到臺

Long before the rise of AI, Big Data, and cloud computing, Fang-Yin Lin and her team at Bright Ideas Design had studied culture and history, wrote code, and - with help from hardware engineering - brought digital curation into the National Palace Museum, creating a multimedia orientation system. The company's most iconic achievement is creating the "Qing Emperor's Splendid Gardens," which was recognized by UNESCO as one of five worldwide classics in digital exhibition.

With extravagant settings in the Yuanming Yuan, routines of the imperial family, ceremonies, and banquets, stories of the Qing court have been a virtual guarantee for high ratings on TV. At the time, Lin had noticed the potential of Chinese subject matters in the global market and began acquiring licenses of Yuanming Yuan relics from museums around the world to digitally recreate life in the Qing court, which became Taiwan's first

灣的價值，」2010 年，林芳吟擔任第一屆文創博覽會總策劃，重新替臺灣創意產業訂定座標、走向國際。她發現，韓國文化振興院早以傾國之力創造智慧財產，在動漫出版授權經濟方面擁有相當程度的地位，甚至盡其所能申請世界遺產認證。

因為深知創意產業的最大價值，就是要當各行各業的魔法棒，點亮話題，三年前，林芳吟再成立頑石生活，以智慧財產（IP）授權替公司帶來穩定的金流。自此，「臺灣創意、華人題材、國際市場」便成為頑石創意縱橫市場的成功方程式。

跨界人才，不斷重新定義「學習」

說起來簡單，做起來難。數位策展工作，得整合文史藝術、軟體工程和硬體工程師，能夠透過數位展覽發揮強大的策展實力，最重要的是跨界人才。

「在科技新時代，『學習』兩字必須被重新定義的，」林芳吟用人的第一原則，就是不

digital experience exhibition.

"In the process of international exchange, I see Taiwan's values with more clarity." In 2010, Lin served as the chief organizer for the first Taiwan International Cultural & Creative Industry Expo and re-oriented Taiwan's creative industry toward a global future. She discovered that the Korea Creative Content Agency has long leveraged resources on a national level to generate intellectual property, established considerable standing in the business of comics and animation publishing and licensing, and pushed for as many World Heritage certifications as possible.

With the understanding that the greatest value of the creative industry is in igniting attention to other industries, three years earlier, Lin founded Bright Ideas for Life, which brought in stable revenue with intellectual property (IP) licensing. Since then, "Taiwanese creativity, Chinese subject matters, and the global market" became the formula for success at Bright Ideas Design.

Multidisciplinary Talents and Constantly Redefining Learning

The work is easier said than done. Digital curation requires experts in culture, history, art, software engineering, and hardware engineering. The key to successful digital curation is multidisciplinary talent.

"In an age of new technologies, learning must be redefined." Lin's number one principle in hiring is to pick those who keep their minds open and have no fear of the unknown. Because digital curation was a freshly minted industry, she spent a lot of efforts in conveying her understanding to hardware partners: "There is value in both software and cultural knowledge." To communicate with people from backgrounds different from hers, she bit the bullet and learned the logic of programming languages. Talents have to be able to work with people from varying disciplines as a team, regardless of their own specialties.

▲ 將多媒體導入故宮博物院導覽系統，進行數位策展。Introduce multimedia into the National Palace Museum navigation system for digital curation.

能畫地自限、不能對未知的事物感到恐懼。由於數位策展在當時是非常新的產業，因此她花了非常多精力與硬體夥伴達成共識：「軟體有價、文史知識亦有價。」為了與不同背景的人溝通，她也咬著牙搞懂程式設計語言運作邏輯，無論專業背景為何，人才必須要能跟來自不同領域的同事團隊合作。

頑石內部有許多同事都有第二專長，比如動畫部門的同仁有深厚的文史涵養，或是硬體工程團隊成員本身是重度動畫迷。如果他們沒有對世界萬物持續觀察的好奇心、與時俱進的能力，不但無法互相理解、甚至無法挖掘新的數位內容題材。因此，林芳吟認為，除了專注於本業的學習，對於生活大小事的關心也是未來人才的必備條件之一。

不怕被取代，真正的大智慧藏身文化底蘊

人工智慧如浪潮襲來，有愈來愈多博物館、圖書館、觀光工廠導入人工智慧，利用機器人負責多國語言的導覽。一如智慧物流讓電

At Bright Ideas Design, many employees have a second specialty, such as some in the animation department having extensive cultural knowledge and some on the hardware engineering team being die-hard animation fans. If they do not have the curiosity to explore things in the world and the ability to keep up with the times, they cannot understand one another or even discover new materials for their digital content. Therefore, Lin believes that in addition to a focus on one's own professional field, a talent of the future must take an interest in life's details.

Cultural depth inspires true great wisdom that will not be replaced

With the rise of AI, an increasing number of museums, libraries, and tourism factories are incorporating related technologies to offer multilingual museum guidance with robots. As smart logistics cover the last mile in online shopping for the e-commerce industry, AI has also broken through traditional confines. Lin suggests that AI can help free Taiwanese people from long work hours and re-establish their work-life balance. With less repetitive labor, more time can be spent on creative endeavors.

子商務產業打通網購的最後一哩，人工智慧也打破了傳統框架。林芳吟認為，藉由人工智慧，臺灣人可望從超長工時中解放、重新調整工作與生活的比重，減少重複的勞動付出，更精準地將時間花費在具有創造力的事物上。

「我們應該去思考，古典的智慧，與現代 AI 的智慧如何結合。」林芳吟回想起，有一年頑石帶著自製動畫影片〈茶文化：宋代喫茶方式〉到日本東京參賽，同場競逐者不乏砸下重金製作的遊戲動畫，但頑石創意的作品最後卻拿下首獎。評審不疾不徐地告訴她，這支細數茶文化的小品動畫，細緻、動人地呈現古人的生活智慧，這是其他團隊砸錢也無法複製的優勢。

林芳吟認為，臺灣從十七世紀的大航海時代就開始與國際接軌，數百年來累積的文化，是人工智慧取之不盡、用之不竭的寶藏。舉例而言，面對高齡化趨勢，養生是不分國籍的全球風潮，生物科技結合漢方中藥便是相當有潛力的發展領域。

「臺灣有很強的研發能量，但沒有太多時間思考如何發揮創意讓產業更具魅力。」在她腦中的藍圖，是讓臺灣成為獨一無二的數位寶島，任何對中華文化有興趣的外國人，想要充電、學習新知，都能在臺灣這個寶島上，找到貫通古今、揉和歷代智慧的精粹，「那才是屬於臺灣的大智慧，」林芳吟笑說。

"We should think about how classical wisdom and artificial intelligence can be combined," Lin recalls when Bright Ideas Design entered a competition in Tokyo, Japan with their in-house animation production "Whisked Tea of the Sung Dynasty." Competitors included game animation that were produced with big budgets, yet Bright Ideas Design won the top prize. The judge told her with ease that their work presented the wisdom of ancient times with subtlety and poignancy, which was an advantage that could not be replicated with sheer funding.

Lin believes that Taiwan has become a part of the global stage since the seventeenth century during the Age of Discovery and has hundreds of years of cultural depth, which is an unlimited resource for AI. For instance, as societies age across countries, health has become a universal hot topic, and combining biotechnology and traditional Chinese medicine presents great potential for development.

"Taiwan possesses tremendous momentum in research and development, but lacks the time to think about using creativity to make the industries more attractive." Lin's vision is to make Taiwan an island of digital uniqueness, so that any foreigner who is interested in Chinese culture and wants to recharge and learn new things can find the essence of timeless wisdom here. "This is the true wisdom of Taiwan," Lin said with delight.

讓人才創造人才
發展數位學習亟需四大人才投入

Creating Talent Through Talents
The 4 main talents required for E-learning

國立臺中教育大學教育學院院長 郭伯臣 Bor-Chen Kuo, Dean of College of Education, National Taichung University of Education (NTCU)

數位學習結合了 AI 人工智慧與大數據分析，需要跨領域人才齊心協力，才能使數位學習平台充分發揮因材施教的功能，培育出更多、更優秀的人才。

E-learning incorporates AI and big data analysis, two complex technologies that require contribution from expertise across different fields to make E-learning a customized teaching platform, and thereby nurture more outstanding talent in greater numbers.

根據 2015 年聯合國教科文組織的《青島宣言》中指出，資通訊科技（ICT）確實有助於改善學生的學習方式、降低學習落差，因此下一個 15 年，應要倡導應用資通訊技術來改善教學與學習。

《青島宣言》肯定了科技的使用，然而，科技頻繁使用者，學習成績就會進步嗎？「答案是否定的」，國立臺中教育大學教育學院院長、同時也是國內數位學習「因材網」創辦人郭伯臣，透過縣市學力調查研究後發現，數位科技的使用度與國語、數學及英語學力表現的相關性幾近於零，究其原因是，「臺灣教育並未將科技妥善運用於學習上。」

As pointed out in the "Qingdao Declaration" made by the United Nations Education Scientific and Cultural Organization in 2015, information and communication technology (ICT) does indeed offer the potential to improve students' learning methods and reduce the learning gap; therefore ICT should be promoted as a study and learning aid for the next 15 years.

The "Qingdao Declaration" affirms the benefit of technology, but does constant use of technology actually assure improvement in learning results to any extent? "Definitely not," said Bor-Chen Kuo, Dean of NTCU College of Education and founder of the domestic E-learning website - "Adaptive Learning." Based on the findings of a study performance survey, there is nearly zero correlation between use of digital technology and

科技＋學習 = 因材施教

數位學習（E-learning）並非讓學生只是「玩科技」，而是利用數位科技促進或改善學習，運用資通訊技術幫助個人化學習，已是目前國際數位學習主要趨勢。

結合 AI 人工智慧與大數據分析，一項題目，學習者停留多久、花多少時間解題、有什麼困難與迷思，都無法逃過數位學習平台的「法眼」，因此可以提供老師，更多的學習訊息回饋；而學生亦可透過平台發現自我學習瓶頸，自主調整學習方向與進度。透過數位科技，可以幫助與提升老師的人力與能力，「但重點是，老師必須懂得如何將數位科技運用於教學之上。」

郭伯臣指出，縣市學力調查研究發現，除了學科教學 (pedagogical) 與自我效能 (self-efficacy) 外，學習毅力、自我調節學習、回饋訊息的運用等三大能力是影響學習成績的關鍵因素。針對此三大關鍵能力，未來的數位學習平台，除了學科學習外，更應協助學生培養這些關鍵能力。

四種人才，共構數位學習大未來

因此，數位學習領域需要跨領域人才積極投入。首先，是推動數位科技以改善教學的人才，例如老師或企業人力培訓人員；其次，是製作數位教學內容或教材研發的人才；第三，是能夠結合大數據技術，進行學習行為分析，找出學生的學習弱點，進而提供教學建議的學習分析人才；第四，是數位平台軟、硬體技術研發人才。有了這些人才的齊心協力，才能使數位學習平台充分發揮因材施教

study performance, whether the subject involves Chinese, math or English. The reason for this lack of correlation, according to Kuo, is that "Taiwan has not implemented technologies properly as a learning support."

Technology + Learning = Customized Teaching

The goal of E-learning is not just to have students "play with technology," but to use digital technology in facilitating or improving the learning progress. Use of ICT in individual studies has become a major E-learning trend around the world.

Incorporating the latest AI technology and big data analysis, the E-learning platform captures every aspect of the learner's progress, including how much time a learner spent on a question, how long it took to solve, and the challenges and confusions encountered. The platform not only provides teachers with more learning feedback, but also enables students to discover their own bottlenecks and adjust their learning approach and progress. The use of digital technology may improve teachers' capacity and skills, "but more importantly, the teachers themselves must be able to apply digital technologies in their teaching activities."

According to Kuo, results of the study performance survey have shown that, apart from pedagogical and self-efficacy, perseverance, adaptive learning, and use of feedback information are the three critical factors that affect learning outcomes. In light of their significance, future E-learning platforms should focus more on helping students develop these critical skills, in addition to the learning of curriculum.

Four Talents that Define the Future of E-learning

For this reason, E-learning requires active contribution from several different fields of expertise. First, it requires talent capable of promoting digital technology and improving

的學習功能，培育出更多、更優秀的人才。

除科技研發人才，郭伯臣認為，其他三種人才更為改善國內數位學習所需。以教育現場的老師為例，在數位學習科技衝擊下，傳統教學方法勢必面臨改變，師培制度與課程也要跟著改變，老師除需懂得教學方法，更要懂得使用數位學習工具，以進行個人化適性教學，如此才能真正發揮數位學習的功效。

「許多老師目前仍停留在使用 PPT 教學階段，只有少數教師能教導學生如何於數位學習平台中獲得學習資訊與資源，達到因材施教、差異化教學，提升教學效率。」

第二種數位學習內容製作人才，除了數位內容製作能力外，還需具備學科學習理論、教

teaching quality, such as teachers or corporate HR trainers. Next, we need people to produce digital content or develop curriculum. Thirdly, we need those who are able to utilize big data technology for learning behavior analysis, finding students' weaknesses, and offering teaching suggestions. Lastly, we need talent capable of developing software and hardware for the digital platform. Only with the coordination of the above teams of talent may E-learning truly become a customized learning platform to nurture more outstanding talent in greater numbers.

Besides technical R&D talents, Kuo said that the other three types of expertise are more desperately needed to improve the domestic E-learning environment. Classroom teachers, for example, will inevitably be required to change their conventional teaching approaches in the face of E-learning technology, whereas the educator certification and curriculum will have to change, too. The new line of teachers will have to be well-versed with new teaching methods as well as E-learning tools in order to personalize and customize teaching activities while maximizing the potential of E-learning.

"Many instructors are still using PPT as teaching aids, and only a handful are able to show students how to obtain information and resources from the E-learning platform for customized, differentiated, and more efficient teaching."

The second type of talent, the content producers, requires more than just the ability to produce E-learning content, but must also be adapted at blending learning theories, educational psychology, and cognitive psychology into the course design to learners' benefit. In addition, they shall be well-experienced in different teaching methods to be able to incorporate scenario design, script writing, and smart technology all at the same time. By using smart technology, the new teaching program will be able to process and make use of information gathered from learners, and will be a giant leap forward from conventional teaching videos and PPTs.

育心理學、認知心理學等專業知識，以巧妙融入於課程內容設計中，使學習者受益；同時，必須熟稔各種教學法，懂得將情境設計、腳本編寫與智慧科技結合。透過智慧科技，處理與運用所偵測出的學習者訊息，而非只是傳統的影片拍攝與 PPT 製作而已。

「培養教育大數據分析人才，更是急迫。」郭伯臣憂心，當國外數位學習平台蓬勃發展、重視培養大數據與人工智慧於教育應用人才時，臺灣卻仍停留在只聞樓梯聲階段，因此未來可能演變成，國內學習者多數使用國外數位學習平台，長此以往，無疑將教育大數據拱手他人。

智慧國家，必有智慧人才

「沒有教育大數據，或政府單位缺乏將教育相關數據整合的實際作為，如何培養教育大數據人才，建立精準教育機制？」他表示，多年來，臺灣數位學習的學術論文發表全球名列前茅，但國內數位學習產業卻遠落後其他國家，代表產學之間有著明顯落差，扶植數位學習產業、強化產官學合作已迫在眉睫。

因此，郭伯臣期待政府將科技部的創新研發成果、教育部的實際應用與經濟部的商業化推動充分整合，以共構良好的數位學習生態系統，使智慧人才在其中得以滋養茁壯，共同打造臺灣成為智慧國家。

"Nurturing of big data analysts for the education sector is especially urgent," said Kuo with concern. While foreign E-learning platforms prosper and shift emphasis towards developing big data and AI talent, this vision has remained in its conceptual stage in Taiwan. In the future, it is likely that domestic learners must embrace foreign E-learning platforms, leaving no one to support local developers.

A Smart Nation Requires Smart Talents

"How should we nurture big data talent and develop a proper education system from scratch, when the government lacks actions to integrate data into education?" Kuo has said for many years that Taiwan has been one of the most active publishers of academic theses on the topic of E-learning, but the nation's actual E-learning development has trailed far behind that of other countries, meaning that there is a significant gap between what we know and what we do. In order to support the E-learning industry, it is necessary for the industry, the government, and the academia to collaborate on a higher level.

Kuo expects the government to integrate innovations from the Ministry of Science and Technology with practical application from the Ministry of Education and commercialization efforts of the Ministry of Economic Affairs to create a strong E-learning ecosystem where smart talent may grow and contribute to transforming Taiwan into a smart nation.

以優質環境為科技人才培力，共創醫護智慧產業新未來

Creation of a Conducive Environment for a Bright Future of Smart Medicare

「以戰代訓的模式，一方面加快企業的發展腳步，另一方面補足我們既有研發人才不足的困境，讓我們對產業前景更加樂觀。」

"The training-by-doing approach helps to speed up the development of the industry and fills the gap in R&D talent pool. We are now more optimistic about the future."

現在，一台手機大小的儀器，搭配一個免費下載的 APP，任何人都能輕鬆隨時掌握個人身體狀況，像是你今天適不適合跑馬拉松、從事激烈競賽？或是這星期的血壓變化如何？都能立即得知。

由於高齡化浪潮與現代人重視健康的風潮下，看好醫療遠距照護的未來發展，衛利生物科技在 2017 年創新研發出 CMATE(心美特可攜式心電圖儀) 二代機 CHI-100，及其搭配使用的遠距照護投放系統，精密監控健康數據，目前這套軟硬結合的健康照護系統使用人數已超過 5 千人；2019 年將大舉進軍歐洲與中國市場，未來可望創造出可觀產值。

A handset-size device with a free app allows us to stay on top of our physical status. Are you fit for a marathon or an intense workout today? How is your blood pressure trending this week? The answer is right in front of you.

The aging of the population and the rising concern over health provide a healthy backdrop for the development of telecare. Revlis Biotech developed Cmate® Portable ECG, its second-generation CHI-100 model, in combination with a telecare projection and health data for high-precision monitoring. This healthcare system (with software) has attracted more than 5,000 users. In 2019, Revlis plans to bring its innovation to the markets in Europe and China.

企業出題，邀請學研能量為產業解題

掌握領先技術，年燒一億打造出這套跨國界健康照護系統的幕後推手，就是衛利生物科技董事長劉大照，早在 12 年前，他就與全球知名遠距醫療照護集團英商康舒妥 (Tunstall) 展開合作，導入歐美風潮，積極推動智慧型遠距照護事業。

當時臺灣 IT 產業正走向思考轉型的關鍵時刻，電子代工產業陷入毛三到四的低毛利瓶頸，許多企業開始對代工的未來產生質疑，積極地想要推出自有品牌，劉大照也在如此時空背景下，重新思索企業的前景。

為了因應趨勢，他區隔原有的美妝保養品研發與銷售事業，全新建立一支 20 人研發團隊，裡面蘊藏著電機、資訊、管理、經濟、人文等各領域人才，目標是做出一套技術先進、符合消費心理需求，並兼具美感與實用價值的健康照護居家投放系統，目前這項產品已獲得 Intel 認證，成功跨上國際合作平台。

行政院於今年 1 月 18 日提出 4 年期的「台灣 AI 行動計畫」(2018-2021)，其中吳政忠政務委員指示經濟部規劃透過以戰代訓，「產業出題 x 人才解題」AI 實兵培訓機制，幫助企業拓展 AI 創新應用。衛利生物科技順勢提出「應用 CNN(Convolutional Neural Network, 卷積神經網路) 技術發展二維心電圖特徵影像進行病徵分類，並找 ECG(心電圖) 和血壓的關聯性以及 HRV(Heart rate variability, 心率變異性) 的特徵應用」的主題，希望透過由公協會與學研單位共同組成的輔導團隊幫助下，導入 AI 類神經網路學習以使用 ECG 來進行病徵分類、估計血壓數

▲ 小儀器隨時掌握血壓變化。Small instruments keep abreast of blood pressure changes.

Academics and Research Institutes Joint Forces to Resolve Industry Challenges

The person behind this healthcare system by investing NT$100 million a year is Ta-Chao Liu , Chairman of Revlis Biotech. As early as 12 years ago, he began to collaborate with Tunstall, a world-renowned telecare company from the U.K, to learn the knowhow from the west for his smart telecare business.

At that time, Taiwan's IT industry was thinking about how to transform itself. The electronics OEM sectors were stuck at wafer slim margins. Many companies were no longer satisfied with manufacturing for others and they wished to build their own brand names. This was the backdrop in which Liu reshaped his corporate vision.

He decided to establish a new R&D team of 20 people, outside his existing beauty products R&D and business. This new team was comprised of professionals from different disciplines: electric engineering, IT, management, economics and liberal arts. The goal was to create a healthcare system based on state-of-the-art technology, practical and aesthetically appealing for home use. This product is now Intel certified.

According to the Taiwan AI Action Plan (2018-2021) launched by the Executive Yuan in January 2018, Minister without Portfolio Wu Tsung-Tsong has instructed the Ministry of Economic Affairs to roll out training-by-doing initiatives and establish an AI talent development program by helping companies in the innovation

值、HRV，找出亞健康與各種慢性病徵應用指標，增加健康照護使用的便利性，為產業發展挹注新動能。

劉大照笑說：「以戰代訓的模式，一方面加快企業的發展腳步，另一方面補足我們既有研發人才不足的困境，讓我們對產業前景更加樂觀。」

從優勢和需求出發，吸納多元人才

面對打造智慧臺灣議題，劉大照的體會是：「臺灣並不需要把所有人工智慧照單全收，而是要先思考到底臺灣的優勢與需求為何？」以衛利生物科技的模式為例，首先了解臺灣已培養出許多優秀醫療、理工人才，再觀察到遠距照護已是全球風潮，於是進一步思索能否結合這兩方人才資本，創造出經濟產值。

談到人才培養，劉大照感觸良多，智慧產業需要的人才可不光只有寫程式，這中間還會牽涉到對社會氛圍、消費心理與營運管理等面向的了解，因此劉大照在人才招募上從不設限學科背景，他笑說：「當人才進來後，發現自己缺少了什麼，他們自己就會去主動學習，動機更強。」

建立智慧制度，降低人才移動成本

此外，劉大照認為臺灣軟體產業最大的成本之一就是人才移動，譬如 A 工程師幫 A 企業設計出一套 A 系統，不到兩年就離職了，這時 A 企業又必須花一番功夫才能維持 A 系統作業，甚至所有工作又必須重新來過，於是在不斷訓練，又流失人才的過程中，企業無形會付出更多成本。

of AI applications. Revlis Biotech seized the opportunity and proposed the application of CNN (Convolutional Neural Network) to develop symptom categorization using 2-D ECG images, identify the correlation between ECG and blood pressure, and come up with applications based on various heart rate variability (HRV). It is hoped that the concerted efforts from industry associations, academic and research institutes, AI neural networks can interpret ECG information in order to categorize symptoms, estimate blood pressures and HRV, and identify subhealth problems and chronic diseases.

"The training-by-doing approach helps to speed up the development of the industry and fills the gap in R&D talent pool. We are now more optimistic about the future," said Liu with a smile.

Attract diverse talents by leveraging existing strengths and catering to needs

Liu argues that Taiwan doesn't need to cover all the aspects of AI. Rather, we should start by thinking about what Taiwan is good at and what Taiwan needs. Take Revlis Biotech for example, Liu began by tapping into the rich talent pool in Taiwan in medicare and engineering. He then explored ways of combining the strengths of engineers and medical professionals, in order to capitalize on the global trend for telecare.

Liu has plenty of experience in talent development. It is insufficient just to know how to write codes. Rather, it is necessary to understand the social atmosphere, consumer psychology, operation and management. Therefore, Liu keeps an open mind regarding the academic backgrounds of new hires. "People find out what they do not have. This is why they learn, and they stay motivated" he said.

A Smart system to minimize staff attribution

In addition, Liu thinks one of the biggest costs for Taiwan's software industry is personnel

▲ 衛利積極為科技人才培力。Revlis actively cultivates talents for science and technology.

但為何企業留不住人才？「政府與企業要共同找出解答，」劉大照指出，雖然政府積極以政策厚實人才實力，但成功關鍵在於，政府要先協助企業將人才激勵措施與企業資產有更好的連接，產官學才能一起動起來。譬如明訂制度，讓企業具有打造理想工作環境的意識，才能持續吸引全世界人才到臺灣創造未來。

對照 12 年前的大膽投入，如今因應物聯網崛起、AI 智慧技術大躍進，遠距健康照護已具備成就產業之實力，對此，劉大照不忘提醒政府在建立智慧產業前，應先建立一套智慧制度，「有了明確制度，企業才能有所依歸，就能從中找到自己的活路。」面對智慧臺灣未來發展，劉大照深具信心，也期待在大家共同努力下，從臺灣到世界，迎向嶄新未來。

turnover. Consider this scenario: an engineer helps a company to develop a system. Two years later, the engineer leaves the company, and now the company needs to spend a ton of efforts maintaining that system, or even redo everything from the ground up. The cycle of training then losing talent is a drain to the company.

But why can't companies retain talents? "The government and companies must work together to find a solution," Liu commented. In addition to human capital development, the government should connect talents with companies by offering incentives and mobilize the industries, academics and research institutions. Only by creating an ideal workplace can Taiwan attract the best brains from other parts of the world.

The bold investment on telecare twelve years ago has paid off, amid the emergence of IoT, advancement of artificial intelligence. Liu would like to urge the government to establish a smart system before building a smart industry. "Companies will find their way once the system is in place." Liu is confident about the future of a smart Taiwan. With the concerted actions from different parties, Taiwan will be able to make great strides in the global market.

借鏡新世代城市的科技創新思維

智慧城市管理暨科技學程，全面打造新加坡智慧國家人才

Innovations from the Next-Generation City

SMT Trains Talent for Singapore's Movement towards Smart Nation

綜觀智慧國家與智慧城市發展趨勢，新加坡的經驗值得參考。2015年發布的「2025年資訊通信媒體發展總藍圖（Infocomm Media 2025）」宣告了新加坡資通訊和媒體業未來發展方向，許多企業在新加坡邁向智慧國家願景中，開始意識到智慧城市人才的必要性。

Singapore's experience in smart nation and smart city development brings new perspectives. Announced in 2015, "Infocomm Media 2025" outlines the future of information and communication technology (ICT) and the media industry for Singapore. As the city-state takes steps toward realizing its vision of a smart nation, many businesses are becoming aware of the necessity of smart city talents.

綜觀智慧國家與智慧城市發展趨勢，新加坡的經驗值得參考。2015年發布的「2025年資訊通信媒體發展總藍圖（Infocomm Media 2025）」宣告了新加坡資通訊和媒體業未來發展方向，許多企業在新加坡邁向智慧國家願景中，開始意識到智慧城市人才的必要性。

打造智慧國，從人才養成開始

如何打造智慧國度所需要的新人才？新加坡管理大學（SMU）去年成立全新的四年制學程—智慧城市管理暨科技學程，來自不同產業、設籍新加坡的眾多組織也紛紛表達對該

How do we train the new talent we need to build a smart nation? Last year, Singapore Management University (SMU) launched a 4-year program called Smart-City Management and Technology Major, and shortly after the program was introduced, many organizations registered in Singapore expressed high interest in recruiting students who graduated from that program, because talent makes up the essential competitiveness we need to progress toward being a smart city.

Smart nation begins with talent development

How do we train the new talents we need to build a smart nation? Last year, Singapore Management University (SMU) launched a 4-year

學程畢業生的高度興趣，因為人才是邁向智慧城市發展不可或缺的核心競爭力。

智慧城市管理暨科技學程（Smart-City Management and Technology Major, SMT）由資訊系統學院與社會學院共同組成，採用經驗學習法則教授課程，學生們透過實習與即時專案學習以下五個領域相關知識與技能：行動（Mobility）、公共服務（Public Service）、商業與經濟（Business & Economy）、健康與銀髮保健（Health & Enabled Ageing），以及家庭與環境（Home & Environment）。從資訊科技顧問、資料分析師、永續方案設計師、都市規劃師，以及物聯網 / 智慧系統設計師與開發師等，未來 SMT 畢業生踏入職場後的工作內容與範疇十分廣泛。

新加坡管理大學資訊系統學院院長房偉華教授（Professor Pang Hwee Hwa）表示，一個城市的「智慧化」不是終極目標，「智慧化」只是讓城市更適宜居住，追求永續發展的工具。為打造永續宜居城市，必須協調來自社會、經濟、商業、環境與科技等不同層面或領域的考量。SMT 學程旨在培訓出足以管理上述跨多重領域需求與考量的專業人才，因應都會化的各項挑戰，創新或開發科技提出解決方案，例如，執行都會規劃，執行改善市民生活的解決方案與服務。

program called Smart-City Management and Technology Major, and shortly after the program was introduced, many organizations registered in Singapore have expressed high interest in recruiting students graduating from that program, because talents make up the essential competitiveness we need to progress toward smart city.

Smart-City Management and Technology Major (SMT) comprises courses offered by School of Information Systems and School of Social Sciences. The program is taught with experience-based learning, where students are assigned to internships and projects to learn knowledge and skills in the following 5 areas: Mobility, Public Service, Business & Economy, Health & Enabled Ageing, and Home & Environment. From IT consultants, data analysts, sustainable solution designers, and urban planners, to Internet of Things (IoT)/smart systems designers and developers, there are extensive job opportunities awaiting SMT graduates upon completion of the program.

Pang Hwee Hwa, Dean and Professor of the School of Information Systems, Singapore Management University (SMU) said that "making a city smart" is not the ultimate goal; it is merely a means to make cities more suitable for living and a tool for sustainable development. To build a sustainable and livable city, efforts must be coordinated on several aspects and levels including social, economic, commercial, environmental and technological. The goal of SMT is to train professional talents capable of coordinating across the various aspects and needs mentioned above, and create, develop and propose solutions to address the challenges of urbanization, such as urban planning, resident lifestyle solutions and services.

科技、管理、社會共同推動智慧化

房偉華的觀點代表學術界對智慧城市的新思維與觀察，認為智慧城市不應只單純檢視智慧化的程度，更應聚焦在城市對於智慧化的努力與企圖心：「智慧城市的真諦，在於城市管理、政策與科技面的創新。」由於每座城市皆有其獨特環境，進而創造出它在科技、組織與政策層面的特質，一座智慧城市是科技、管理與組織創新情境下交織而成的產物。

因此，替智慧城市架構出一個由科技、管理與政策 / 社會共同創新的完整骨幹，成為未來學術與教育需求趨勢。為避免創新過程中的風險，尋求可避險的創新策略，及釐清構成創新與風險的背景等，培育足以面對這些需求的智慧城市人才，成為推動智慧城市的關鍵因素。

為邁向智慧國家積極打造基礎建設之際，新加坡政府資訊科技總監曾昭河（Chan Cheow Hoe）觀察公部門對於智慧城市科技的能力，諸如感測器與物聯網、資料分析與

Smart development through technology, management and society

Pang Hwee Hwa's views are representative of how the academia has observed and envisioned towards a smart city. He believes that a smart city should be assessed not only for how smart it is, but also for the efforts and ambitions committed to making it smart. "The connotation of a smart city represents innovation in management and policy as well as technology." Since the unique context of each city shapes the technological, organizational, and policy aspects of that city, a smart city can be considered a contextualized interplay among technological innovations, managerial and organizational innovations, and policy innovations.

For this reason, we aim to build a comprehensive framework to view the smart city movement as an innovation comprised of technology, management, and policy, and in doing so lead the academic and educational movement. We shall constantly explore ways to avoid risks from innovation, strategies to innovate while avoiding risks, and contexts underlying innovation and risks. Nurturing the talent needed to accommodate such requirements will be the key to the success of the smart city movement.

機器學習等亦隨之成長。成立 SMT 學程打造明日人才渠道，讓新加坡更有把握推動智慧國家各項藍圖大計。不論是轉型數位政府、優化智慧城市服務或催生都會創新，數位經濟風潮為 SMT 畢業生帶來許多挑戰與機會，讓他們將所學實踐於解決真實世界的問題，大展長才。

原來智慧城市可以如此聰明

SMT 學程是獨一無二的跨域學程，教授學生發展出整合關鍵性要素——科技、社會科學與管理學，提出創新智慧城市解決方案的專業技能。課程提供學生們資料分析、解決方案開發技能、智慧城市創新相關的政策、與商業與社會影響的實證推論。專長領域彈性選修，讓學生們在資訊系統、社會科學與管理學三者間擇一選修，為產業界補足跨域及迎接未來趨勢的專業人才缺口。

學生 Timofey 選擇就讀 SMT 學程，因為他認為跨域教學對科技教育非常重要。對他來說，在策劃任何創新性的科技解決方案時，應該全盤考量這項解決方案將對社會造成何種長遠影響。

另一位學生 Sunho Lee 在 SMT 學程中體會到智慧城市的豐富與多元面相，第一學期課程裡導入眾多不同概念，從整合科技到設計智慧城市的生活條件，以及改善城市安全、環境、交通運輸與能源問題的各種方法。

學生 Steve Tay 則利用寒假參與一項名為「兼容並蓄的智慧國度——智慧保健」專案（Inclusive Smart Nation - Smart Healthcare），讓他對新加坡城市網路的「智慧化」大開眼界，也對未來職涯產生更多的想像與想法。

In order to build the infrastructures needed for a smart nation, Chan Cheow Hoe, Singapore Government Chief Information Officer, has been monitoring the government's access to smart city technologies, and found that demands for sensors, IoT, data analysis, and machine learning have grown. SMT opens access to future talent and makes Singapore more confident about its vision of being a smart nation. The rise of the digital economy brings challenges and opportunities to SMT graduates; whether they are needed for the government's digital transformation, optimization of smart city services, or to inspire urban innovations, the world will have no shortage of real problems for them to solve.

A smart city that is smart beyond imagination

SMT is a unique program that incorporates expertise from different fields. It teaches students the skills to integrate key elements, namely technology, social science and management, into creating innovative smart city solutions. The program teaches skills such as data analysis and solution development, policies relating to smart city innovation, and discussions about their commercial and social impacts. Students are offered the option to choose between three specializations: information system, social science, and management. These courses will address the talent shortage faced by industries trying to embrace future trends.

Timofey, a student of SMT, chose the program because he considered inter-field teaching to be very important to technological education. He believes that it is essential to establish long-term impacts on the society when devising any solution involving innovative technology.

Sunho Lee, another student of SMT, learned from the program the complexity and diversity of a smart city. The first semester courses introduced many different concepts from technology integration to smart city design, as well as methods of improving safety, environment, transportation, and energy issues of a city.

從需求導入，全民參與更重要

就科技定義來說，智慧城市採用不同型態資訊溝通科技，支援資產與資源管理相關資訊，同時仰賴物聯網發展、無線通訊科技與其他創新技能改善生活品質。然而人們卻輕易忽略智慧城市不只能運用科技收集資料與訊息，也企圖透過資訊的解讀和分析，提出使城市生活更具魅力的對策與方案。

想順利升級成為智慧城市，必須充分了解居民需求與最佳對策。市政府著手建置精簡市政服務的物聯網方案，將過去仰賴大量人力的作業，如交通控管、能源配置與公用事業服務等自動化，同時從中取得資料來優化服務品質。此外，創造可提供更優質服務、產生「下一步行動」資料的基礎建設，也是尋求「科技化」強化市政效益之城市的首要任務。

智慧城市不僅止於在城市導入昂貴科技，更鼓勵居民參與智慧化歷程，強化市民對智慧化的了解與認同，成為發展智慧城市良好永續的基礎。以莫斯科為例，市政府花費數百萬元建置專案，介紹改善市民生活的亮點發展、協助居民發聲與投票，「我們的城市」APP 讓市民舉報市政問題與公共服務建議，解決超過 190 萬件的市政問題。

以科技推動更優質的未來生活

《經濟學人雜誌》引述美國著名智庫布魯金斯研究院（Brookings Institution）報告，指出：全球前三百大都會的經濟活動，約占全球近二成人口與全世界五成的國內生產總值。過去十年來，這些大都會區域的收入或工作機會的成長速度，都遠高於整體國家平均值，可見打造智慧城市也是推動國家經濟成長，創造國民就業機會的良方。

As for Steve Tay, he spent his school breaks participating in a project named "Inclusive Smart Nation - Smart Healthcare," which opened his mind about the "smartness" of Singapore's city network and helped him develop a broader imagination and thoughts about future careers.

Demand-driven and total participation

From a technology perspective, a smart city uses different forms of information communicate technology to support assets and resource management, and relies on IoT, wireless communication and other innovations to improve lifestyle quality. However, people can easily neglect that a smart city is more than just using technology to gather data and information, but is also about interpreting and analyzing information, and developing strategies and solutions to improve urban lifestyles.

To transform into a smart city, it is necessary to learn the needs of the residents and devise strategies accordingly. A city government may adopt IoT solutions to facilitate its administrative services, automating processes that used to be labor-intensive, such as traffic control, energy deployment, and public utilities, while at the same time gathering the necessary data to optimize service quality. Furthermore, building infrastructures capable of supporting better quality services and generating data for "the next step" are also critical to a city's "technological transformation" and enhancement of administrative efficiency.

A smart city requires more than just implementing expensive technologies; it is equally important to encourage residents' participation throughout the process, as doing so would enhance the residents' understanding about why and how to go about the transformation, and thereby provide the strong, sustainable foundation for smart city development. In Moscow, for example, the city government has spent millions of dollars explaining urban development highlights that would improve the residents' lives and assisting the residents in voicing opinions and voting. An app called "Our City" has been launched to assist residents in reporting problems and raising

隨著 21 世紀轉型，接受各種科技與移動的挑戰。為成功因應這一波的都會蛻變，許多歷史悠久的城市勢必要建置一套有效、永續且量身打造的經濟策略，以便型塑新都會模式、保存與優化都市環境，在高速都會化與生活品質間取得平衡。而智慧城市正是一個標竿典範，運用科技為人們的生活、商業活動與環境創造良性正面影響。

智慧國家及數位政府（Smart Nation and Digital Government, SNDG）副主任陳谷炎（Tan Kok Yam）認為，新加坡推動智慧國家機制的目標，在於運用資通科技、網路與資料來改善生活、創造機會，打造緊密社群。透過培養擁有相關技能、企圖心與毅力的人才，創新發展不同解決方案，改善新加坡與全球生活品質，才有機會達成智慧國家目標。

科技始終來自人性，全方位檢視智慧城市，以此架構培育新型態人才，SMT 學程是這波浪潮裡值得關注的智慧世代新契機。

suggestions regarding public services, and more than 1.9 million administrative issues have been resolved as a result.

Better lifestyle made possible through technology

"The Economist" cited a report produced by the Brookings Institution, which pointed out that the world's top-300 metropolitan areas represent nearly 20% of world's population but account for 50% of world's production value. In the last 10 years, these metropolitan areas have exhibited far higher growth in terms of income and job opportunities than the overall averages of their respective nations. Building a smart city is undoubtedly the ideal solution to ensuring the growth of a nation's economy and creating employment opportunities for the residents.

The 21st century brings challenges in terms of technology and mobility. To successfully respond to urban transformation, many of the world's historic cities will inevitably have to implement an effective, sustainable and customized economic strategy that shapes the new metropolitan lifestyle while at the same time preserving and optimizing the city's characters, and thereby ensuring a balance between urbanization and lifestyle quality. A smart city presents such a role model, where technologies are used to bring positive influences to peoples' lives, commercial activities, and the environment.

Tan Kok Yam, Deputy Head of Smart Nation and Digital Government (SNDG), said that Singapore's movement towards building a smart nation will involve ICT, the Internet and data management, and are intended to accomplish several improvements including lifestyle, job opportunities, and closer social networks. These smart nation objectives can only be achieved by developing the required skills, nurturing talents with the right ambition and perseverance, and devising customized solutions specifically for the lifestyles of Singaporeans and the rest of the world.

Technology originates from humanity. SMT's vision towards a smart city and the framework it adopts for nurturing new talent may set new standards for the smart movement.

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