

CLOUD

> **Connecting Leaders Online for
University Digital Transformation**

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**Digital Intelligence,
Talent as the Bridge**

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**When Trade
Begins to Think:
New Possibilities
in Emerging Markets**

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**Designing IIOE
AI+Cross-border
E-commerce
Micro-certification
Course**

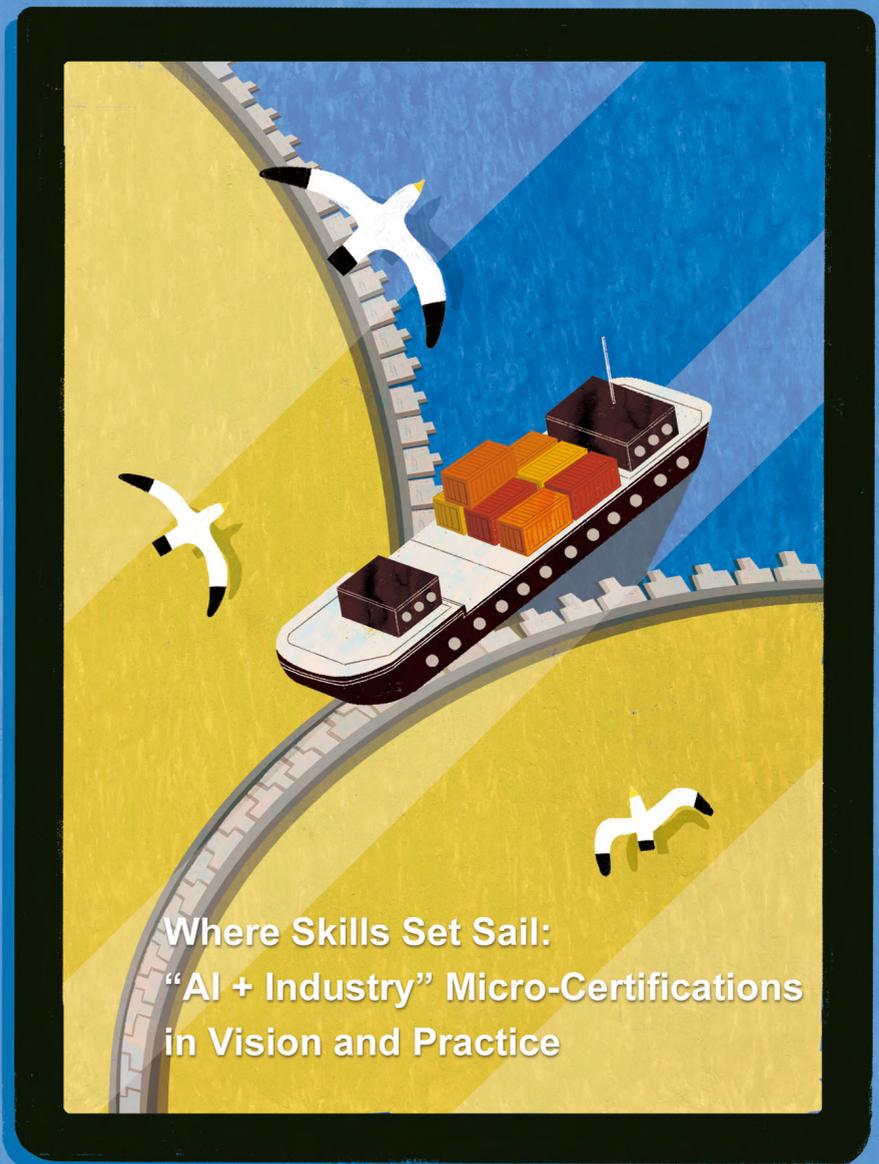
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**Where Skills Set Sail:
“AI + Industry” Micro-Certifications
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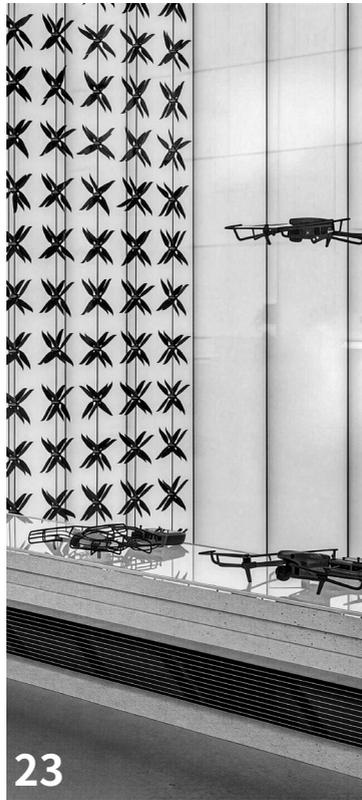
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Jakarta, Indonesia: Southeast Asia's Largest E-commerce Market



Digital Intelligence, Talent as the Bridge:

Opening a More Inclusive Future for Global Digital Trade

TANG Min

Former Counsellor of State Council of the
People's Republic of China;
Chairman of the China Cross-Border
E-commerce 50 Forum

As artificial intelligence reshapes the fabric of industry and digital waves ripple through global trade, competition in the digital economy is, at its core, a competition for talent. At the crossroads of technological revolution and industrial transformation, a shared question emerges: how can the long-standing gap between higher education and the digital economy be bridged? And how can the gains of technological progress reach beyond geographical divides to benefit a wider community of societies and participants? These are no longer questions for any single country or institution. They have become a common agenda for the global partners of UNESCO-ICHEI, for UNESCO, and for all those working to shape the future of education and development.

At a time when the global shortage of digital skills continues to widen, "AI + Industry" micro-certifications are beginning to break through the traditional boundaries of disciplines, classrooms and calendars. Small in scale yet sharply focused, they create a direct bridge between higher education and the real demands of industry, allowing talent development to keep pace with the evolving digital economy.

Among these innovations, "AI + Cross-border E-commerce" stands out as an inclusive example. The World Trade Organization estimates that AI could boost global trade in goods and services by nearly 40% by 2040. In this context, AI-driven cross-border e-commerce is emerging as one of the key engines behind that growth. By lowering long-standing barriers, including language gaps, limited market insight, and complex compliance costs, it opens new possibilities for small businesses and entrepreneurs, especially in developing countries. Even the smallest players can begin

to navigate the vast ocean of international trade.

The "AI + Cross-Border E-Commerce" course developed by the International Institute of Online Education (IIOE) is a practical response to this moment of change. It does more than teach hands-on skills—from AI-assisted product selection and intelligent operations to cross-border compliance. It also conveys a broader vision of inclusive and shared development, nurturing a new generation of professionals equipped with global outlooks, digital literacy and practical expertise.

These talents will become the digital connectors of global markets, helping to transform AI from a mere tool of efficiency into a driver of opportunity. In doing so, they can enable developing countries to seize the possibilities of digital trade, narrow the digital divide, and ensure that the promise of the digital age reaches every path of development.

This issue of *CLOUD* takes talent development in the digital-intelligence era as the central thread. We explore the practical value of "AI + Industry" micro-certifications, examine the inclusive potential of AI + Cross-border E-commerce, and share innovative experiences from partners around the world.

These pages are an open invitation — to educators, innovators, and everyone with a stake in where the world is heading. Inside, you will find sharp thinking on the future of digital-era talent, fresh perspectives on AI-driven cross-border commerce, and a shared vision for a more equitable global trading system.

Talent is the bridge; technology, the sail. Let us navigate the digital economy together!

Growth is Here: Are Skills Ready?

When the first steam engine roared to life in a factory at the end of the 18th century, few could have foreseen how profoundly it would transform the world. Originally designed to pump water from mines and power textile looms, this machine inadvertently reshaped urban landscapes, redefined the rhythms of work, and altered humanity's understanding of growth. A century later, electrification repeated the pattern. Artificial lighting extended working hours, assembly lines revolutionised production methods, new industries emerged, and traditional jobs gradually faded away. Each major technological breakthrough has etched itself into history in a similar manner: while creating greater productivity, it has also compelled societies to reconfigure skills and redistribute opportunities.



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Economist Joseph Schumpeter termed this process "creative destruction." In his view, technological progress periodically supersedes existing industries and practices, redirecting capital and labour toward activities of higher productivity. While such shifts foster long-term growth, they often inflict short-term disruptions upon workers and enterprises of the era. In 2025, the Nobel Prize in Economics was awarded to Joel Mokyr, Philippe Aghion, and Peter Howitt [1], reflecting the continuation and deepening of this intellectual tradition: growth arises from the process through which innovation is absorbed by society, diffused, and consistently transformed into productive forces.

Unlike the eras of steam or electricity, the creative destruction we face today is seldom ignited by any single, isolated technology. The impact of artificial intelligence stems, rather, from how deeply it integrates with the familiar fabric of our world: algorithms embedded within platforms, data threading through supply chains, automation permeating what may seem like ordinary decision-making and service delivery. The locus of competition has consequently shifted from merely possessing the technology to determining who can translate that technology into genuine capability sooner and more effectively.

The narrative of a new wave of growth is unfolding, yet its entry tickets are not automatically distributed. While artificial intelligence dominates every major conversation, with fervent discussions on its capabilities and efficiency, we seldom pause to ask: Who truly possesses the capacity to engage in this round of value creation? In the digital age, what determines one's eligibility to

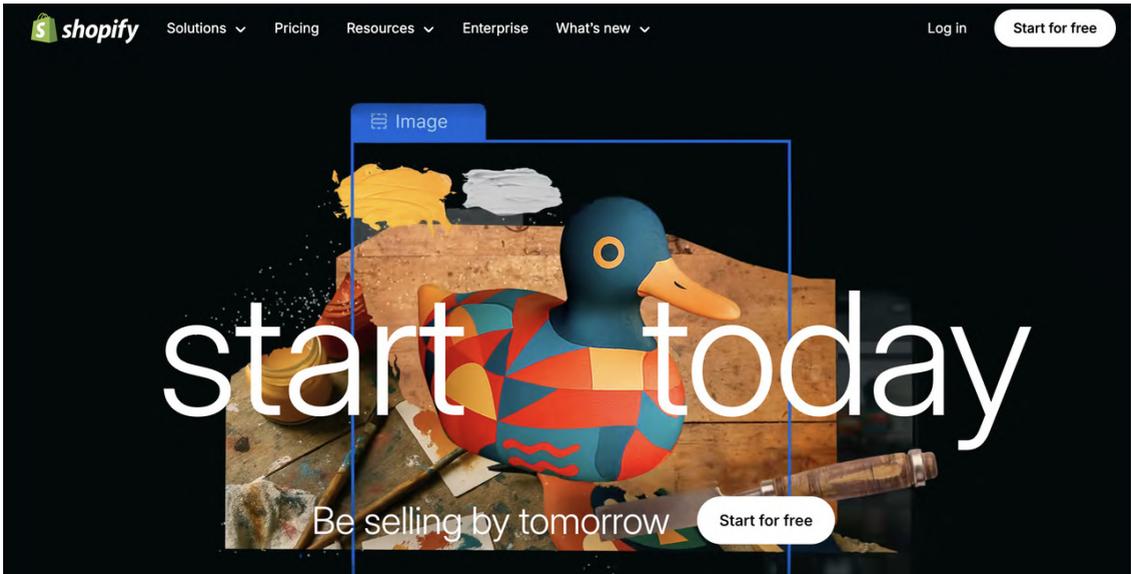


| 2025 Nobel Prize In Economic Sciences

participate is often not the technology itself, but rather the ability of education systems to transform that technology into skills that can be learned, transferred, and sustained over time. This is precisely the question that warrants deeper reflection when considering future growth, employment, and equity.

New Growth: A Tech-Driven Shift in Trade

The World Economic Forum indicates that, despite tariff adjustments and other trade disruptions, global trade as a whole has remained resilient, growing at an annual rate of approximately 2.5% (slightly outpacing GDP growth) [2]. The current wave of technological transformation, propelled by AI, is directly reshaping how transactions occur, how enterprises access markets, and how individuals participate in economic activity. Innovation unfolds not only in laboratories and on production lines but also propagates rapidly, through platforms, logistics networks, and digital infrastructures, into commercial practices across the globe.



| Shopify Magic AI-assisted Website

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The era of the "digital-intelligence economy," centred on data and artificial intelligence, is reshaping our commercial choices and lifestyles with unprecedented force.

”

Cross-border e-commerce stands as one of the most visible manifestations of this shift. It has long evolved beyond the mere flow of goods on virtual shelves, transforming into a holistic system encompassing consumer insight, intelligent recommendation, inventory management, and cross-border fulfilment. Digital services, too, no longer remain confined to the screen; they are now deeply

embedded in every stage, from design and production to after-sales support.

In the Global North, this manifests more as an intelligent enhancement of existing advantages. E-commerce platforms like Shopify in North America leverage AI algorithms—through features such as intelligent product selection and dynamic pricing—to help small and medium-sized enterprises (SMEs) identify overseas demand more swiftly and reduce trial-and-error costs. Industry studies estimate that such tools can increase cross-border sales revenue for SMEs by up to threefold and boost average order value by half [3]. By leveraging long-accumulated platform capabilities, technological infrastructure, and brand networks, economies in the North continue to shape the rules, standards, and ecosystems of digital trade.

Simultaneously, emerging markets are demonstrating notable dynamism. The *Global Trade Update* report of January 2026 highlights that South-South cooperation is driving global export growth, with 57% of

developing economies' exports flowing to fellow developing markets, predominantly through Asian-led regional value chains [4]. In the Middle East, logistics enterprises are accelerating the development of international express delivery and smart logistics networks, gradually transforming regional hubs into crucial nodes connecting Asia, Europe, and Africa. As the speed of goods movement increases, cross-border transactions are becoming a more routine part of commerce. In Africa, change is often initiated through payments. From East to West Africa, a range of mobile payment platforms are filling the gaps left by traditional financial services. The *Global Financial Prosperity Barometer* notes that Africa is currently the only region where the usage rate of mobile payments surpasses that of traditional banking systems [5]. This strengthening payment infrastructure is fueling the expansion of the e-commerce market, with projections indicating its size will grow from 55 billion in 2024 to 112.73 billion by 2029—a 105% increase over five years [6]. Within this growth, demand for digital products is particularly vibrant, ranking among the fastest-

growing categories. In Latin America, Brazil and Mexico have emerged as key regional markets, collectively accounting for over 60% of the region's cross-border e-commerce share and contributing more than \$110 billion in e-commerce retail revenue [7].

Together, these dynamics underscore that cross-border e-commerce is becoming a tangible pathway for emerging markets to participate in the global economy.

Skills: Responding to Industry Challenges

Artificial intelligence and digital trade are creating opportunities while simultaneously redefining the terms of participation. This raises a direct and pressing question: Is education prepared for this shift? The answer is concerning. While the number of graduates worldwide continues to rise, businesses consistently face the enduring challenge of recruiting talent equipped with adequate digital skills.

| The 2nd Conference of the International Association for Safe and Ethical Artificial Intelligence



Indeed, the mismatch between supply and demand in the job market reveals a pronounced skills gap. The operational logic of cross-border e-commerce now extends to every link—data analysis, cross-cultural customer support, compliance management, and intellectual-property protection. The same holds true for digital-service exports. Yet conventional, single-discipline-driven curricula are often ill-equipped to cultivate the kind of integrated, commercially-savvy competence that the sector demands. Perhaps the core issue, then, is not whether universities teach enough, but whether they are still responding to a structurally transformed industry with knowledge systems of the past.

The feedback mechanism between education and industry remains insufficient. Emerging needs from business practice struggle to enter the classroom in a timely manner, and students rarely gain opportunities to train in authentic commercial environments

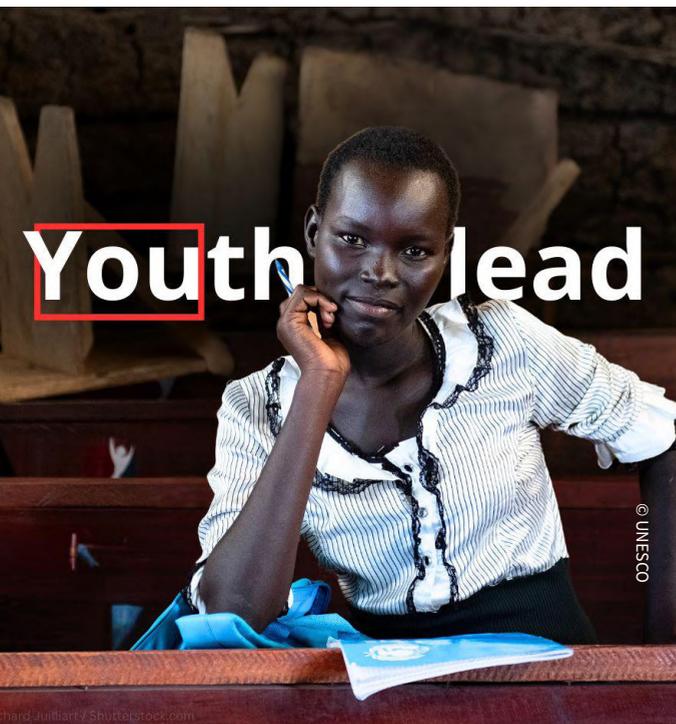
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In the era of AI prosperity, skills extend beyond merely using tools. They now encompass the ability to exercise judgment within algorithmic environments and to collaborate effectively with them.

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during their studies, leaving them with few immediately applicable skills. For enterprises, this not only raises recruitment costs but also implies a protracted waiting period before new talent can begin to deliver value.

A deeper challenge stems from the digital divide. For institutions with limited resources, ambitions such as establishing digital laboratories, acquiring cutting-edge software, or hiring instructors with industry experience are often constrained by practical realities. While some classrooms are already delving deeply into AI-driven supply-chain optimisation, other students may still be engaging with a previous generation of technology. **Beyond the gap in equipment, this represents a form of "cognitive generational gap" that risks becoming entrenched.** If not addressed in a timely manner, it may well solidify into a persistent disparity in opportunities to participate in the digital era—one that could widen over time.



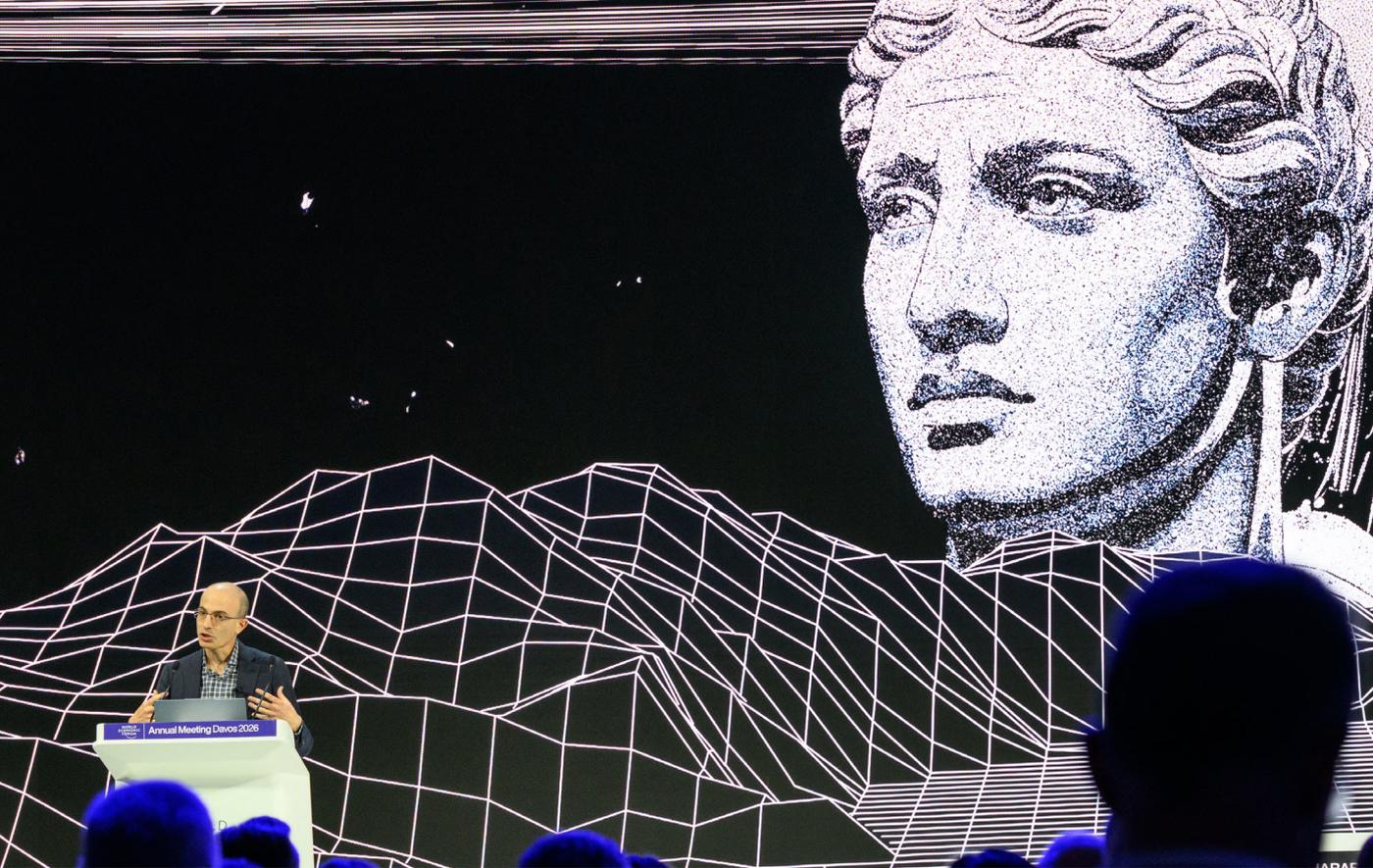
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UNESCO has long been attentive to the structural impacts of digital technologies on education, employment, and social equity, regarding the narrowing of the digital divide and the enhancement of workforce skills as critical public priorities in the AI era. In response to widespread digital skills gaps, UNESCO has promoted initiatives such as the Global Skills Academy (GSA) and the Future Skills Platform, supporting individuals in developing digital literacy, entrepreneurial competencies, and green skills to help diverse groups prepare for the future of work. Additionally, UNESCO has launched the Global Skills Tracker, which provides in-depth analysis of skills landscapes across multiple dimensions, including country, industry, and occupation.

Underpinning these efforts is UNESCO's commitment to the principle of digital humanism. While recognising the role of market dynamics and the private sector in energising the digital transformation of higher education, it insists that the well-being of educators and learners must remain paramount. This approach emphasises that digital transformation should ultimately serve the long-term development of people and society.



GSA held a high-level workshop at Machakos University in Nairobi, to build out the expansion of its transformative Digital and AI Skills Programme.



| An Honest Conversation on AI and Humanity Session

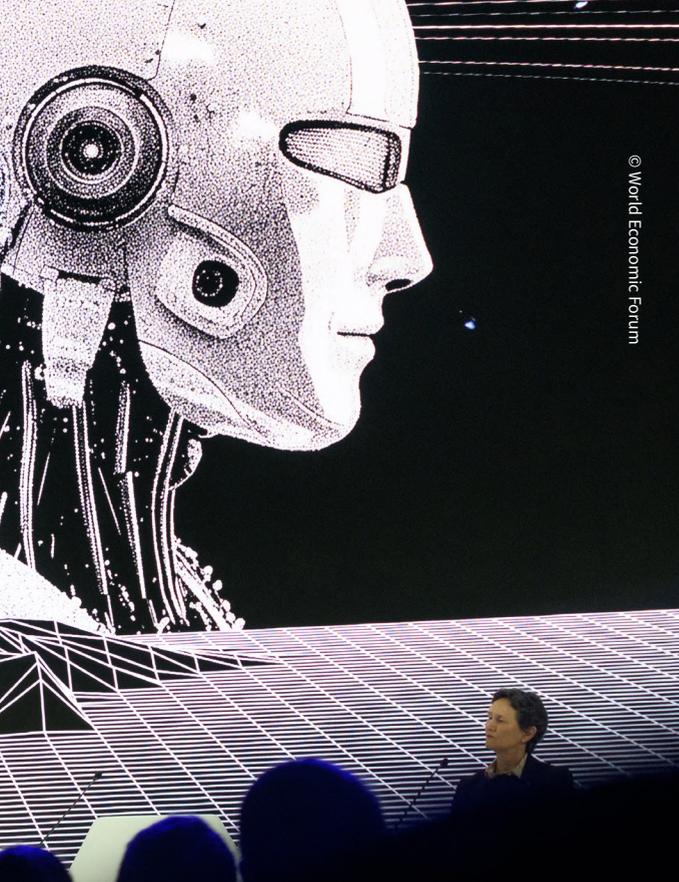
Turning Resources into Capabilities

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Cross-border e-commerce, as one of the engines driving global trade growth, inherently functions as an efficient channel for the flow of knowledge.

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Challenges have emerged, yet responses are far from unattainable. Over the past decade, leading platform enterprises and advanced economies have accumulated a set of proven practices through their engagement in digital trade. From platform technology and data tools to supply chain collaboration and talent cultivation, these elements together form a relatively mature digital commercial ecosystem. As illustrated in the *Cross-Border E-Commerce Practice Case Studies (2025)* released by the World Internet Conference in Shenzhen [8], platforms can share their accumulated expertise, enabling a broader range of market participants to benefit. Take the e-commerce platform SHEIN as an example: through its "proprietary brand + platform" model, the digital supply chain experience and global market insights once confined within the company have gradually been made accessible to merchants across multiple industrial clusters domestically.



© World Economic Forum

These best practices themselves outline a competency profile for talent development, offering a concrete reference point.

From these practices, we can now discern the competency profile of a composite talent, which is often described as a "T-shaped" structure: a vertical pillar formed by solid digital technical skills, such as data analysis and platform operation, coupled with a horizontal breadth that extends outward to connect with an understanding of the global business environment, including market insight and cross-cultural communication. It is precisely this combination of specialised depth and industry-wide breadth that constitutes the competitiveness of talent in the digital-intelligence era.

When the industry's demand for competencies grows more urgent, and the experience and resources for reference indeed exist, the

central question becomes how to transform these resources into accessible capabilities for a broader population. It is in this sense that education plays a decisive role: it helps learners construct their competency frameworks and determines who can truly enter the industrial field and sustain their relevance amid continuous change. This is because, alongside long-accumulated knowledge systems, we equally require a more flexible, inclusive, and future-oriented skills system—one that enables individuals to continually learn, adapt, and participate in creation within an ever-evolving environment. Hence, advancing "reskilling" training for those entering or re-entering the labour market has become essential.

Cultivating digital-intelligence talent is becoming a pivotal lever connecting educational equity, economic development, and inclusive growth—core objectives of sustainable development.

It is first reflected in youth employment. As traditional industrial jobs decline and white-collar roles become automated, conventional career paths are narrowing. The global youth unemployment rate rose to 12.4% in 2025, with approximately 260 million young people classified as "NEET" (Not in Education, Employment, or Training) [9]—a trend driven in part by the rapid evolution of industry skill demands. At the same time, new economic models centred on digital trade are rapidly emerging, creating a wide range of novel and flexible job opportunities. Whether as independent entrepreneurs in cross-border e-commerce, digital marketing specialists, or project coordinators in software service outsourcing, these roles rely less on upfront capital and more on the ability to learn quickly, apply digital tools, and solve real-world problems. This opens a new pathway for

young people, women, and marginalised groups to participate directly in the global market by mastering relevant skills—often bypassing traditional career ladders. Higher education institutions (HEIs) can help convert young people's existing digital experience into sustainable livelihood capabilities and developmental capital by providing targeted skills training, industry certifications, and entrepreneurship support.

Equally important is advancing South-South and North-South cooperation to accelerate the integration of the Global South into the digital era. By collaborating with enterprises to develop practical curricula, provide technical consulting, and cultivate talent with applied capabilities, we can help SMEs in Global South countries leverage digital platforms to access global markets. This goes beyond commercial success. It strengthens endogenous drivers of growth through skill localisation. Technological expertise and systemic experience from the Global North can flow southward, while innovative practices emerging locally in the Global South, such as social commerce and mobile payment

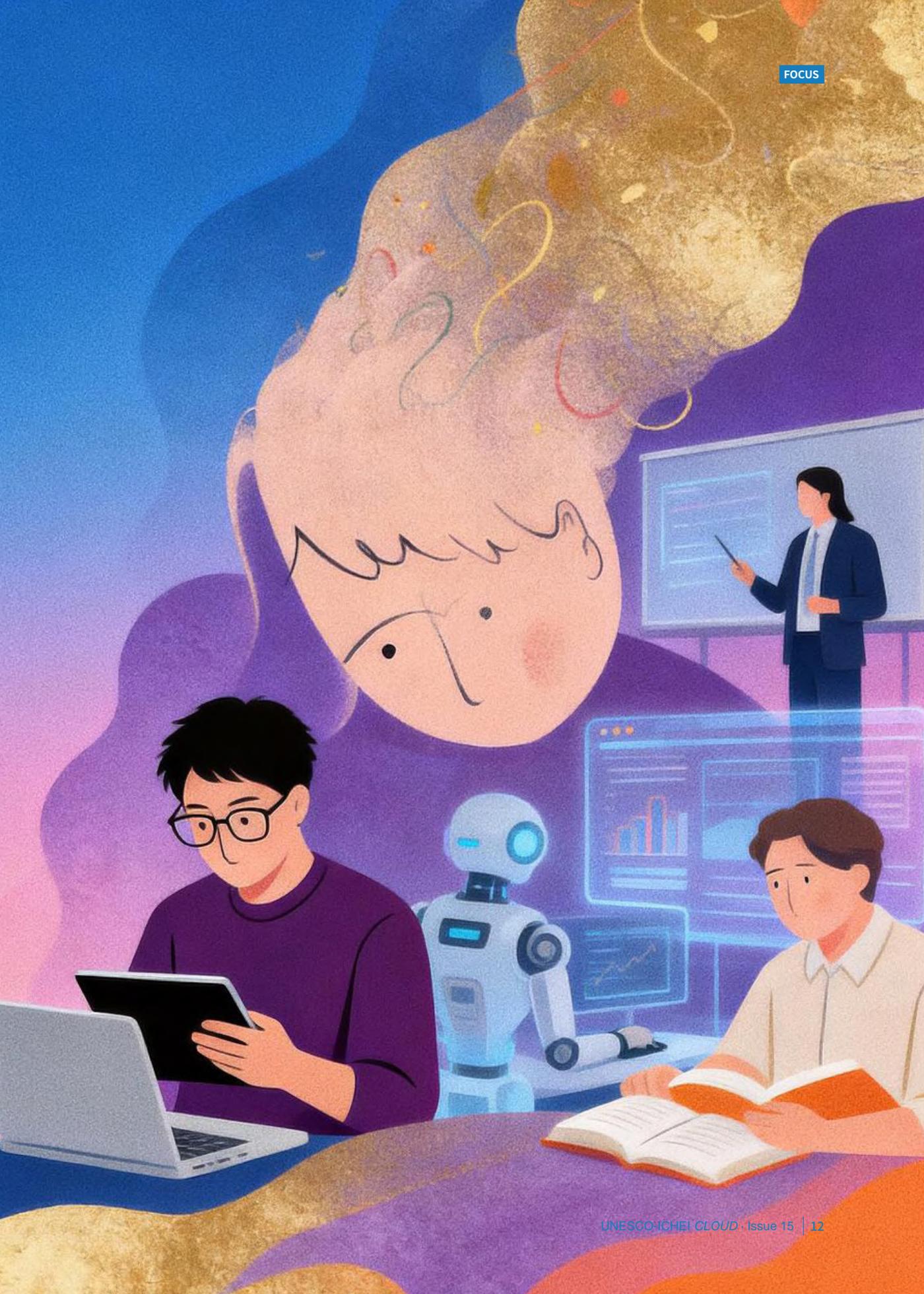
systems, can contribute diverse models. This kind of two-way interaction and sharing lies at the heart of bridging the digital divide and achieving inclusive growth.

Ultimately, it's about preventing new forms of exclusion, particularly the risk of "skills obsolescence." By introducing high-quality curricula, micro-certifications, and teacher-development programmes into resource-constrained regions, we bridge not only gaps in educational infrastructure but also lay a more equal and solid foundation for every individual's development.

These considerations underpin the recent launch of the "AI + Industry" micro-certifications courses by the International Institute of Online Education (IIOE), which include the "AI + Cross-Border E-Commerce" series. The initiative aims to develop learners' capacities for judgment, action, and adaptation in real-world commercial environments. The related explorations and practices will be presented in this issue of *CLOUD*.

References:

- [1] Nobel Foundation, "Nobel Prize Outreach 2026," *Nobel.org*, Jan. 2026.
- [2] Aparna Bharadwaj&Kasey Maggard, "The future of global trade? Introducing the trade patchwork model," *World Economic forum*, Jan. 2026.
- [3]Shopify,"AI Statistics for 2026: Top Ecommerce Trends," *Shopify*,Sep.2025.
- [4] UN trade&development, "Global Trade Update (January 2026): Top trends redefining global trade in 2026," *UN trade&development*, Jan. 2026.
- [5] Li Jiabao, "Africa's E-commerce Accelerates Development (Global Hot Topics)," *People's Daily Overseas Edition*, Aug. 2024.
- [6] The Economic and Commercial Office of the Embassy of the People's Republic of China in the Republic of Cameroon, "Africa's E-commerce Market Size to Double in Five Years, Reaching \$113 Billion," *Ministry of Commerce of the People's Republic of China*, Nov. 2024.
- [7] Hugo Cross-border Editorial Department, "Latin American E-commerce 2025: Brazil + Mexico Control 2/3 of the Market Share! Chile and Peru Become New Gold Mines," *Hugo Cross-border*, May 2025.
- [8] World Internet Conference, "Cross-border E-commerce Practice Case Studies (2025)," *WIC*, Sep. 2025.
- [9] International Labor Organization, "Employment and Social Trends 2026," *ILO*,2026





When Trade Begins to Think: New Possibilities in Emerging Markets

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We are witnessing a global digital trade revolution driven by AI agents.

”

A Nigerian buyer can complete direct sourcing from a Chinese factory within minutes via an AI platform. Southeast Asian consumers can make purchasing decisions with the help of AI assistants, boosting conversion rates. Central Asian traders can use AI to analyse vague and scattered demand, thereby discovering blue ocean markets.

This goes beyond the application upgrade of technological tools, pointing to a deep transformation: the connection between consumption, commerce and production is being re-established, with the core shifting from a "people finding goods" cross-border transaction model to a new form of "goods finding people" and even "demand directly connecting with manufacturing".

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For emerging markets in Southeast Asia, Central Asia and Africa, this change brings entirely new possibilities for participating in global digital trade and unleashing their economic potential. The combination of artificial intelligence with cross-border e-commerce and digital trade is becoming an important driving force for stimulating regional potential.

How AI is Redrawing the Rules of Global Trade?

In the age of intelligent agents, the rules of the game are being rewritten. The basis of commercial competition is shifting from capturing human attention to earning the trust of AI systems that interpret and evaluate data.

Acting as a proxy for the user, AI tends to base its judgements and decisions on the rational analysis of structured, machine-readable product data rather than on eye-catching marketing. In other words, a product's digital profile, including its precise technical specifications, compliance certifications and details of compatibility, can matter more than any advertisement.

These shifts are already prompting a number of adjustments. The centre of online traffic is moving from the search box to AI-driven conversational interfaces. Within these interfaces, recommendations, summaries and direct links can guide users through the purchasing process, making so-called "zero-click" transactions increasingly possible. Also, established commercial dynamics are beginning to change. The traditional logic of brand premiums is being challenged, and relying solely on brand visibility may become less effective. Instead, platforms and

merchants are paying closer attention to whether their data can be easily interpreted by AI and whether product information is presented in a more transparent and structured way. In this context, making data "AI-friendly" may well become a new threshold for participating in digital trade.

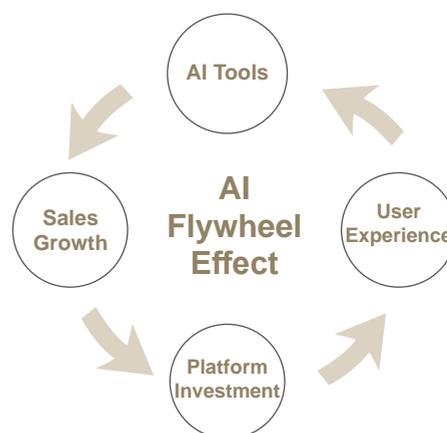
Additionally, discussions about trust and responsibility have been brought to the forefront—when intelligent agents are allowed to represent users in inquiries, ordering, or payments, the trust system can be rebuilt. By establishing a credible digital identity and authorisation boundaries for AI agents, a new cornerstone for cross-border transactions is constructed.

Growth of Emerging Markets

Although the underlying logic is similar, Southeast Asia, Central Asia, and Africa differ significantly in market fundamentals and consumer habits, and their AI-enabled growth paths are also distinct.

Southeast Asia: The Ecological Flywheel

Southeast Asia has become one of the regions where the integration of AI and





THEN
AND
NOW

From endless calls to effortless clicks.



MODERN
SHOPPING

From endless search to effortless style.



MARKET
DISCOVERY

From vague demands to global solutions.

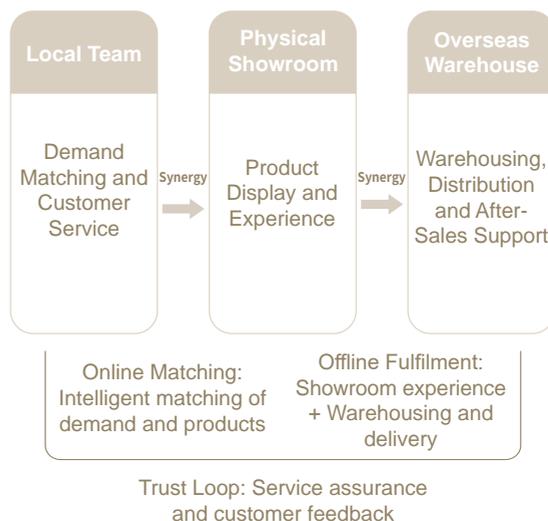
cross-border e-commerce is most advanced. Building on a well-established consumer internet ecosystem, AI tools are woven into stages of transactions and business operations. Through everyday use, these tools interact and reinforce one another, creating a self-sustaining cycle of growth.

A large population of young internet users and high levels of mobile connectivity have created fertile ground for AI applications. Some e-commerce platforms, such as Lazada, have introduced AI shopping assistants that offer personalised recommendations and virtual try-on features, helping consumers make decisions more easily. These tools are not particularly complex, yet they subtly improve the shopping experience and make the path to purchase smoother.

On the seller side, AI tools covering the entire process, from intelligent product listing and customer communication to cross-language services, are gradually being integrated into everyday operations, improving efficiency for merchants. A powerful cycle begins to take shape: AI improves efficiency, better experiences encourage purchases, sales grow, and the gains are reinvested in further AI development.

Central Asia and BRI: Infrastructure Empowerment

In Central Asia and parts of the Belt and Road region, developments tend to follow a more industry-oriented path, centred on business-to-business cooperation. Here, supply chains provide the backbone, while emerging digital infrastructure is increasingly used to address long-standing challenges of trust and efficiency in cross-border trade.



|"Trinity" Overseas Operations Centre Model Diagram

These markets hold considerable potential, but in reality, they also face severe information asymmetry and high trust costs. Some practices have explored connection methods centred on the industrial internet: by building a three-in-one digital hub integrating localised teams, physical showrooms, and overseas warehouses, transaction barriers are systematically reduced, providing "visible trust." In this process, AI is also used to organise and interpret previously vague demand information, revealing latent blue ocean markets such as "special construction materials suitable for high-temperature environments." The aggregation of such information not only helps to identify previously overlooked niche demands but also provides reference for product improvement and production adjustments. Finally, this drives flexible manufacturing. As front-end orders gradually accumulate, the production process can be more flexibly adjusted according to actual feedback, enabling small-batch, diverse demands to be met more effectively.



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Africa: Leapfrog Development

Africa's markets present a more diverse picture, with a focus on leveraging AI to make vertical breakthroughs in high-value scenarios while strengthening infrastructure.

The continent's digital economy is vibrant and growing, yet fundamental conditions such as electricity, connectivity, and payment systems still present challenges. It is in this context that many initiatives have chosen to begin with specific and clearly defined use cases. Rather than attempting to build all-encompassing platforms, many efforts focus on areas where demand is concentrated, such as agricultural technology, cross-border B2B procurement, and localised financial services. For instance, AI-driven B2B platforms helps African buyers connect more directly and efficiently with

factories in China and elsewhere. AI tools are also increasingly used to interpret local cultural contexts, offering insights that inform product design and service adjustments so that goods better match real-world conditions of use.

These developments do not occur in isolation. The growth of digital trade often advances alongside improvements in physical infrastructure, such as logistics and energy systems, so that, together, they gradually enable new forms of economic connection.

Shared Foundations and Future Prospects

Successful growth models tend to rest on two essential foundations. The first is deep

localisation and the building of trust. Bridging cultural divides begins with understanding and respecting local contexts, and with the relationships that grow from this engagement. No matter how technology evolves, navigating differences in culture, institutions, and markets ultimately depends on sustained, attentive collaboration on the ground.

The second foundation is data-driven supply-chain flexibility. By using AI to connect fragmented demand around the world with agile manufacturing, digital tools help organise scattered information and improve coordination across production and distribution. As these connections strengthen, markets that once operated in isolation can gradually become part of a more resilient and interconnected network.

As AI and digital trade continue to develop, the focus of discussion is also changing. Beyond the movement of goods across borders, increasing emphasis is being placed on how capabilities can take root, grow and be used long-term locally. In this process, the value of platforms, technology and training resources lies not only in efficiency improvement but also in their ability to support local talent development, promote knowledge sharing, and create positive interactions with educational systems and industrial development.

From this perspective, the experience accumulated by some developed economies and China in the cross-border e-commerce sector can be treated as open resources, combined with the practical needs of countries in the Global South, and translated and applied within a multilateral cooperation framework. Through curriculum development,

skills training and institutional coordination, digital trade has the potential to become a practical path for narrowing the digital and educational divide.

Technology itself does not automatically bring inclusive growth, but under careful guidance and joint participation, it can open windows to global markets for more people. For many emerging economies, AI-driven digital trade is still in a stage of continuous exploration. The future key may lie in enabling more regions, learners and practitioners to participate in this ongoing transformation with capacity and appropriate conditions.

AI-driven digital trade is the certain future of reshaping the global landscape. For emerging markets, this high-speed train has already departed.





The Greater Bay Area: Innovation in the Making

© DJI

| DJI Flagship Store in Shenzhen

The Guangdong-Hong Kong-Macao Greater Bay Area (GBA) is often described as one of the world's most dynamic hubs of the digital economy. This is accurate, yet it can feel distant. More concrete images might appear in an office in Shenzhen Bay Science and Technology Ecological Park at night, where a cross-border transaction facilitated by an AI agent has just been completed; or in a mould factory in Dongguan, where an engineer fine-

tunes a production line equipped with AI-powered visual inspection; or in a classroom in Guangzhou, where students run online shops for customers who may be based in the Middle East, Africa or Latin America.

From a macro-level perspective, the Greater Bay Area occupies less than 0.6% of China's land, supports a population of approximately 86 million and generates nearly one-ninth of the country's total economic output. In 2025, its innovation cluster topped the list of the "World's Top 100 Innovation Clusters" [1]. At a level closer to industry, the total value of foreign trade imports and exports for the nine mainland cities of the Greater Bay Area reached 8.75 trillion yuan in 2024 [2]. In the realm of cross-border e-commerce, Shenzhen hosts around 120,000 sellers and 100,000 supporting

| Shenzhen-Hong Kong-Guangzhou claims the top spot in 2025 Global Innovation Index

Global Innovation Index 2025
Top 100 Innovation Clusters

1

Shenzhen-Hong Kong-Guangzhou
China and Hong Kong, China

© WIPO



service providers [3], making it a central hub nationwide. Behind this scale lies an operational model interwoven with technology application, talent mobility and industrial collaboration.

A more immediate set of questions begins to emerge. At a time when the shortage of AI talent remains significant, why have the factories and offices of the GBA become sites of experimentation? When an industrial ecosystem coexists deeply with AI, what new demands does it place on human capabilities?

When AI Becomes a Buyer

In this region, technology functions more like a constant background hum, quietly reshaping the rhythms of work and the division of tasks. If one seeks a scenario that most vividly encapsulates this transformation, cross-

border e-commerce offers a clear point of entry: transactions are frequent, feedback is immediate, and the demands placed on efficiency and judgement are more direct, revealing (earlier than most) how processes are being reconfigured.

Some cross-border sellers have begun to use AI intelligent agent tools provided by the platform.

One such example is "AlphaShop" (Ao Xia), launched by Alibaba's 1688 platform in Shenzhen[4], whose defining feature is a simple but powerful premise: if it can be seen, it can be sold. In the past, when sellers spotted a trending product on overseas social media, they often had to rely on experience to infer its materials and production methods, before navigating a complex supply chain in search of a suitable manufacturer, sending enquiries, refining samples and waiting for replies. The process was time-consuming, uncertain and heavily dependent on individual judgement.

Now, a single uploaded image can set a different sequence in motion. The system conducts initial market analysis, breaks down product features and matches potential suppliers, while flagging relevant compliance requirements and standards in the target market at an early stage. Tasks that once took days can be completed in a fraction of the time. It can also filter for manufacturers capable of small-batch production, responsive communication and cross-border service, reducing friction from the outset.

In one pilot case, a seller using AlphaShop received market insights, niche recommendations and a shortlist of factories within minutes. Daily sales rose to five or six times those of previous bestsellers, with a marked improvement in conversion rates.



| 1688 cross-border e-commerce AI intelligent agent AlphaShop ("Ao Xia")

Behind this shift lies a layered set of technological innovations. At its foundation is a dual-sided data system, bringing together supply-side factory data, such as procurement costs and delivery reliability, with demand-side signals drawn from global e-commerce trends, including Amazon pricing and overseas consumer preferences. Built on this is a hybrid model architecture: Alibaba's proprietary Qwen large language model forms the core, complemented by an AlphaShop model fine-tuned specifically for cross-border trade scenarios. Alongside it runs a multi-agent system, in which complex tasks are broken down and distributed across specialised agents working in coordination. The result is not only greater efficiency, but also a marked reduction in so-called AI "hallucinations", keeping outputs grounded and reliable.

Cross-border practitioners in the Greater Bay Area are rapidly adapting to the redistributed work processes. Processes previously limited by experience, connections, and luck are being replaced by a more stable approach.

Algorithms are gradually taking over those tedious, inefficient, and information-asymmetric mechanical tasks, while creating new roles that require deep thinking, strategic judgement, and cross-domain collaboration. Today's cross-border e-commerce practitioners no longer need to handle product selection materials or basic inquiries themselves. They can focus more on predicting market trends, differentiating their brands, and finalising business decisions. This shift has not only improved the efficiency of matching supply and demand, but has also begun to erode the information barriers that long underpinned traditional trade.

Similar shifts can be observed across other industries in the Greater Bay Area. In advanced manufacturing and robotics, engineers are no longer concerned solely with mechanical structures; they also understand how algorithms are woven into production processes. In the world of wearables and smart devices, product managers find themselves constantly balancing algorithmic

capability, hardware constraints and feedback from overseas markets. In digital health and the life sciences, questions of data handling, privacy compliance and cross-border collaboration have become part of everyday work. Across these varied fields, technology now runs through the entire process, from design and production to service.

How to Organise Capabilities: Intelligent Networks

As AI and digital technologies become embedded in industrial processes, a deeper shift is unfolding in the GBA: the region is learning how to organise itself more swiftly.

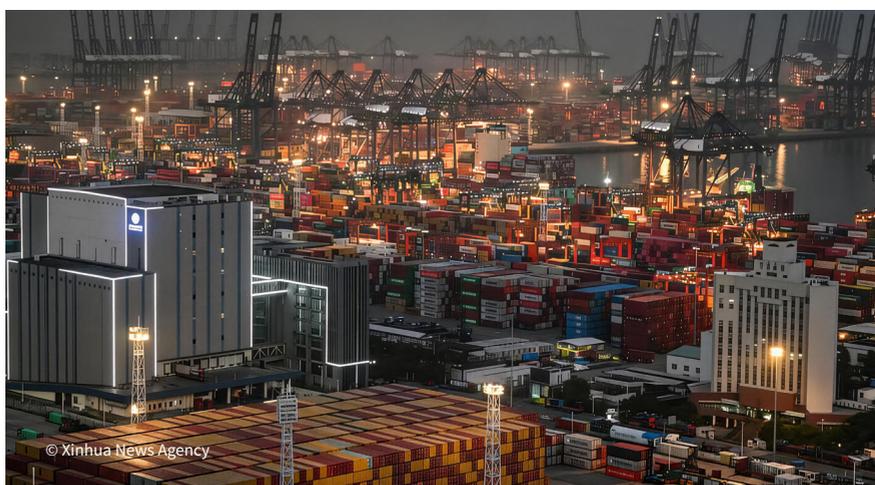
Fluctuations in the external environment and the fragmented demands of online shopping have put pressure on manufacturing and trade: order sizes are shrinking, delivery cycles are shortening, and customisation requirements are increasing, while changes in tariffs, exchange rates, and market rules can disrupt existing plans at any time. Against this backdrop, the GBA relies on cross-city collaboration to reconnect research and development, manufacturing, logistics, settlement, and compliance, forming a shorter and more flexible operational chain.

This capability is reflected in rapid "chain formation." The Greater Bay Area has gathered approximately 300,000 upstream and downstream supporting enterprises. From design and mould making to component supply and assembly production,

specialised companies collaborate locally at each stage. For example, when a customer requests a customised smart bracelet with BeiDou positioning functionality, a solution design team in Shenzhen, a mould factory in Dongguan, and a battery supplier in Huizhou can be quickly matched, forming an executable solution in a short period of time. The division of labour among the various stages is clearly defined: who is responsible for the design, who undertakes trial production, and who ensures the supply of key components. This collaborative approach reduces the time from product conception to implementation, making customisation a routine capability that can be continuously undertaken.

The continued operation of this collaboration also relies on the hard connectivity of infrastructure and the soft connectivity of institutional rules. From cross-sea bridges and high-speed rail networks to ports and airports, the travel time between cities in the GBA is constantly shrinking, facilitating the flow of research and development personnel, samples, and goods. The integration of settlement, customs clearance, certification, and other institutional arrangements is becoming increasingly seamless. The practice

| Shipping containers at Yantian Port in Shenzhen, China



© Xinhua News Agency

of the Zhuhai Hengqin Free Trade Zone is a microcosm of this soft connection [5].

Seen from a broader perspective, the Greater Bay Area is beginning to take shape as an intelligent network, in which capabilities are amplified and recombined through collaboration, and, in turn, made more resilient.

Shenzhen: Starting from the Industrial Site

An increasingly uncertain external environment has prompted many companies in the Greater Bay Area to reconsider their place in the global market. Fluctuating

demand, shifting regulations and recurring trade frictions have brought pressure, but also pushed firms to look towards emerging markets in Southeast Asia, the Middle East and Africa. In this process, strengthening in-house research and development, and building more differentiated products, has become a shared direction for many of them.

Artificial intelligence is being brought more deliberately into production and service processes. As a key node of technological innovation within the GBA, Shenzhen has long been defined by its emphasis on application. Here, new technologies tend to move quickly from development into use, where they are refined through practice rather than perfected in isolation. Drawing on a strong industrial base and a diverse ecosystem of firms—from established technology leaders such as Huawei and Tencent to newer hardware innovators like DJI, Insta360, Bambu Lab, PaXini, Shenzhen is using AI to reshape the entire chain of research, production and service. In turn, this capability is beginning to extend into the wider manufacturing hinterland of the region, including Dongguan, Foshan and Guangzhou [6].

This model, grounded in collaboration and real-world application, has not only accelerated the pace of internal iteration within enterprises, but also opened up new possibilities for smaller and medium-sized enterprises to enter global markets. By integrating cross-border e-commerce with industrial clusters, manufacturers that once relied primarily on contract production are beginning to reach overseas customers directly, whether through third-party platforms or their own independent sites. For these firms, this shift is not simply an expansion of market reach, but a process of relearning their capabilities.



© DJI



| Tactile Humanoid Robot

As AI capabilities accumulate in industry, more and more manufacturing enterprises are beginning to view it as part of "going global" and a key element for participating in the international market.

Such an environment facilitates the sharing of technology and creates conditions for narrowing the digital divide. Unlike Silicon Valley, which originated from universities and research institutions, innovation in Shenzhen stems primarily from the marketplace itself. Design, manufacturing and supply chains are situated in close proximity, shaping a coordinated way of working. This development path is built upon long-term and pragmatic cooperation both within and beyond the region, supporting the exchange and sharing of technology and knowledge on a broader scale.

Real-world Capabilities

Universities: Understanding Technology Through Practice

As industries raise new demands, education must respond. As early as the twelfth issue

of *CLOUD*, we placed the issue against the backdrop of the accelerating evolution of the industrial structure, economic model, and educational landscape in the GBA, focusing on the exploratory practices of several universities: Southern University of Science and Technology, The Hong Kong University of

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CLOUD Issue 12 "Teaching and Learning with Generative AI: Perspective from the Guangdong-Hong Kong-Macao Greater Bay Area"



Science and Technology, Shenzhen University of Advanced Technology, City University of Hong Kong, and other institutions continuously seeking a balance between cultivating innovative talent, scientific research, and the commercialisation of research results; while the university-enterprise cooperation practices represented by the BGI Group demonstrate another pathway for industry-education integration to address the demand for scarce talent.

This change is particularly evident in highly dynamic industries such as cross-border e-commerce. The distance between the classroom and industry is rapidly narrowing, and technical training is constantly tested, adjusted, and refined in real-world scenarios. Students are developing the ability to understand technology, assess problems, and respond in changing environments.

TVET: Bringing the Classroom into Reality

In the field of vocational education, this shift is quite evident. At the the School of International Digital Business at Guangzhou Vocational and Technical University of Science and Technology, classrooms have

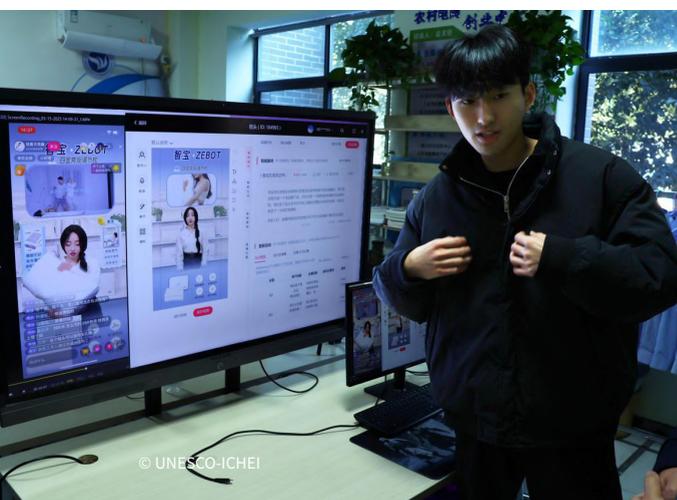
been transformed into workspaces for cross-border e-commerce companies [7]. Students operate real online stores in groups, handling every stage of the process—from product selection, photography, graphic design to online promotion and logistics coordination. An online store for oral care products, operated by a student team, has achieved annual sales exceeding one million yuan. For these students, data is no longer merely a case study found in textbooks, but rather real-world feedback that demands their attention and response every single day.

Similar explorations have also appeared in other institutions. Shenzhen Polytechnic University has opened workshops related to AI tools, introducing constantly updated technologies into the classroom [8]. Its "Cross-border E-commerce Practice" course uses real transaction processes as the main thread, allowing students to understand platform rules, supply chain collaboration, and job division in specific tasks. Learning progresses gradually around problems and scenarios.

In 2024, a national consortium for the integration of industry and education in cross-border e-commerce was established in Dongguan [9], bringing together vocational institutions and enterprises to create a shared platform for collaboration. It indicates vocational education responds more steadily to the shifting needs of industry.

Enterprises: Defining in the Production Chain

Enterprises are also involved in shaping capabilities. For example, SHEIN, the Guangzhou-based fashion company and cross-border e-commerce giant, has begun gradually extending its work on supply chain



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management and digital transformation into the realm of talent development [10]. Around the actual job requirements, the enterprise cooperates with vocational institutions to develop courses, embedding production, operation and data analysis into the instructional process. In its industry-education integration training base, students undergo assessments based on real-world projects, simultaneously earning both a national vocational skills grade certificate and an enterprise-specific job certification. This "dual certification" mechanism makes the connection between learning and employment smoother.

Corporate engagement is further manifested in the reciprocal empowerment of both upstream and downstream segments of the supply chain. Through collaborations with academic institutions to develop customised curricula and jointly establish "micro-specialisations," as well as by providing continuous training to suppliers' employees, capabilities across

For economies still searching for their own path, the story of the Greater Bay Area offers a point of reference: how technology might be folded more naturally into everyday life, how capabilities can take root within industry, and how learning might return to the real world.

The more common face of innovation is likely one of tentative exploration, adjustment, and rewriting—over and over again. This process is still unfolding.

the entire supply chain are disseminated on a broader scale. Technical expertise and practical experience are no longer confined within the boundaries of individual enterprises but are instead progressively shared through collaborative efforts.

References:

- [1] World Intellectual Property Organization (WIPO), "Global Innovation Index 2024/2025: Shenzhen-Hong Kong-Guangzhou Cluster Ranks Top Globally," *WIPO*, 2025.
- [2] General Administration of Customs (Guangdong Sub-administration), "Statistical Data on Foreign Trade of the Nine Cities in the Greater Bay Area for 2024," *Customs.gov.cn*, Jan. 2025.
- [3] Shenzhen Municipal Bureau of Commerce, "2024 White Paper on Cross-border E-commerce Development in Shenzhen," *Commerce.sz.gov.cn*, 2024.
- [4] Alibaba 1688, "Launch of AlphaShop: An AI-driven Agent for Global Sourcing and Supply Chain Matching in Shenzhen," *1688 News*, 2024.
- [5] Executive Committee of the Hengqin Guangdong-Macao In-depth Cooperation Zone, "Implementation and Impact of the 'Tiered Management' Policy in Hengqin (2024-2025)," *Hengqin.gov.cn*, 2025.
- [6] Shenzhen Science and Technology Innovation Bureau, "AI-Driven Industrial Transformation: From Hardware Tech to Regional Supply Chain Integration," *Stic.sz.gov.cn*, 2025.
- [7] Guangzhou College of Technology and Business, "Case Study on Integrated Industry-Education: Practical E-commerce Labs and Student Entrepreneurship Success," *GZ_College*, 2024.
- [8] Shenzhen Polytechnic University, "Workshop on AI Tools and Curriculum Standards for Digital Trade and Cross-border E-commerce," *Szpu.edu.cn*, 2024.
- [9] China Education Daily, "Inauguration of the National Cross-border E-commerce Industry-Education Integration Community in Dongguan," *Jyb.cn*, 2024.
- [10] SHEIN Group, "Empowering the Supply Chain: Industry-Education Integration and Dual-Certification Programs," *Sheingroup.com*, 2024.

Insights from IIOE's Industry-Oriented Learning Initiatives



In working alongside universities, vocational colleges, businesses, and public institutions, the International Institute of Online Education (IIOE) has increasingly found itself returning to a simple but pressing question: how can learning keep pace with industrial transformation? For higher education institutions (HEIs), the challenge is tangible: can curricula be updated quickly enough, and are teaching staff equipped to deliver new skills? For educators, the questions are more immediate: whether to learn, what to learn, and how to meaningfully integrate AI into teaching. For students, the concern is more direct still: will what I am learning today still matter tomorrow?

The deeper driving force stems from industry. Digitalisation and AI technologies are accelerating changes in work practices, calling for a more profound educational response, specifically the cultivation of composite competencies that integrate technology into industrial processes, support decision-making, and create value within workplace scenarios.

Grounded in a close reading of both higher education systems and labour market demands and shaped by long-term engagement with partner institutions, IIOE has sought to bring AI into higher education through collaboration between universities, industry, and research. Since 2025, this has led to a clearer focus on "AI + Industry", with micro-certifications as a key vehicle. Through this approach, IIOE has worked to deepen localised models of curriculum development, capacity-building, and training, gradually connecting the pathways between learning, certification, and employment.

The Evolution of the Curriculum System

In response to the needs of partner institutions, IIOE developed a series of micro-certification courses, including "Digital Skills for Teachers" and "Generative AI for Higher Education Professionals", prior to launching the "AI + Industry" series. At the time, these initiatives were centred on a more immediate question: how to support university teachers in understanding and applying ICT and the fundamentals of generative AI within their teaching practice.

Looking towards future educational trends, IIOE has established a leading layout by launching "AI + Discipline" micro-certification courses. These include "AI + Medicine" and "AI + Education" developed in collaboration with the iMED team from Southern University of Science and Technology, as well as planned courses in "AI + Agriculture", "AI + FinTech", and "AI + Clean Energy".

What, then, sets "AI + Industry" micro-certifications apart? They signal a shift in both direction and perspective: from a focus on academic disciplines to the realities of industry, and from organising knowledge to understanding workflows and the skills required for specific roles. In doing so, they mark an extension of IIOE's course ecosystem beyond the educational sphere into the world of work, distinguishing themselves from earlier offerings in several important respects.

	Digital Skills and AI Courses / "AI + Discipline" Courses	"AI + Industry" Courses
Driving Entity	Led by IIOE/HEI experts; delivering cutting-edge knowledge and pedagogy.	Led by enterprises (e.g., BGI); defining real industrial skill requirements.
Core Objective	Competency popularisation and teaching empowerment; improving education and research standards.	Precise employment and skill matching; aligning with specific job role skills.
Content Logic	"Disciplinary Knowledge + AI Tools"; technology serves the disciplinary knowledge system. Focuses on digital literacy, basic AI understanding, and the application of AI tools within disciplines to solve the problem of how to use capabilities in a professional context.	"Industrial Workflow + AI Empowerment"; courses are deconstructions and simulations of real-world work tasks. Solves the problem of how to translate capabilities into job value and employment.
Outcome Certification	Focuses on knowledge mastery and teaching application capability certification.	Focuses on industrial application capability certification.

One of the most distinctive features of this approach lies in the depth of industry involvement in course design. Rather than simply identifying which skills should be taught, the courses begin with real-world industrial contexts and job requirements, asking how skills are actually applied in

practice, and how they can be developed into capabilities that translate directly into workplace value. In this process, IIOE's role has also evolved, creating a mechanism through which universities and companies work together to define what those skills should be.

| "AI + Health" series course, developed in collaboration with ILEA in Singapore, offers the "Healthy Lifestyle Coach Certification," focusing on exercise, sleep, and nutrition.

Currently, IIOE has co-developed "AI + Life Science" with BGI Group, co-created "AI + Health" with International Leading Education Alliance (ILEA), and collaborated with the China Association of Trade in Services (CATIS) and other institutions to develop the "AI + Cross-Border E-Commerce" curriculum system. On 15 January 2026, IIOE officially launched its first set of "AI + Cross-Border E-Commerce" micro-certifications, initially aimed at university leaders and teaching staff worldwide. These early offerings are designed to lay the pedagogical and operational groundwork for a broader rollout, with student-focused courses to follow throughout 2026.



What do we mean when we talk about "AI+"?

Artificial intelligence is fast becoming the underlying logic of many industrial workflows. From gene-sequence analysis in the life sciences to product selection and marketing in cross-border e-commerce, it is reshaping the skills that different roles now demand. "AI+Industry" micro-certifications, therefore, are not simply existing courses with a new prefix attached. Rather, they embody a different learning logic—one in which curricula evolve alongside industry, continually adapting and renewing themselves. At their core, these programmes function as a living catalogue of industry-relevant capabilities, designed for lifelong learning.

Enterprises as Co-designers of the Curriculum

Taking the "AI + Life Sciences" course in collaboration with BGI as an example, it originates from BGI's actual business scenarios and the demand for talent who are proficient in biotechnology and can master intelligent and automated technologies. The course content covers a complete system from basic theory to cutting-edge applications, ensuring that students can apply what they learn immediately.

The curriculum design is comprehensive and practical, with a focus on cultivating data insight, AI scenario application capabilities, and a spirit of cross-disciplinary and cross-role collaboration. The theoretical modules guide learners to gradually build a cognitive framework for research and industrial scenarios: how to use

multi-omics and single-cell technologies to understand living systems, how to process data and make judgements in intelligent laboratory environments, and how to apply these capabilities to health management, agricultural ecology, material design, and even brain science. The courses deliberately retain a cross-disciplinary perspective, emphasising that the value of capabilities often arises at the intersection of disciplines and practical problems.

| IIOE "AI + Life Sciences" Course



Cyber-Physical Learning Alliance Summit 2025

Connecting Minds, Technology and Learning Spaces

Data-Driven Education | Artificial Intelligence | Innovative Learning Space
Synchronous Seamless Learning | Human-Centered and Ethical CPL | Immersive Learning and XR



| UNESCO-ICHEI at the 2nd Cyber-Physical Learning Alliance Summit (CPLAS 2025)

The curriculum also includes practical modules where students are guided to personally disassemble and assemble sequencing instruments, operate data platforms, and collect personalised health data. This further narrows the distance between learning and work; by interacting

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Developing "AI + Industry" courses is, by nature, a collaborative process between universities, industry, and research institutions.

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with equipment, operating platforms, and handling data, learners better understand the requirements for accuracy, collaboration, and standardisation in an industrial environment.

In this model, industry plays a leading role in defining needs and shaping real-world contexts, while academia contributes its strengths in curriculum design and the structuring of knowledge. In developing the "AI + Cross-Border E-Commerce" programme, for example, organisations such as CATIS and the China Cross-border E-commerce 50 Forum worked closely with universities, including Hangzhou Normal University's Alibaba Business School, Xi'an International Studies University, and Shanghai University of International Business and Economics, alongside a range of domestic and international companies. Together, they have created a curriculum that is both grounded in industry realities and viable within an educational setting.

Global Delivery, Local Adaptation

Once a course has been developed, a more difficult question follows: how can it truly take root among universities and learners?

Drawing on a global network of over 150 partner institutions, IIOE is able to pilot its courses across countries, refining them through practice and feedback. Yet scale alone is not the point. Partner institutions are encouraged to reshape them in line with local industrial structures, skills needs, and even teaching traditions and cultural contexts. It is an approach that is rarely achievable on purely commercial online platforms.

At its heart lies a simple intention: to nurture talent that can stay, contribute, and grow within local economies. In this way, learning becomes not just a way for individual advancement, but a means of supporting communities and national development, turning global collaboration into a longer-term exchange grounded in mutual understanding and respect.

A New Ecosystem

Across the world, a growing number of educators and industry experts are turning to online platforms to develop courses that are closely aligned with real-world practice, translating their professional experience into more open and accessible forms of learning. Courses in areas such as digital marketing and AI have become especially prominent,

expanding where and how learning takes place, and allowing learners to engage more directly with an ever-changing world of work. It is in this context that flexible, open micro-credentials are increasingly seen as a bridge between education and employment.

Meanwhile, many countries, including China, are promoting policies for higher education to strengthen vocational training and technical skill cultivation. Enterprises in fields such as AI and FinTech are engaging in closer cooperation with HEIs to explore curriculum forms that are more aligned with actual needs. IIOE continues to advance curriculum innovation, hoping to jointly build a learning ecosystem with global partners that can better respond to the changes of the era.

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IIOE is stepping into a more mature stage of its ecosystem's development.

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In 2026, IIOE plans to explore more "AI + Industry" courses. As a global digital education platform, its role, influence, and ecological value are evolving. At this stage, the curriculum becomes a public tool to respond to the AI development agendas and industrial transformations of Global South. By cultivating future-oriented industrial talent, education can translate its long-term value into real capabilities that drive inclusive and sustainable growth.



Learning Across Boundaries: Designing IIOE "AI + Cross-Border E-Commerce" Micro-Certification Course

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What is the IIOE "AI + Cross-Border E-Commerce" Micro-Certification? How is it designed, delivered, and co-built?

Prior to the course's finalisation, IIOE underwent a process of research, deliberation, and iterative refinement. To ensure the course closely aligns with real-world needs, IIOE invited institutions with deep experience in cross-border e-commerce education, leading enterprises, industry associations, and government regulatory bodies to engage in collaborative discussions. As these discussions progressed, key consensus points emerged: the clarity of strategic policy intent from institutional leadership, the ability of teachers to bridge theory and practice flexibly, and the possession of practical operational

and problem-solving skills by students were identified as crucial factors for the course's practical applicability.

Consequently, the course design further delineated and responded to the roles and needs of three core stakeholder groups in higher education, forming a complete cycle from macro-level understanding to micro-level practice:

See Before Decide

Tier 1 is global perspective and top-level design (for leaders and managers). The objective is to cultivate decision-makers with a global outlook and systemic thinking. Content covers the global landscape of cross-border e-commerce, methodologies for designing university programmes, multi-platform operation strategies, and innovative practice cases from countries like China and Ethiopia. This helps managers grasp trends, understand models, and learn from experiences to scientifically plan their institution's cross-border e-commerce education and development path.

As mentioned, the international trade landscape is undergoing significant changes

with the accelerated restructuring of global value chains. Against the backdrop of sluggish growth in traditional trade, digital trade, particularly cross-border e-commerce, is creating new spaces and emerging as a key growth driver. Its rise has altered consumer goods trade patterns, enabling Global South countries and SMEs to participate more directly in global trade.

The course *Cross-Border E-Commerce Global Panorama* interprets the global market size, growth drivers, geopolitical analysis, key competitive factors, and policy and regulatory risks of cross-border e-commerce, helping managers build a foundational understanding. It makes them aware that cross-border e-commerce is not merely a commercial phenomenon but a complex field combining digital technology and international rules, requiring educational planning from the perspective of national development and regional economic needs.



Cross-Border E-Commerce Global Panorama

SUN Xiangyang

**Chairperson,
Cross-Border E-Commerce 50 People Forum China**

| IIOE Course: Cross-Border E-Commerce Global Panorama

Teaching in the Age of Platforms

Tier 2 is teaching capacity and professional depth (for teachers). The goal is to empower teachers to become "dual-qualified" talents with both theoretical knowledge and practical experience. Content focuses on core cross-border e-commerce operations, such as seller operations, compliance and risk management, new marketing strategies, payment and settlement, data analysis, and AI applications. The course not only imparts specialised knowledge but also enhances teachers' course delivery capabilities and practical guidance skills through platform hands-on practice (e.g., on platforms like E-Trade Cloud) and teacher development cases.

The course empowers the teaching workforce, developing "dual-qualified" teaching key personnel. It includes modules specifically designed for teachers, enhancing their expertise through "theory + platform practice + case studies"; provides teacher development cases and teaching guides to help them translate industry knowledge into teaching designs; and promotes the establishment of

a collaborative teaching mechanism involving university teachers and enterprise mentors, building a sustainable ecosystem for teacher development.

Getting Your Hands Dirty

Tier 3 is practical skills and process integration (for students and practitioners). The aim is to cultivate versatile technical talent with strong immediate operational capability, competent across the entire cross-border e-commerce workflow. The Global South faces pronounced digital divide issues, such as high concentration of cross-border e-commerce development in certain countries, poor infrastructure, outdated payment systems and regulatory challenges, and digital skills shortages. Notably, there is a shortage of versatile talent proficient in both international trade, supply chain, finance, tax, and compliance, as well as foreign languages, platform operations, digital marketing, etc.

The IIOE "AI + Cross-Border E-Commerce" Micro-Certification course content employs blended learning modules centred around

the entire cross-border e-commerce business process (from market entry, product selection, supply chain and logistics, pricing and marketing, to customer service, compliance, and risk control). Each step is broken down into standardised learning units comprising 1 theoretical video, 1 practical operation video, and 1 case study or tips sheet. This integrated Learn-Do-Reflect model ensures learners not only understand the "why", but also master the "how".

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The course aims to promote educational equity and inclusive growth, expanding the reach of quality education.

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The entire Cross-Border E-Commerce Micro-Certification forms an organic whole through its macro-strategic composition, achieving full-chain integration from conceptual guidance to teaching support and finally to skill application. It addresses the structural contradiction of education lagging behind industry, achieving deep industry-education integration. It transforms real business scenarios into teaching units, keeping classroom content aligned with market frontiers; provides universities with ready-to-use, high-quality teaching resources, significantly lowering the threshold and trial-and-error costs of course development; and empowers universities in their transition from knowledge transmitters to co-builders of industrial capability.

The micro-certification can serve as a supplement to degree programmes or be offered independently to in-service professionals and small business owners; its modular design facilitates localised adaptation based on specific national industry characteristics (e.g., agricultural exports, handicrafts), serving local economies; the online delivery model allows institutions in remote areas to access quality resources, narrowing the digital divide and enabling more youth, especially women and rural youth, to acquire knowledge for participating in global trade.

Still in the Making

For universities across the Global South, the course represents an effort to explore new, more systematic ways of approaching change. It offers institutions a different perspective on curriculum development and talent cultivation in cross-border e-commerce, helping align teaching design and skills development more closely with the evolving practices of the digital economy. It also provides students with a structured approach to gradually build professional capabilities that can adapt to international contexts.

In an era where digital technologies are reshaping the global trade landscape, IIOE stands ready to collaborate with its network, inviting HEIs worldwide to join hands in advancing the localised iteration, systematic refinement, and scaled implementation of curriculum series. This initiative aims to empower more economies and practitioners to seize opportunities in the digital economy and adapt to the demands of the AI era. We seek to foster inclusive and equitable development within the global digital economy, collectively advancing the construction of a digital civilisation.

Micro-Certifications and the New Order of Lifelong Learning

No longer confined to the margins as educational trials, micro-certifications today are increasingly being woven into mainstream education and skills frameworks. This shift reflects both mounting pressure on traditional, long-cycle education in the digital age and a direct response to labour markets where skills evolve faster than formal qualifications can keep pace.

Since 2025, debates over the value of university degrees have intensified worldwide, forcing a broader rethinking of how talent is identified and rewarded. Against this backdrop, the US software company Palantir launched the Meritocracy Fellowship, a four-month, full-time programme open to high-school graduates. With no degree requirement and no traditional admissions criteria, the offer

is disarmingly simple yet consequential—participants work alongside the company's core teams on real technical problems, with standout performers advancing directly to interviews for full-time roles.

The programme's self-description is deliberately provocative: *College may not be for everyone* [1].





| The Meritocracy Fellowship

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In an era in which occupations are constantly being reorganised, what learning outcomes deserve long-term trust?

”

Palantir's assertion has sent ripples across the surface of a long-still pond. As a central pillar of social mobility and career security, traditional degree-based education is now facing scrutiny from multiple directions. In advanced economies, university graduates increasingly confront skills mismatches and employment bottlenecks, making the disconnect between education and industry a policy challenge that can no longer be ignored. For developing countries, meanwhile, the mass expansion of higher education has

not necessarily translated into proportional career returns, prompting renewed reflection on the widening gap between credentials and capabilities.

The value of emerging learning model such as micro-certifications, therefore, is becoming visible. Far from serving merely as supplements to existing degree systems, they signal a broader shift in education: one that responds to individual development and labour-market demand, is shaped by the realities of the digital and intelligent age, and is embedded within a lifelong learning ecosystem.

Global Micro-Certification Ecosystems

From a global perspective, the development of micro-certifications has followed markedly different regional trajectories.

In China, local governments are exploring ways to embed learning outcomes within "credit bank", allowing diverse forms of

“

The Asia-Pacific stands out for the diversity of its experimentation and the scale of its institutional ambition.

”

learning to be documented, transferred, and mutually recognised as traceable educational capital. In Zhejiang Province, for example, standards for lifelong-learning micro-certifications have been introduced, digitally incorporating outcomes from community

education and vocational training into the credit system and enabling cross-sector recognition of learning achievements [2].

Elsewhere in the region, micro-certification systems are moving toward greater maturity. In countries such as Singapore, South Korea, and Japan, government-led skills platforms, such as SkillsFuture and JV-Campus, have integrated micro-certifications into national lifelong-learning strategies, responding to skill reconfiguration driven by industrial transformation. In March 2025, JV-Campus and the JMOOC Micro-certification Joint Working Group jointly released the *Digital Micro-certification Issuance Guidelines 3.0*, further strengthening the credibility and mutual recognition [3].

In Latin America, Africa, and ASEAN countries, the story of micro-certifications is still in its early chapters, yet it is already marked by a distinctive vitality. Here, the focus is less on credential reform for its

| SkillsFuture: Empowering Individuals to Give Back through Digital Transformation

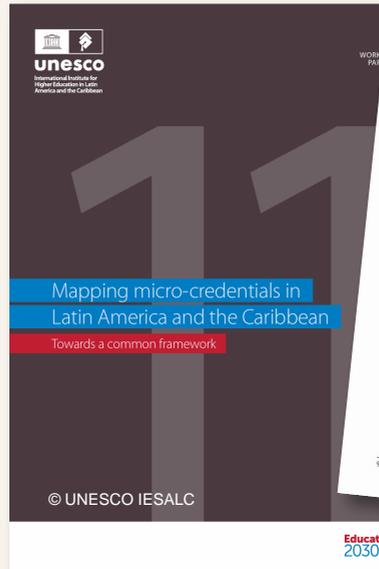
Trailblazer in AI Ethics

While most people tend to slow down in their 60s, Dr Kwong Yuk Wah continues to pioneer AI Ethics education to shape Singapore's AI adoption responsibly.

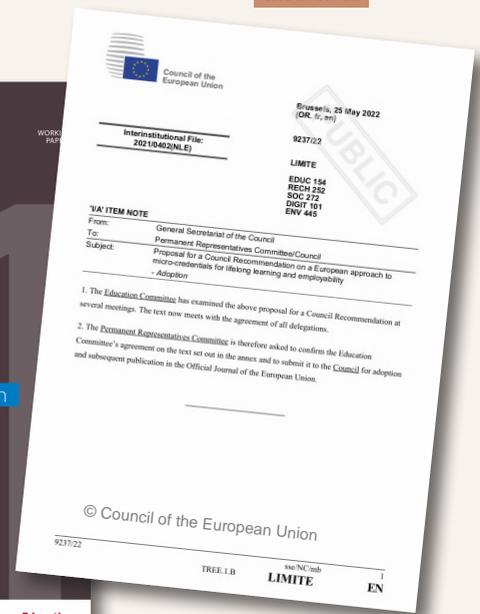
© SkillsFuture

own sake than on using micro-certifications to address foundational challenges: access to education, persistent skills gaps, and youth employment. Consensus and demand are coalescing rapidly. In the summer of 2025, a report by UNESCO IESALC, *Mapping micro-certifications in Latin America and the Caribbean: towards a common framework*, noted that in a region characterised by a large and youthful population, integrating micro-certifications into national education policies has become an urgent priority [4]. No longer seen merely as an add-on to traditional degrees, micro-certifications are viewed as a strategic option for injecting flexibility and inclusiveness into education systems.

As mature markets for micro-certifications, the European Union and the United States offer a study in contrast. If Europe is patiently weaving an orderly institutional fabric, the US resembles a dense and energetic ecosystem of innovation. In Europe, progress has been driven largely by top-level design. Countries have worked to build a standardised, cross-border ecosystem through shared policy frameworks, most notably the *Proposal for a Council Recommendation on a European approach to micro-certifications for lifelong learning and employability*. With the launch of the Micro-certifications Exchange System for Higher Education in Europe (MESHE) in 2026 [5], the circulation and recognition of learning outcomes have become more rule-based,



Mapping micro-certifications in Latin America and the Caribbean: towards a common framework



Proposal for a Council Recommendation on a European approach to micro-certifications for lifelong learning and employability

strengthening inter-institutional trust and accelerating cooperation across the region.

The US operates follows a different logic. Micro-certifications are shaped by market dynamics, driven by experimentation from universities, enterprises, and digital platforms. In the absence of a unified national framework, universities have taken on the role of gatekeepers, safeguarding quality and credibility across the entire value chain, from programme design and institutional approval to delivery, assessment, and post-credential follow-up.

Viewed across the global landscape, a consensus is taking shape: through short-cycle, flexible learning, micro-certification can respond swiftly to emerging skill demands in areas such as the digital economy and the green transition, becoming an essential approach as individuals move back and



UNESCO-ICHEI at the International Forum on Developing University Education Programs in Arab Countries in Light of Future Skills & Professions

forth between lifelong learning and career development.

A plural and interconnected supply network is coming into focus. One shaped jointly by governments, universities, online platforms, industry employers, and international organisations, drives a remarkable diversity of practice. Micro-certifications also carry an inherently digital "genetic code," enabling integration with MOOCs, digital badges, and related technologies, while ensuring both access to learning and the verifiability of outcomes. Learning is no longer sealed inside thick paper certificates; instead, it appears as data and signals, mapped onto learners' evolving professional journeys.

Within this increasingly mature ecosystem, micro-certifications reflect a broader rethinking of the boundaries of education, the rhythms

of learning over time, and the mechanisms through which skills and capabilities are recognised and trusted.

Making Lifelong Learning Possible

Micro-certifications are becoming a powerful driver of lifelong learning, expanding access, enabling flexibility, and supporting long-term sustainability. Its value is also reflected in how they enhance societal resilience by improving adaptability at both individual and system levels.

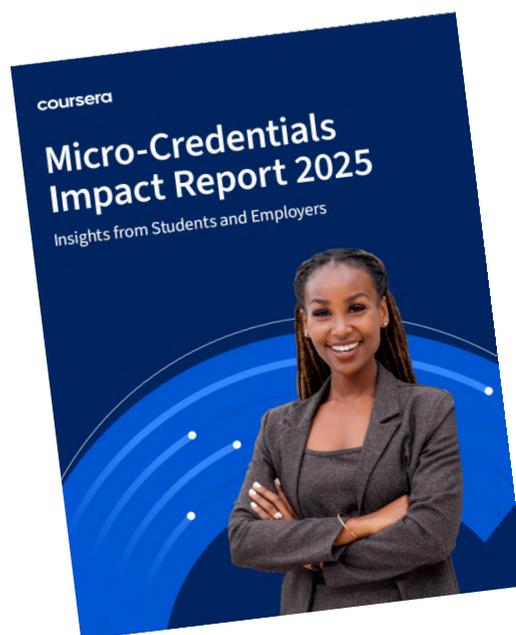
For individuals, by gradually loosening the constraints of time, space, and identity, and by lowering the barriers to reskilling through

digital platforms, micro-certifications support students and workers alike in periods of transition and growth, enhancing personal resilience in rapidly changing environments. More importantly, it helps cultivate a mindset of proactive learning. Faced with disruption, individuals can turn to learning as a means of self-renewal, adjusting to new rhythms and generating a positive feedback loop that sustains lifelong learning.

Evidence from Coursera's *Micro-Certifications Impact Report 2025* underscores this effect: 80% of learners reported increased confidence in their skills, while 31% secured internship opportunities through micro-certifications. In emerging technology fields, credentials in areas such as GenAI are prominent. 70% of certificate holders experienced significant productivity gains, and 87% felt better equipped to meet future technological challenges [6].

For the labour market, by strengthening the specificity and mobility of skills in the market, micro-certifications alleviate structural mismatches in the labour force, and meet talent shortages in a timely manner. In ASEAN, the labour market is being simultaneously reshaped by digitalisation, the rise of the green economy and the expansion of the gig economy. A single, linear pathway through traditional higher education can no longer meet fast-changing job requirements. Micro-certifications function instead as a form of "skills cushioning", absorbing the shock of industrial transformation and providing a buffer between workers and jobs, thereby reducing the risk of collective unemployment triggered by structural change.

For social systems, micro-certifications are



| Coursera, Micro-certifications Impact Report 2025

driving the implementation of a sustainable learning ecosystem, an ongoing flow of knowledge that does not break off due to age, identity, time or location. In this ecosystem, learning is not a task confined to a specific stage of life but a normal part of daily living that can be started at any time. Micro-certifications are learner-centred tools. Their digital form enables learning activities to transcend constraints and be more effectively tailored to individual needs and market orientation. Flexibility, convenience, progression, specificity and sustainability give workers across society ongoing and comprehensive opportunities to learn. When learning becomes a low-threshold and sustainably accessible product, society gains a buffer capacity against systemic risks such as supply chain restructuring and technological revolutions through collective upskilling. A continuously advancing, lifelong learning society is thereby constructed.

Beneath the Halo

Beneath the momentum surrounding micro-certifications, however, lie challenges that cannot be overlooked.

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A fundamental challenge stems from fragmented systems and the difficulty of mutual recognition.

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At present, definitions, standards, and quality-assurance mechanisms for micro-certifications remain far from harmonised globally. Credentials issued by different providers vary in quality, and when learners attempt to carry these fragmented achievements across education systems or national borders, their verifiability and portability often diminish. What is meant to be a flexible learning pathway can become precarious.

This fragmentation helps explain why UNESCO has placed such emphasis on strengthening global mechanisms for the recognition of higher education qualifications. In 2019, UNESCO adopted the *Global Convention on the Recognition of Qualifications concerning Higher Education*, which entered into force in 2023. As the first higher education convention with worldwide applicability, it seeks to establish principles



| Global Convention on the Recognition of Qualifications concerning Higher Education

of fair, transparent, and non-discriminatory recognition, while facilitating academic and professional mobility across borders [7]. By December 2025, 39 countries had ratified the Convention and begun advancing its implementation through national policies and inter-university cooperation. In the Asia-Pacific, UNESCO has worked closely with countries through thematic seminars and policy dialogues, sharing experiences on national qualifications frameworks and recognition systems to support coordinated regional implementation of the Convention.

Another unresolved question lies in how micro-certifications can meaningfully engage with more traditional and deeply rooted qualification frameworks. Can they be absorbed into national qualifications frameworks, stack toward higher levels of recognition, and ultimately open credible pathways into degree programmes or career progression? What appear to be technical

design questions are, in fact, matters of consequence.

Equity risks, too, cannot be ignored. A flexible and open mode of learning is, in its early stages, largely shaped by a small group of elite universities and major corporations. Backed by resources and brand recognition, the courses they offer are more readily accepted, while the voices of marginalised learners and smaller education providers are often drowned out. This uneven pattern of development risks reinforces existing education gaps.

Digitalisation carries a similar duality. It promises learning anytime and anywhere, but it also deepens exclusion for regions and populations without reliable access to the internet or digital devices, further entrenching patterns of marginalisation.

Looking ahead, the foremost priority for the global micro-certifications is harmonisation,

forging the shared standards and cross-border partnerships that can dissolve credentialing barriers and give these qualifications the portability they deserve. Regional frameworks modeled on the European Union's approach are already beginning to emerge, establishing a common language that allows credentials to travel freely across institutions and industries alike.

The agenda is also shifting from supply to ecosystem. Rather than simply multiplying the number of available credentials, the field is moving toward integrated environments that weave together learning, certification, quality assurance, credit banking, and employment services, transforming micro-certifications from stand-alone badges into living bridges between education and industry. Central to this evolution is a decisive pivot away from seat time: what will matter is demonstrable, real-world skill, not the hours logged in pursuit of it.

References:

[1] Palantir, "Build the future, while building your career." Available: <https://www.palantir.com/careers/students-and-early-talent/#meritocracy-fellowship>.

[2] Guo Queping, "Addressing Non-Degree Education Recognition Challenges: Zhejiang Launches Pioneering 'Micro-Certification' for Lifelong Learning", Hangzhou Daily, Dec.8, 2025.

[3] JV-Campus and JMOOC, "Guidelines for Issuing Micro-credentials Digitally 3.0", Mar. 12, 2025.

[4] UNESCO IESALC, "Mapping micro-credentials in Latin America and the Caribbean: towards a common framework", UNESCOC, 2025.

[5] Micro-credentials Exchange System for Higher Education in Europe, Available: <https://meshe.eucen.eu/>.

[6] Marni Baker Stein, "Micro-Credentials Impact Report 2025", Coursera, 2025.

[7] UNESCO, Global Convention on Higher Education Unlocking global mobility through recognition.





EXPORT

The Evolution of Agritech Education in Malaysia: Lifelong Learning Pathways, Government Support, Linkages to SDGs



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Over the past three decades, agriculture has evolved from largely labour-intensive practices into an industry increasingly shaped by information and communication technologies and data-driven systems.

This transformation has been especially evident in Southeast Asia, including Malaysia, where digital tools, automation, and analytics are progressively embedded in agricultural production and management processes [1][2]. Within this context, Malaysia has established a coherent policy framework that positions agritech as both a strategic economic priority and a critical educational concern. Key national policies, including the *Malaysia Education Blueprint 2013–2025*, the *National Agrofood Policy 2.0* for 2021–2030, and the *National TVET Policy 2030*, emphasise the need to develop a skilled workforce capable of integrating technological innovation with agricultural practice. Together, these policies underscore the importance of coordinated efforts across education, industry, and government sectors to address the complex demands of agritech development [3][4][5].

This study examines five interrelated policy and research questions that frame the development of agritech education in Malaysia. First, it investigates how agritech has been incorporated into formal education systems at both the primary and tertiary levels. Second, it explores the educational, economic, and social benefits that agritech education can provide for learners across different age groups, including youth and adult populations. Third, it analyses government-supported lifelong learning initiatives related to agriculture and agritech, with particular attention to how agritech may function as a sustained learning pathway across the life course. Fourth, it examines the alignment between agritech education and key Sustainable Development Goals, specifically SDG 4 on quality education, SDG 1 on poverty reduction,





| UPM Campus

and SDG 8 on decent work and economic growth. Finally, the study considers the role of UNESCO in advancing agritech education and lifelong learning agendas within Malaysia and the broader ASEAN region. The analysis draws on policy documents, programme fact sheets, industry initiatives, and relevant academic literature published between 2010 and 2025.

Agritech in Malaysian Education

To situate the discussion of agritech implementation within Malaysia's education system, it is necessary to first clarify the policy and structural conditions that have shaped its gradual institutionalisation. The integration of agritech has not occurred as an isolated curricular reform but rather as part of a broader transformation of agricultural education in response to economic restructuring, technological advancement, and shifting workforce demands. Against this backdrop, the following subsection traces the historical progression of agricultural education

in Malaysia and explains the rationale for the subsequent incorporation of agritech into formal educational pathways.

Historical Progression and Justification

Agricultural education in Malaysia traces its origins to British colonial administration in Malaya, where formal and informal training programmes were developed to transmit scientific agricultural knowledge and support plantation and peasant farming practices. These programmes included elementary and intermediate agricultural instruction designed to improve cultivation methods and support colonial agricultural objectives [6]. After independence, the expansion of agricultural education in Malaysia was closely linked to broader rural development and extension services that supported farming communities and rural schools. Early post-independence development plans prioritised rural welfare and infrastructure, including education and rural extension services, in order to improve livelihoods and agricultural productivity.

Over time, and particularly from the late 1990s

onward, national development strategies began to emphasise the role of innovation, technology adoption, and knowledge accumulation as key drivers of economic transformation. Later national development planning documents, such as the *Twelfth Malaysia Plan 2021–2025*, explicitly highlight the integration of technology in agricultural and rural development, reflecting a shift toward a knowledge-based agricultural agenda [3][7]. The amalgamation of national education reforms, focusing on STEM and TVET, with agrofood policy, prioritising smart agriculture, established an institutional framework for the incorporation of agritech into curricula and training paths.

Over the past three decades, Malaysia's agricultural education has increasingly shifted from production-oriented training toward a human capital and skills-based model that supports modernisation and technology adoption in the agrofood sector. A notable trend has been the consolidation of competency-based training through national occupational standards and skills certification, which strengthened the portability of qualifications and enabled more structured progression across TVET pathways [8]. In parallel, national development planning has expanded and repositioned TVET as a strategic lever for raising the share of skilled workers, with growth in training institutions and stronger emphasis on industry relevance and employability outcomes [9].

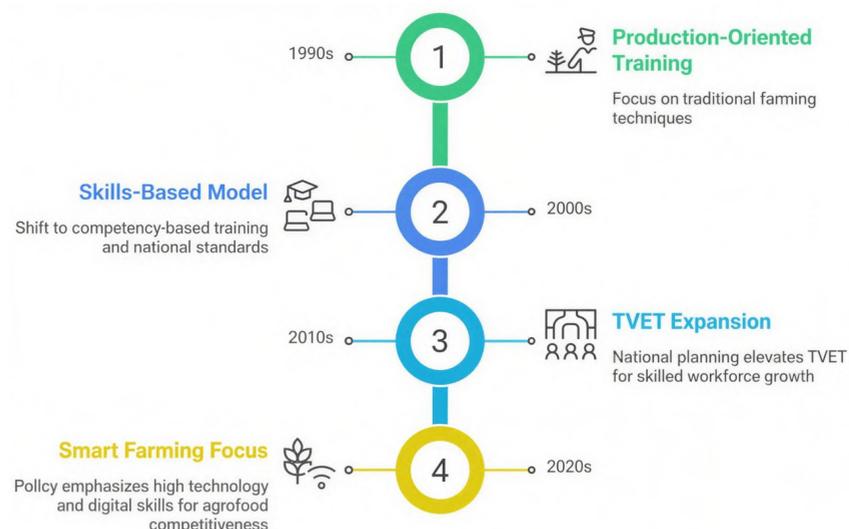
More recently, agrofood policy has explicitly framed the sector's future competitiveness around high technology and smart farming, reinforcing demand for

curricula that integrate digital monitoring, automation, and data-oriented decision-making. This policy direction has intensified pressure on education providers to align agricultural programmes with new skill profiles and lifelong upskilling needs across the agrofood value chain [10] (Figure 1). Against this historical and policy backdrop, the integration of agritech has progressively moved from national-level strategies into concrete educational practices, beginning with its introduction at the school level.

Introduction at the School Level (Primary and Secondary)

At the primary and secondary levels, agritech is mainly introduced through STEM-oriented curricula, vocational agriculture electives, and school-based practical activities. Rather than being delivered as a standalone subject, agritech-related content is embedded within science, technology, and applied learning modules that emphasise problem-solving and real-world applications. The *Malaysia Education*

Figure 1: Evolution of Agricultural Education in Malaysia Over the Past Three Decades



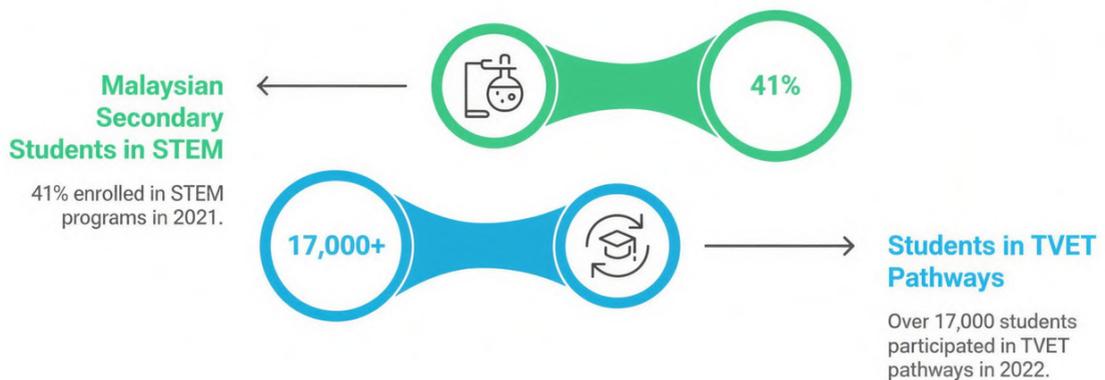


Figure 2: STEM and TVET Participation at the Secondary Education Level in Malaysia

Blueprint 2013–2025 explicitly promotes early exposure to STEM and applied technologies, with the aim of building foundational competencies that can support later specialisation within technical and vocational education pathways [3].

National data indicate that approximately 41% of Malaysian secondary students were enrolled in STEM programmes in 2021, while over 17,000 students participated in TVET pathways across vocational colleges in 2022, demonstrating a substantial institutional base for applied and technology-oriented learning at the school level [8][11](Figure 2). In practice, this policy orientation has been operationalised through pilot initiatives such as school greenhouse projects, agricultural demonstration units, and extracurricular innovation programmes supported by local authorities and partner agencies. These initiatives provide students with hands-on experience in areas including basic sensor use, hydroponic systems, and small-scale automation, linking theoretical concepts to observable agricultural processes.

Such early exposure plays an important role in reshaping students' perceptions of agriculture by presenting it as a knowledge-intensive and technology-enabled field,

thereby laying the groundwork for sustained interest and progression into agritech-related vocational and tertiary education. Building on this foundational exposure at the school level, agritech education is further consolidated and specialised within tertiary institutions and formal technical and vocational education and training pathways.

Tertiary Education and Technical and Vocational Education and Training

Universities, polytechnics, and community colleges serve as the principal venues for agritech knowledge dissemination, applied research, and advanced skill development in Malaysia.

At the university level, institutions such as Universiti Putra Malaysia (UPM) offer a range of agriculture- and agritech-related programmes, including a Bachelor of Agricultural and Biosystems Engineering with specialisations in mechanisation, automation, biological systems, and precision farming, which combine engineering principles with agricultural applications, as well as a Bachelor of Science in Smart Agricultural Technology and related agricultural science honours degrees that integrate technology with traditional agricultural disciplines. These

programmes aim to produce graduates capable of addressing contemporary challenges in agricultural production, mechanisation, and digital farm management and are fully accredited and embedded with industry-relevant competencies suited to Malaysia's agritech transformation.

Malaysia also has specialised undergraduate offerings such as Bachelor of Applied Science (Agrotechnology) with Honours at institutions like Universiti Malaysia Kelantan, which emphasise applied agricultural technology and industry-oriented skills training. Across these and other public universities, curricula increasingly incorporate components related to sensor technologies, precision irrigation, data analytics, and automation to

align with evolving sectoral needs. At the technical and vocational level, polytechnic diplomas and TVET modules aligned with the National Occupational Skills Standards (NOSS) similarly embed technology-oriented competencies to support pathways into agritech careers and reinforce linkages with industry practice.

At the tertiary level, agritech education in Malaysia is supported by a stable and expanding institutional base. According to official higher education statistics released by the Ministry of Higher Education Malaysia, total enrolment in agriculture-related fields increased from 14,083 students in 2022 to 15,147 in 2024, representing an overall growth of approximately 7.6%. Public universities

Bil. No.	Bidang Pengajian <i>Field of Studies</i>	Kategori IPT <i>HEIs Category</i>	Kemasukan / <i>Intake</i>			Enrolmen / <i>Enrolment</i>			Keluaran / <i>Output</i>		
			L/M	P/F	J/T	L/M	P/F	J/T	L/M	P/F	J/T
6	Pertanian & Veterinar <i>Agriculture & Veterinary</i>	UA <i>Public universities</i>	1,538	1,914	3,452	4,712	5,964	10,676	1,116	1,519	2,635
		IPTS <i>Private HEIs</i>	195	75	270	623	308	931	107	63	170
		Politeknik <i>Polytechnics</i>	497	306	803	1,305	977	2,282	391	392	783
		Kolej Komuniti <i>Community Colleges</i>	81	45	126	133	61	194	46	28	74
		Jumlah / Total	2,311	2,340	4,651	6,773	7,310	14,083	1,660	2,002	3,662

Figure 3: Enrolment in Agriculture-Related Fields Across Malaysian Higher Education Institutions (2022)

Bil. No.	Bidang Pengajian <i>Field of Studies</i>	Jenis Institusi <i>Type of Institutions</i>	Kemasukan / <i>Intake</i>			Enrolmen / <i>Enrolment</i>			Keluaran / <i>Output</i>		
			L/M	P/F	J/T	L/M	P/F	J/T	L/M	P/F	J/T
8	Pertanian, Perhutanan, Perikanan dan Veterinar <i>Agriculture, Forestry, Fisheries and Veterinary</i>	Universiti Awam <i>Public Universities</i>	1,981	1,952	3,933	5,451	5,957	11,408	1,435	1,667	3,102
		IPTS <i>Private HEIs</i>	215	73	288	831	342	1,173	102	51	153
		Politeknik <i>Polytechnics</i>	459	273	732	1,461	867	2,328	432	333	765
		Kolej Komuniti <i>Community Colleges</i>	87	41	128	160	78	238	58	27	85
		Jumlah Total	2,742	2,339	5,081	7,903	7,244	15,147	2,027	2,078	4,105

Figure 4: Enrolment in Agriculture-Related Fields Across Malaysian Higher Education Institutions (2024)



| Food Security Carnival on 7 June 2024 at the UPM Grand Hall

consistently accounted for more than three quarters of total enrolment, while polytechnics and community colleges jointly contributed around one sixth of student participation. This pattern indicates that agritech talent development in Malaysia is characterised by incremental expansion within a structurally stable higher education and TVET system, where universities and vocational institutions play complementary roles [1][12][13](Figure 3, 4).

Government incentives, Programmes, and Industry Collaborations

Beyond institutional capacity and enrollment trends, the continued expansion of agritech education is closely linked to policy-driven incentives, targeted programmes, and structured collaborations between government, industry, and education providers.

Policy Commitments and Funding Orientation

Malaysia's policy commitment to agritech development is clearly articulated in the *National Agrofood Policy 2.0 (2021–2030)*, which prioritises the strategic deployment of technology across the agrofood sector. The policy explicitly identifies capacity building, research and development, and human capital enhancement as core pillars for improving productivity, sustainability, and sectoral competitiveness [10]. In parallel, national budget allocations and ministerial initiatives have increasingly directed resources toward strengthening technical and vocational education and training, with a particular emphasis on industry-relevant skills and applied technological competencies.

These aligned policy and funding orientations create a supportive environment for the integration of agritech within education and training systems. Educational institutions are incentivised to embed technology-oriented

agricultural content within curricula, while public agencies are encouraged to invest in demonstration projects, pilot programmes, and extension initiatives that translate policy objectives into practical learning and workforce development opportunities.

Rezeki Tani and Livelihood-Focused Initiatives Rezeki Tani

Livelihood-oriented programmes such as Programme Rezeki Tani function as policy instruments that link agricultural support with poverty alleviation and basic skills development for low-income households. The programmes provides a combination of livelihood grants, starter kits, and short-term training aimed at enabling beneficiaries to engage in small-scale agricultural and agro-based activities. According to official programme information and implementation guidelines, training components primarily emphasise practical and low-cost production techniques, with selected initiatives incorporating basic agritech elements such as protected cultivation methods, simple greenhouse management, and introductory exposure to basic sensing or monitoring tools [15](Figure 5).

Rather than positioning agritech as an advanced or standalone technological pathway, Rezeki Tani adopts an integrated "skills plus inputs" approach, in which technical training is closely coupled with material support and on-site guidance. This model lowers entry barriers to technology adoption and supports incremental learning among smallholders and marginalised populations. Such livelihood-focused initiatives illustrate how agritech-related competencies can be embedded within broader income generation and social support programmes,

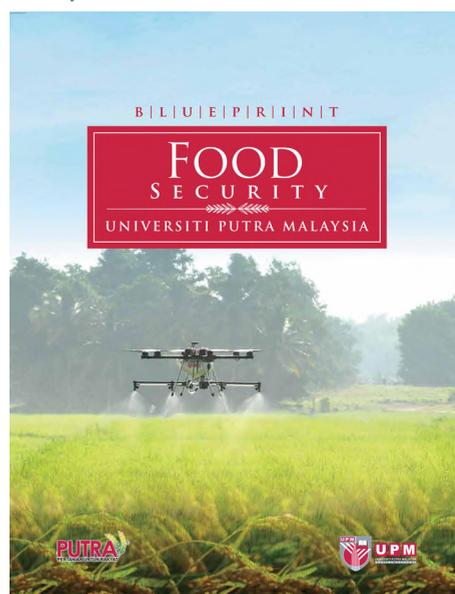
complementing formal education and TVET pathways by extending access to applied agricultural technologies beyond institutional settings.

Digital Agricultural Technology Initiatives and Public–Private Platforms

The Malaysia Digital Economy Corporation (MDEC) plays a central coordinating role in advancing digital agriculture through initiatives such as MD AgTech, which aim to accelerate the adoption of technologies including the Internet of Things, artificial intelligence, unmanned aerial systems, and data analytics across the agrofood sector. Implemented in collaboration with public universities, technology start-ups, agribusiness firms, and agricultural extension services, these programmes are designed to bridge innovation, skills development, and industry application [16] (Figure 6).

Through funding for pilot deployments, capacity-building workshops, and the

| UPM Food Security Blueprint 2024



implementation of shared digital platforms, MD AgTech and related initiatives create applied learning environments that support both workforce preparation and technology diffusion. Industry–academia–government testbeds established under these programmes provide students, TVET trainees, and extension agents with exposure to field-scale digital agricultural technologies, while simultaneously offering pathways for graduate employment, entrepreneurship, and lifelong learning. Such public-private platforms illustrate how digital agritech initiatives complement formal education and livelihood-oriented programmes by embedding advanced technological competencies within real-world agricultural systems.

Agritech Education for Children and Adults

Beyond institutional structures and policy mechanisms, agritech education

generates differentiated benefits for learners across the life course, shaping opportunities for both youth and adult populations (Figure 5).

Youth: Employability, Innovation, and Rural Retention

Agritech education equips young learners with digital, technical, and problem-solving skills that enhance employability across a range of agriculture-related occupations, including agribusiness operations, service-oriented roles such as drone operation and IoT system maintenance, and technology-driven agri-startups [17]. Evidence from Malaysia and comparable contexts suggests that early exposure to technology-enhanced agricultural practices increases young people's interest in agricultural careers by reshaping perceptions of the sector as innovative, knowledge-intensive, and economically viable.

Beyond employability, agritech education also supports youth entrepreneurship by lowering entry barriers to agri-based innovation and enabling graduates to identify value-added opportunities along the agrofood value chain. By creating higher-skilled and better-remunerated technical positions within rural areas, agritech contributes to rural retention and more balanced regional development, reducing the need for outward migration while strengthening local economies.

Characteristic	Youth	Adults
 Focus	Employability, Innovation, Rural Retention	Productivity, Resilience, Income Diversification
 Key Benefits	Enhanced employability, increased interest in agriculture, support for entrepreneurship, rural retention	Reduced input costs, improved yields, income gains, income diversification, access to higher-value markets
 Target Audience	Young learners	Smallholders, extension personnel, agripreneurs
 Training Type	Agritech education	Short-term agritech training programs
 Impact	Reshapes perceptions, lowers entry barriers, creates higher-skilled positions	Enhances productivity, supports income diversification, translates skills into economic outcomes

Figure 5: Comparative Benefits of Agritech Education for Youth and Adults

Adults: Productivity, Resilience, and Income Diversification

For adult learners, including smallholders, extension personnel, and agripreneurs, short-term agritech training programmes play a critical role in enhancing productivity and economic resilience. Technical courses that focus on practical applications such as sensor-based monitoring, precision irrigation, and postharvest handling technologies have been shown to reduce input costs and postharvest losses while improving yields and product quality, thereby contributing to income gains [18][19].

Beyond productivity improvements, agritech education also supports income diversification by enabling adult learners to adopt new production practices, access higher-value markets, and engage in complementary agri-services. Evidence from targeted livelihood and extension programmes suggests that income effects are most pronounced when

technology training is combined with initial material support, advisory services, and market linkages, highlighting the importance of integrated training models in translating technical skills into sustainable economic outcomes.

Lifelong Learning Initiatives and the Integration and Evaluation of Agritech

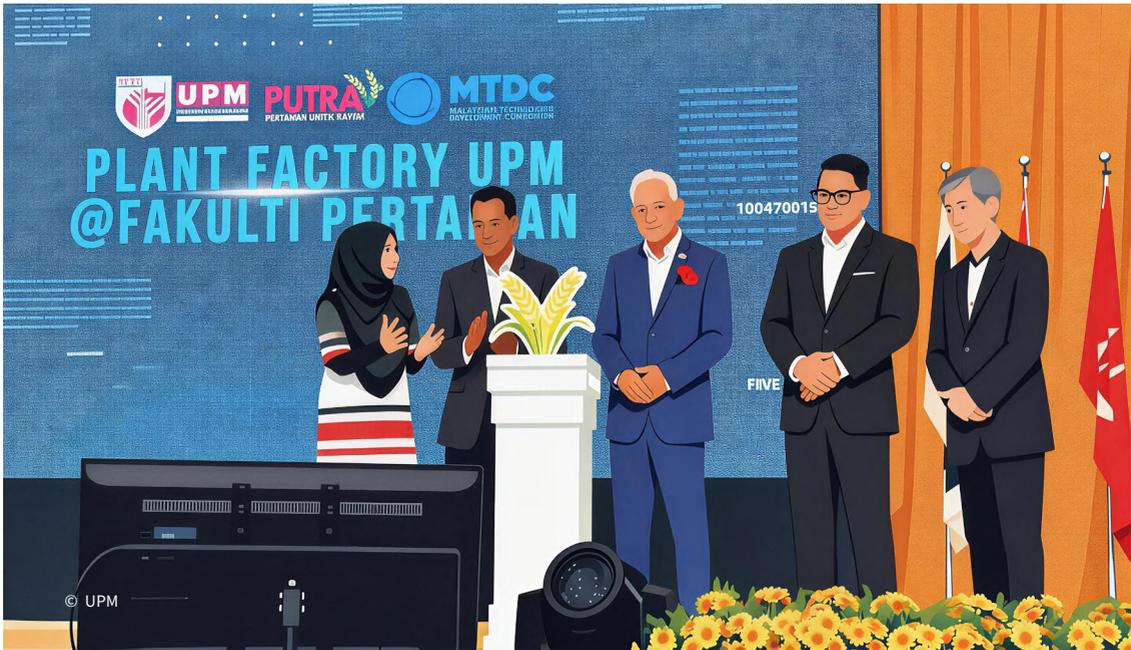
Building on the differentiated benefits of agritech education across the life course, this section examines how government-led lifelong learning frameworks in Malaysia institutionalise agritech learning through formal, non-formal, and informal pathways.

Current Lifelong-learning Frameworks

Malaysia's lifelong learning system is structured around interconnected pathways,



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| MTDC and UPM launch plant factory programme to accelerate smart farming

encompassing formal routes such as degree programmes and technical and vocational education and training, non-formal opportunities including short courses and extension-based training, and informal learning through on-farm practice and peer knowledge exchange. This tripartite structure aligns with Malaysia's national commitment to strengthening a lifelong learning culture, as articulated in the Blueprint on Enculturation of Lifelong Learning for Malaysia (2011–2020), which provides a policy road map for coordinating lifelong learning stakeholders and broadening participation across diverse learning modes [20][21].

A key enabling mechanism within this framework is the Malaysian Qualifications Framework (MQF), which functions as a unified post-secondary qualifications system and supports comparability and progression across education and training

sectors [22]. Malaysia's AQRF Referencing Report further positions MQF as part of a broader architecture that facilitates mobility and recognition across pathways, including lifelong learning progression between academic and skills sectors [23]. Central to cross-pathway mobility is Recognition of Prior Learning, operationalised in Malaysia through Accreditation of Prior Experiential Learning (APEL) routes, which enable learning acquired through non-formal and informal experiences to be assessed for admission and credit award aligned with MQF levels [24].

Within the agricultural sector, lifelong agritech learning is implemented through a combination of livelihood programmes, public extension services, and university continuing education units, which serve as practical delivery nodes that translate national lifelong learning commitments into skills upgrading opportunities for diverse learner groups.

Integration of Agritech: Modalities and Evaluation Approaches

The integration of agritech into Malaysia's lifelong learning system can be operationalised through several complementary modalities, each requiring clearly defined evaluation mechanisms to ensure effectiveness, quality, and policy alignment.

Micro-certifications and Stackable Certification Pathways

One key modality involves the use of micro-certifications and stackable certification structures to deliver agritech competencies in a flexible and modular manner. Technical skills such as drone operation, basic sensor installation and maintenance, digital farm monitoring, and precision irrigation management can be organised into short, competency-based learning units with formal assessment components. When aligned with the Malaysian Qualifications Framework and National Occupational Skills Standards, these micro-certifications allow learners to accumulate recognised learning outcomes incrementally while remaining active in the workforce [28].

From an evaluation perspective, the effectiveness of micro-certification pathways is commonly assessed through competency-based assessment results, completion and progression rates, Recognition of Prior Learning uptake, and the successful articulation of micro-certifications into higher-level qualifications. At the system level, monitoring also focuses on participation by working adults and rural learners, as well as employer recognition of micro-certifications as

valid indicators of occupational competence. International policy guidance highlights the importance of embedding such evaluation criteria within national TVET and lifelong learning quality assurance frameworks to ensure credibility and portability [30][31].

Mobile Demonstration Laboratories and Regional Training Hubs

A second integration modality is the deployment of mobile agritech demonstration laboratories and regionally based training hubs. Mobile units equipped with scalable and cost-effective technologies, including basic



environmental sensors, automated irrigation systems, and digital farm management tools, can be linked to polytechnics, community colleges, and agricultural extension services. This approach addresses geographical and infrastructural constraints by bringing hands-on training directly to underserved rural areas [26].

Evaluation of mobile and regional demonstration models typically combines process and outcome indicators. Process indicators include reach, frequency

of deployment, participant profiles, and trainer capacity, while outcome indicators focus on skill acquisition, technology adoption rates, and short-term productivity improvements. Regional hubs complement mobile units by serving as sites for trainer development, curriculum testing, and technology validation. Development partners emphasise that systematic data collection at both learner and community levels is essential to assess whether decentralised training models translate into sustained agritech adoption and livelihood improvements [4][25].

University Industry Short Courses and Professional Development Programmes

A third modality centres on university–industry collaboration in the provision of short courses and continuing professional development programmes in agritech. Universities can deliver blended or fully online courses in partnership with agritech firms, start-ups, and industry associations, targeting extension officers, agri-entrepreneurs, and technical personnel. Industry partners contribute current technological practices and market insights, while universities ensure academic oversight, assessment integrity, and credential validation [29].



Evaluation in this modality focuses on labour market relevance and workforce outcomes. Key indicators include employer satisfaction, post-training employment or role advancement, application of skills in workplace settings, and participant retention in continuous learning pathways. In Malaysia, pilot initiatives supported under digital agriculture programmes coordinated by the Malaysia Digital Economy Corporation illustrate how industry-linked training can be assessed through a combination of learner feedback, employer engagement metrics, and follow-up surveys on skills utilisation and career progression [27].

Agritech Education, SDGs, and the Role of UNESCO

Agritech education contributes directly to the achievement of multiple Sustainable Development Goals by linking skills development with inclusive economic and social outcomes. Most immediately, agritech-related training supports SDG 4, through the provision of relevant and skills-based learning that aligns with labour market needs. At the same time, by enhancing productivity, incomes, and access to higher-value employment within agricultural value chains, agritech education advances SDG 1 and SDG 8, particularly in rural and agriculture-dependent communities. Evidence from development-oriented programmes suggests that agritech interventions generate stronger poverty alleviation and employment effects when technical training is combined with market access, continuing advisory support, and institutional linkages, rather than delivered in isolation.

Despite contributions, systematic monitoring of the development outcomes associated with agritech education remains limited. Many existing programmes lack consistent mechanisms for tracking income changes, employment trajectories, or longer-term livelihood resilience. Strengthening monitoring and evaluation practices, including income tracking, employment follow-up, and alignment with established SDG indicators, would improve accountability and provide more robust evidence of the social and economic impacts of agritech education.

Within this context, UNESCO plays an important facilitative role in supporting the alignment of agritech education with sustainable development objectives through policy guidance, capacity building, and regional coordination. Through specialised entities such as the UNESCO Institute for Lifelong Learning and the UNESCO UNEVOC International Centre, UNESCO supports Malaysia's efforts to strengthen technical and vocational education and training systems, lifelong learning frameworks, and Education for Sustainable Development. UNESCO's normative frameworks and analytical tools provide technical support, comparative insights, and platforms for regional dialogue, enabling national reforms to align agritech education with broader sustainability priorities.

At the regional level, UNESCO also contributes to the coordination and mutual recognition of qualifications across ASEAN, which is increasingly important for mobility,

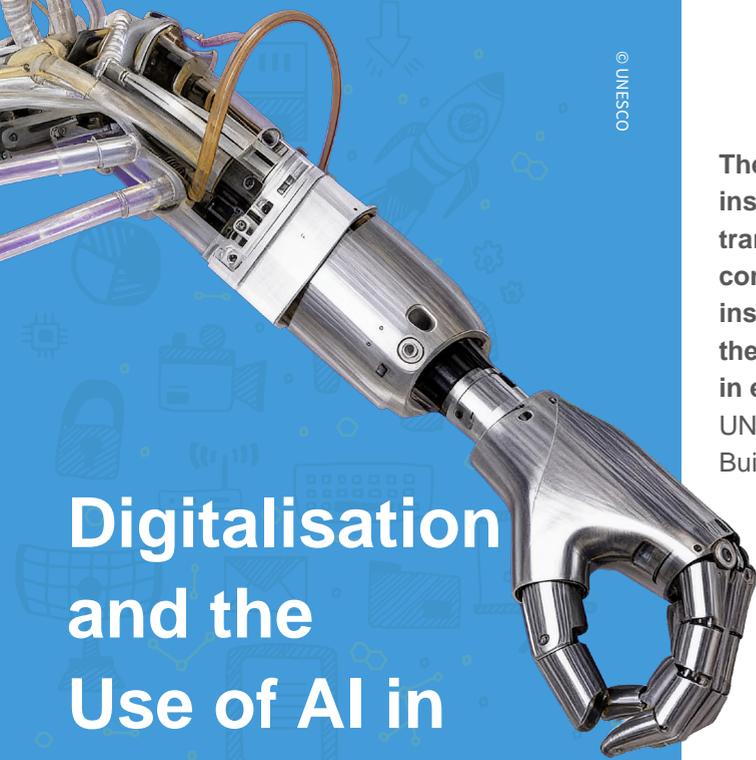
transferability, and recognition of agritech-related skills.

Agritech education in Malaysia is at a critical crossroads, characterised by robust policy indicators (NAP 2.0, TVET 2030, Education Blueprint), industry initiatives (MD AgTech), and established lifelong-learning frameworks that foster a conducive

ecosystem. For pilots to provide systemic impact, Malaysia requires synchronised standards for micro-certifications, expanded demonstration models, industry–TVET routes, and comprehensive monitoring associated with SDG outcomes. These measures will improve youth employment, facilitate adult upskilling, and aid in poverty alleviation and economic resilience.

References:

- [1] Pingali, P. (2012). Agricultural transformation. *PNAS*, 109(31).
- [2] Wolfert, S., et al. (2017). Big data in smart farming. *Agricultural Systems*, 153.
- [3] Ministry of Education Malaysia. (2013). *Malaysia Education Blueprint 2013–2025*. Putrajaya.
- [4] Ministry of Agriculture and Food Security. (2021). *National Agrofood Policy 2.0 (2021–2030)*.
- [5] *Dasar TVET Negara / National TVET Policy 2030. (2023/2024)*. Ministry of Human Resources / TVET Council.
- [6] Arman, E., Mamat, M. Z., & Hasbullah, M. (2016). Agricultural education as a medium for the transmission of Western science during British rule in Malaya, 1905–1957. *History of Education*, 45(5), 587–601.
- [7] Economic Planning Unit (EPU), Prime Minister's Department, Malaysia. (2021). *Twelfth Malaysia Plan 2021–2025*.
- [8] UNESCO-UNEVOC. (2019). *World TVET database: Malaysia (Country profile)*. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training.
- [9] Economic Planning Unit. (2015). *Strategy Paper 09: Transforming technical and vocational education and training (TVET)*. Prime Minister's Department.
- [10] Ministry of Agriculture and Food Industries. (2021). *National Agrofood Policy 2021–2030 (NAP 2.0)*. Government of Malaysia.
- [11] Ministry of Education Malaysia. (2022a). *Malaysia education blueprint annual report 2022*. Ministry of Education Malaysia.
- [12] Ministry of Higher Education Malaysia. (2022b). *Statistik pendidikan tinggi 2022*.
- [13] Ministry of Higher Education Malaysia. (2024). *Statistik pendidikan tinggi 2024*.
- [14] It should be noted that the 2024 classification expands the agriculture category to include forestry and fisheries, which may partially contribute to the observed increase.
- [15] Program Rezeki Tani. (2025, May 29). *Putra*. Retrieved January 25, 2026.
- [16] Malaysia Digital Economy Corporation. (2024). *MD AgTech: Digitalising Malaysia's agriculture sector*.
- [17] World Bank. (2020). *Harvesting Prosperity / Future of Work in Agriculture*.
- [18] FAO. (2018). *Youth and Agriculture; Digital agriculture reports*. FAO publications (2018–2022).
- [19] OECD. (2021). *Innovation, productivity and sustainability in food and agriculture*.
- [20] Ministry of Higher Education Malaysia. (2011). *Blueprint on enculturation of lifelong learning for Malaysia 2011–2020*. UNESCO Institute for Lifelong Learning. Retrieved January 25, 2026.
- [21] UNESCO Institute for Lifelong Learning. (2023, May 25). *Malaysia: Blueprint on enculturation of lifelong learning for Malaysia (2011–2020) issued in 2011*. Retrieved January 25, 2026.
- [22] Malaysian Qualifications Agency. (2025, November 19). *Malaysian Qualifications Framework (MQF) 2nd edition*. Retrieved January 25, 2026.
- [23] Malaysian Qualifications Agency. (2019). *AQRF referencing report of Malaysia (2019)*. Retrieved January 25, 2026.
- [24] Malaysian Qualifications Agency. (2016). *Guidelines to good practices: Accreditation of prior experiential learning for credit award (APEL.C)*. Retrieved January 25, 2026.
- [25] Asian Development Bank. (2021). *Education and skills development in ASEAN*.
- [26] Food and Agriculture Organization. (2022). *Digital agriculture and rural transformation*.
- [27] Malaysia Digital Economy Corporation. (2023). *MD AgTech programme overview*.
- [28] Ministry of Human Resources. (2023). *National Occupational Skills Standards and TVET reform initiatives*.
- [29] OECD. (2021b). *Adult learning and skills development*.
- [30] UNESCO Institute for Lifelong Learning. (2021). *Micro-credentials and lifelong learning*.
- [31] UNESCO-UNEVOC. (2020). *Innovating TVET for digital transformation*.



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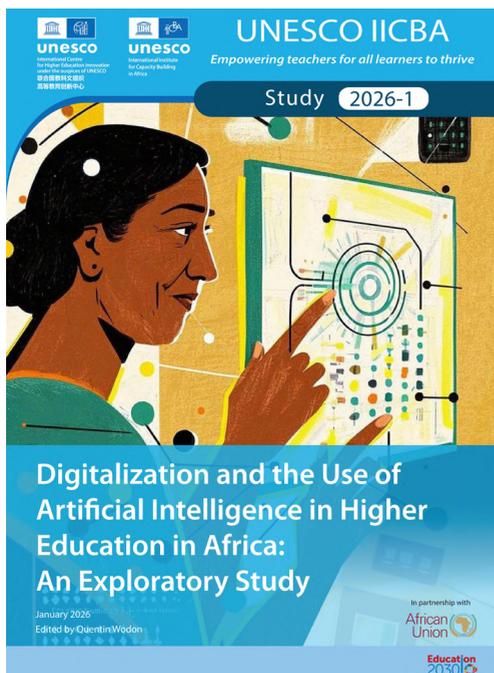
FRONTIER

Digitalisation and the Use of AI in African Higher Education: An Exploratory Study

The readiness of higher education institutions (HEIs) for digital transformation is one of the key conditions determining whether institutions can effectively adapt to the integration of Artificial Intelligence in education. UNESCO-ICHEI and the UNESCO International Institute for Capacity Building in Africa (IICBA) jointly conducted survey research to examine the status of digital transformation in HEIs across the five subregions of Sub-Saharan Africa (West, Central, East, Southern, and North Africa), as well as key issues related to integrating AI into higher education systems.

Higher Education Digitalisation: Africa's Progress

Among the institutions covered by the survey, most remain at the initial stage of digital transformation and the application of AI. Notably, levels of engagement with digitalisation and AI in Francophone Africa are clearly lower than in Anglophone Africa.



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Strategies, Governance, and Online Resources

Do African HEIs have digitalisation/AI strategies? What are their governance arrangements and the state of their online resources?

A majority of institutions have a digitalisation strategy, but most embed it within the overall institutional strategy or rely on national strategies rather than issuing a standalone digitalisation document. The coverage of topics within institutional digitalisation policies is broadly consistent across institutions. Access to online educational resources remains substantially constrained by language. In Anglophone institutions, university library online academic resources are much more available (electronic books 67 per cent, journals 62 per cent, databases 58 per cent) than in Francophone institutions (electronic books 34 per cent, journals 37 per cent, databases 31 per cent).

Digital Offerings for Services and Courses

“

What online services and digital course modalities do HEIs provide?

”

Survey results indicate uneven coverage of online services. Apart from registration (higher in Francophone HEIs at 85 per cent versus 69 per cent in Anglophone HEIs) and student support services (low in both, around 35–37 per cent), Anglophone institutions have a higher proportion of online provision for

services such as course selection and grade enquiry. Fully online degree programmes and MOOCs are lagging behind. Anglophone institutions perform better than Francophone institutions in integrating digital skills into curricula. Digital assessment has made some progress and is often applied across all types of courses, not solely for online courses.

Student Skills and Institutional Support

What is the level of students' digital skills?
What digital support do institutions provide to staff and students?

In the Anglophone survey, respondents consider that students' online research

skills, multimedia application abilities, skills for using learning platforms, and especially programming skills need improvement. In the Francophone survey, ratings are lower across most skills, signalling greater needs for support. Compared with advanced digital skills training courses, support for digital pedagogy, or equipment provision, institutional support tends to focus more on network access and IT helpdesk services. For staff, support emphasises opportunities for digital skills training rather than other forms of assistance.

Constraints to Digitalisation

“

What are the main factors constraining digitalisation and the use of AI in HEIs?

”

Respondents highlight a range of potential obstacles, including: inadequate infrastructure (e.g., insufficient connectivity or equipment), a conservative academic culture, scarce funding opportunities, lack of technical support, insufficient leadership and strategic planning, centralised institutional management models, limited peer collaboration, inadequate compensation,





| The Virtual University of Côte d'Ivoire (UVCI) hosted a Chair Forum

weak incentives for innovation, suboptimal administrative organisation, insufficient professional development support, inadequate digital technology application skills among educational staff, inadequate digital technology application skills among students, limited access to devices for students, limited access to devices for teachers, and other impediments.

Perceptions Regarding AI

What do faculty and students think about AI's potential impacts, benefits, and risks? In what areas is AI currently being used?

Seventy-one per cent of Anglophone respondents think AI will greatly affect higher education, compared to only 39 per cent of Francophone respondents. The potential benefits of AI for research assistance are the most widely recognised. Most institutions lack

policies related to AI, but there is some awareness of AI-related risks. Teachers express strong demand for guidance in the use of AI, especially for personalised learning, research assistance, and the ethical use of AI.

Across the African continent, significant linguistic and regional disparities are evident (with Francophone Africa lagging behind Anglophone Africa in development), alongside generally low institutional awareness and adoption of AI, and pronounced constraints. AI development currently resides in a phase characterised by

shallow understanding, weak application, policy gaps, and existing demand, necessitating strengthened policy frameworks at the institutional level. It is precisely within this context that educators' demand for AI application guidance is particularly pronounced, thereby charting a clear course for future capacity building.

Diverse Case Studies

This report presents 13 case studies showcasing innovative practice, challenges, and experience in digitalisation and AI application across different countries and types of HEIs in Africa. The case studies cover Cameroon, Côte d'Ivoire, Ghana, Ethiopia, Kenya, Nigeria, Sierra Leone, South Africa, Togo, Zimbabwe, and Botswana, illustrating a path of digital education in Africa characterised by both commonalities and differences.



| e-SHE Universities Bi-Annual Program Progress Review and Graduation Workshop

Côte d'Ivoire: Systematically Building a Virtual University

The Virtual University of Côte d'Ivoire (UVCI) is not only an online course platform; it has developed a complete digital education ecosystem that includes a digital content production studio, a FabLab, and an incubator. It has also actively hosted the UNESCO Chair on AI, Humanities, and Open Science, raising awareness of AI ethics, equity, governance, and inclusion. Through blended learning and MOOC-based flexible models, UVCI has significantly expanded access to higher education, serving particularly students from rural areas and disadvantaged groups. It has popularised digital pedagogy, trained hundreds of teachers, and helped other universities transition rapidly to online learning during COVID-19, thereby strengthening system resilience. Through cooperation

networks, such as the Francophone virtual university network, UVCI has become a model for digital education in West Africa, promoting knowledge sharing and sustainable development.

Ghana: Aligning the National Digital Agenda with Industry Needs

The Government of Ghana is cultivating AI talent through a National AI Strategy and a “One Million Coders Programme” to help tackle youth unemployment. Universities such as the Kwame Nkrumah University of Science and Technology (KNUST) cooperate with companies including Google to establish AI research centres. They leverage social media tools such as WhatsApp to develop low-bandwidth AI learning systems suitable for local conditions and emphasise

entrepreneurship education to address practical problems. Organisations such as Ghana Tech Labs also run entrepreneurship bootcamps in formats like “six weeks of coding plus two months of incubation”, channelling graduates into AI start-ups to ease youth unemployment and empower students’ entrepreneurial capabilities.

Ethiopia: Centrally Led Platform Construction

Under the leadership of the Ministry of Education, Ethiopia has developed “one-stop” digital platforms (for example, the e-Learning for Strengthening Higher Education, e-SHE platform) to provide unified online learning services for all public universities. The top-level design aims to achieve economies of scale and resource sharing to address widespread infrastructure challenges. The platforms benefit all Ethiopian public universities, including first-generation institutions such as Addis Ababa University, Haramaya University, and Hawassa University. With support from the platforms, universities have made progress in digitalisation, for example using e-SHE for course delivery, online assessment, and resource sharing, although digitalisation remains at an early stage.

Nigeria: A Dual-Track Pathway to Digitalisation

Using the University of Calabar (UNICAL) as an example, UNICAL advances digitalisation via a dual-track pathway. On one track, it

is vigorously digitising Graduate School administrative processes to improve efficiency; on the other, it has established a new Open and Distance Learning Centre (ODLC) to expand educational access, and is actively exploring the use of AI chatbots for student services. By introducing online registration and payment systems, UNICAL has reduced paper-based processes and enhanced administrative efficiency, while the ODLC provides flexible learning opportunities for non-traditional students, expanding access and stimulating interest in AI (for instance, planning the use of AI chatbots for student services). This blended learning model improves the learning experience and increases student engagement.

South Africa: Cutting-Edge Research Focused on Teacher Readiness

Using mixed methods, case studies in South Africa analyse teachers’ willingness and obstacles to integrating AI into teaching, thereby providing evidence to design targeted teacher training courses and overcome cultural and pedagogical resistance. Technological Pedagogical Content Knowledge (TPACK) training is used to assess pre-service teachers’ readiness for AI. After training, teachers become more adept at using AI for personalised tutoring and assessment, which indirectly improves student outcomes. Post-TPACK training, students may experience a more interactive classroom environment, for example through AI-assisted simulations and assessment tools that enhance engagement. Tools such as personalised learning systems enable adaptive learning pathways, providing instant

feedback and tailored content to improve students' conceptual mastery and critical thinking.

The Road Ahead

This report also offers recommendations for higher education stakeholders, especially higher education authorities and institutional leaders.

UNESCO's *ICT Competency Framework for Teachers (ICT-CFT)* and the *AI Competency Framework for Teachers* provide pathways and references for capacity-building. The first covers abilities across multiple domains such as equipment operation and information literacy. The second emphasises human-centred and ethical AI development, foundational knowledge and applications of AI, AI-informed pedagogy, and teacher professional development, thereby pointing



| Continental Artificial Intelligence Strategy (2024)

the way for teacher capacity-building.

Align with African Union Strategies and Recommendations. As a key hub for regional coordination and continental integration, the African Union has recently issued the *Digital Education Strategy and Implementation Plan (2022)* and the *Continental Artificial Intelligence Strategy (2024)*. The former sets out three themes for AI in education—“Learn with AI”, “Learn about AI”, and “Prepare for AI”—and six domains of AI readiness. The latter emphasises inclusive national AI education policies, building AI competencies for staff and students, investment in AI-related training, and attention to key issues such as AI ethics and data security.

In line with UNESCO's *Recommendation on the Ethics of Artificial Intelligence (2021)*, Africa should promote AI ethics education, strengthen interdisciplinary research, cultivate responsible AI development capabilities, and ensure inclusion and lifelong learning. In short, the purpose of education and research is to teach people how to build AI responsibly and understand its societal impacts. The goal should be to cultivate citizens with AI literacy and moral awareness, and to establish a research ecosystem that prioritises human well-being and fundamental rights while advancing AI innovation.

Respondents to this study emphasise that both infrastructure and the capabilities of higher education personnel require stable funding environments to keep pace with the ongoing transformations brought by AI. African universities should increase financial and technical support to enable them to benefit from digitalisation and the application of AI.

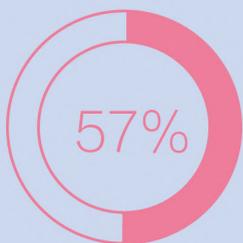
Youth Column | Skills, Work and Career Futures

Drawing upon multiple global youth surveys and trend studies, this column seeks to explore how young people perceive the significance of skills, view shifts in the nature of work, and envision their own professional futures.

Optimistic Embrace and Cautious Concern



Deloitte's 2025 Generation
Z and Millennial Survey



Gen Z



Millennials

They have already employed GenAI in their daily work to handle diverse tasks. These include **data analysis, creative work, content creation, project management, strategy creation, and risk assessment**. For most young people, AI has become an integral tool embedded within their workflows.

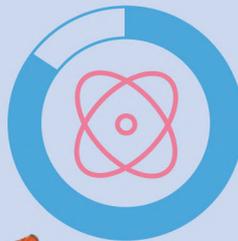




Young people broadly acknowledge the positive changes brought by AI.

78% Gen Z **82%** Millennials

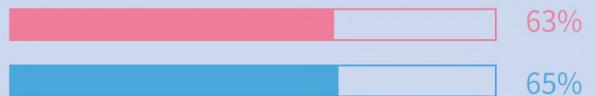
GenAI has enhanced the quality of their work.



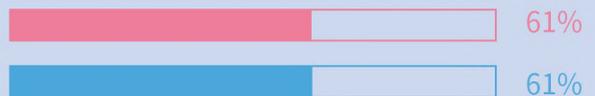
Approximately **80%** of respondents indicated that GenAI has helped them save time and improve their work-life balance

Concerns About AI

Concerned that GenAI may reduce job opportunities



Concerned that automation makes it harder for young people to enter the workforce



■ Gen Z ■ Millennials



Consequently, **66%** of millennials and **68%** of Generation Z they are beginning to look towards career fields perceived as "less susceptible to AI disruption".

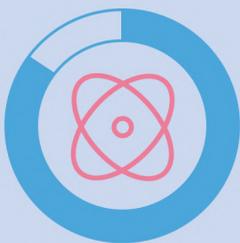
Careers Are in A State of Flux

What are "new-collar" jobs?

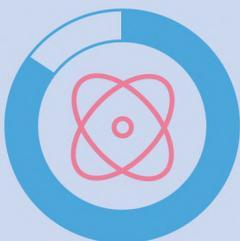
In technology-intensive sectors such as IT and healthcare, some employers are beginning to de-emphasise the rigid requirement for traditional university degrees, instead focusing on whether candidates possess the specific skill sets required for particular roles. These skills are often not exclusively acquired through full academic qualifications, but may instead be gained through micro-credentials, community college courses, or other non-traditional learning pathways.

Self-directed, agile and pragmatic skills deployment

The findings of the 2025 *Youth survey report on AI and Digital Skills* reveal that young people widely perceive existing provision of AI and digital skills training as inadequate.



30%
of respondents had received systematic training in these areas



44%
explicitly expressed a desire to learn but had yet to secure corresponding opportunities

This disparity indicates a significant and unmet demand for formalised, accessible AI education.

The Current State and Needs of AI and Digital Skills Training

Have received systematic, relevant training



Have received non-formal education



Willing to learn, but have not yet had the opportunity

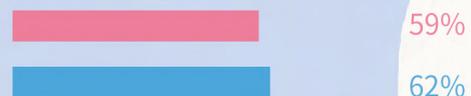


Not interested



Perceptions of the Importance of Skills

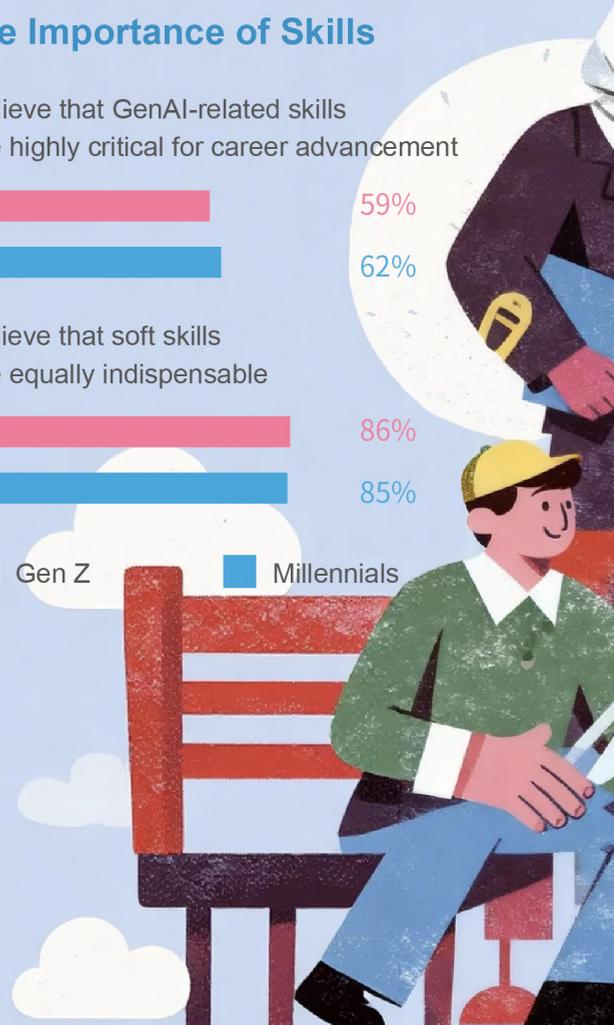
Believe that GenAI-related skills are highly critical for career advancement



Believe that soft skills are equally indispensable



■ Gen Z ■ Millennials

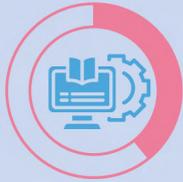


The Practice and Frequency of Self-Directed Skill Learning



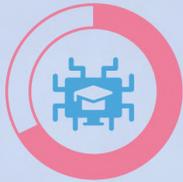
70%

Frequently drive career advancement through skill enhancement



Approx. 33%

Learn new skills on the job



Approx. 67%

Pursue continuous learning outside of working hours

■ Gen Z



Micro-credentials: Expectations versus Reality

Micro-credentials hold immense appeal for young people due to their flexible and focused nature. The ILO report, *Microcredentials for youth and work*, indicates that young people require clearer guidance to discern which credentials possess genuine market value and how to combine them into effective career progression pathways.

Young people are responding to uncertain career futures through continuous learning, skills renewal and shifting career paths. They call for more human-centred AI, fairer access to education and opportunity, and are ready to take on social and ethical responsibilities. Their choices also present urgent challenges for education systems, industry and policymakers.

References:

- [1] Deloitte, "Deloitte's 2025 Gen Z and Millennial Survey," *Deloitte*, 2025.
- [2] UNESCO-UNEVOC, "Youth survey report on AI and digital skills," *UNESCO-UNEVOC*, 2025.
- [3] International Labour Organization (ILO), "Microcredentials for youth and work," *ILO*, 2025.



Programme Updates

UNESCO-ICHEI and UNESCO IITE Co-launched IIOE Micro-Certification Courses



On 20 November 2025, UNESCO-ICHEI and the UNESCO Institute for Information Technologies in Education (UNESCO IITE) jointly launched two Micro-certification courses on the International Institute of Online Education (IIOE) learning platform. These courses focus on the application of generative artificial intelligence in teaching and learning: Generative AI and Learning

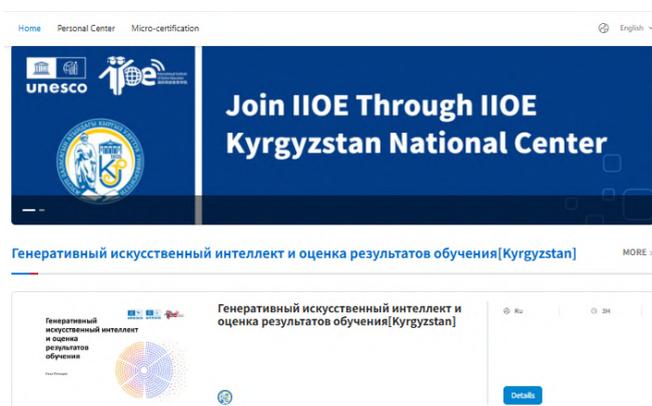
Outcomes Assessment and How to Guide Students in Using Generative AI. The courses were officially released during a webinar that attracted more than 1,200 higher education stakeholders from over ten countries, including Russia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan, Armenia, Ukraine, Belarus, Moldova, and Latvia.

2025 UNESCO-ICHEI IAC Meeting Held

On December 8, 2025, the International Advisory Committee (IAC) Meeting of UNESCO-ICHEI was successfully held at SUSTech. The hybrid meeting brought together nearly twenty expert members from UNESCO and other international organisations, HEIs, enterprises, and think tanks. Participants reviewed the development achievements of the IIOE over the past six years and engaged in in-depth discussions on its future strategic planning. The successful convening of this meeting has provided important guidance for IIOE's future development.



IIOE Kyrgyzstan National Centre Formally Established



On November 26, 2025, UNESCO-ICHEI and Kyrgyz National University (KNU) officially signed an agreement to establish the IIOE Kyrgyzstan National Centre, marking a significant milestone in their cooperation. The Centre becomes the second IIOE National Centre in Central Asia and the fifteenth worldwide. On the same day, UNESCO-ICHEI and KNU co-organised a national workshop on IIOE, which drew more than

420 teachers and administrators from over 50 universities across Kyrgyzstan. The workshop provided a systematic introduction to the Russian version of the IIOE platform and its Micro-Certification course series, laying a solid foundation for the National Centre to coordinate higher education institutions nationwide and to launch large-scale, localised faculty capacity-building initiatives.

The IIOE Annual Partnership Meeting 2025 Held

On 15 January 2026, the IIOE Annual Partnership Meeting 2025 convened online, co-hosted by UNESCO-ICHEI and the Indonesia Cyber Education Institute, the 2025 IIOE Rotating Presidency Unit. Bringing together more than 300 participants from HEIs, enterprises, and



international/regional organisations across 52 countries, the meeting offered a moment to take stock of IIOE's work over the past year. Discussions reflected on progress in supporting universities through technological innovation, strengthening digital literacy among higher-education professionals, and expanding practical capacities in AI. It also set out 2026 priorities and marked the launch of the AI+Cross-Border E-Commerce Micro-Certification Programme.

IIOE Mali National Centre Formally Established



In January 2026, the Université des Sciences Sociales et de Gestion de Bamako (USSGB) officially became the sixteenth IIOE National Centre. As one of the leading public universities strongly supported by the Government of the Republic of Mali, USSGB holds a prominent position in the country's higher education landscape. In the future, USSGB will coordinate localised training programmes, facilitate resource alignment, and expand partnerships.

This collaboration has received high-level attention at the national level in Mali and is supported and coordinated by the UNESCO Office in Bamako.

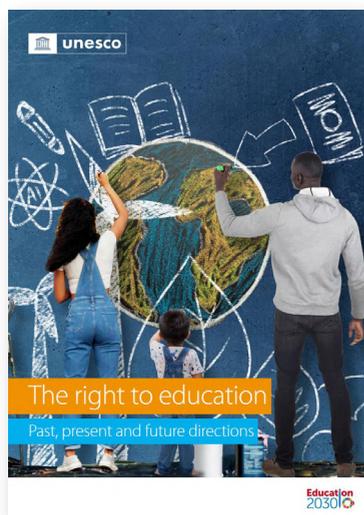
Shenzhen to Host the Global Future Higher Education Summit

On 6 June 2026, UNESCO Regional Office for East Asia (UNESCO Beijing), UNESCO IITE, Southern University of Science and Technology (SUSTech) and the UNESCO-ICHEI will jointly convene the "Global Future Higher Education Summit: A New Ecosystem for AI-Driven Industry–Academia Collaborative Talent Development." Against the backdrop of rapid advances in AI and digital technologies, the summit will explore new models of industry–education integration and the evolving ecosystem of higher education, while seeking forward-looking pathways for talent development.



Knowledge Sharing

Reimagining the Future of Learning: Towards Boundaryless, Intrinsically Motivated Lifelong Learning



Are the educational philosophies and models still in use today adequate to address the challenges of the 21st century? The report emphasises that in an age where AI can efficiently deliver knowledge, the core value of teachers lies in designing learning experiences that stimulate intrinsic motivation and encourage deep inquiry. Their focus should shift from preparing lessons to crafting activities and project-based learning, evolving into the roles of curriculum designers and guides to the learning process. For learners, it is essential to discard the notion that "education has an endpoint" and internalise "continuous learning" as a lifelong way of being. Furthermore, learning spaces must extend beyond the boundaries of school campuses. Learners should consciously build and engage with personal learning

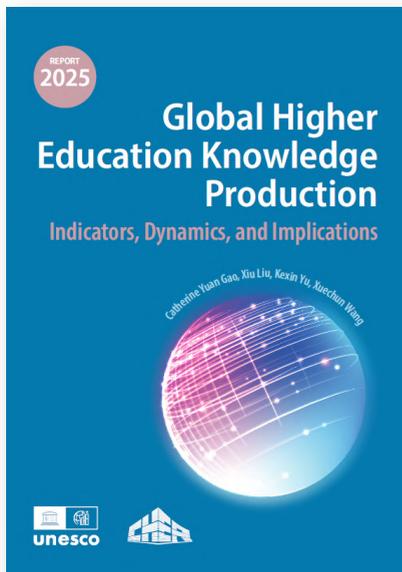
networks, encompassing online courses, professional communities, and even in-depth dialogue with AI.

Steady Yet Concerning: The Resilience Challenge of the Global Labour Market

Employment and Social Trends 2026 is a key report in the International Labour Organization's World of Work Series. Based on data from 2025–2027, the report notes that despite high global economic uncertainty, the job market has shown resilience, with the global unemployment rate projected to remain stable at 4.9%. However, the decent work deficit continues to worsen: there are 284 million workers living in extreme poverty, the number of people in informal employment has risen to 2.1 billion, and the issue is particularly acute in low-income countries. The report explores regional disparities in depth, such as high youth unemployment in Africa, the expansion of service sector employment in Asia, and the challenges posed by an ageing population in Europe. It also highlights the potential impacts of AI, trade policy uncertainty, and debt risks on the labour market.



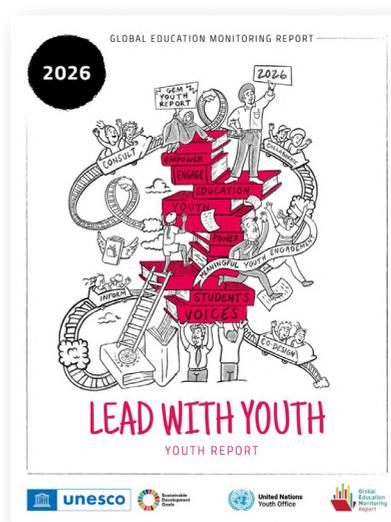
Unveiling the Historical Landscape of Global Higher Education Knowledge Production



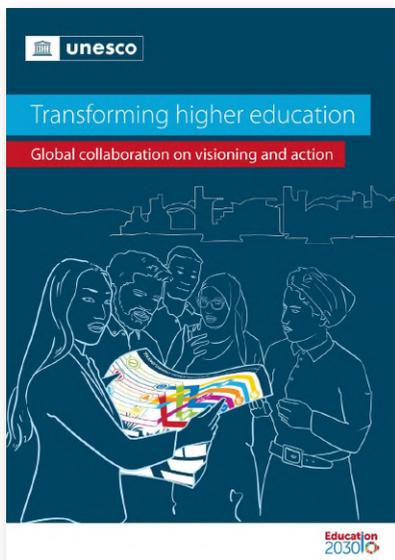
The report unveils the developmental trajectory, dynamic evolution, and institutional variations in global higher education knowledge production. The report presents a comprehensive panorama of the production and organisational modes of global higher education research knowledge from 1991 to 2024. It focuses on examining who produces higher education knowledge, where it is generated, through which channels it is disseminated, what key research topics are addressed, and how academic collaboration networks have evolved against the backdrop of profound transformations in the global higher education landscape. The report serves as a crucial reference for higher education researchers and policymakers in understanding the continuously shifting global map of higher education research. The report is an open access publication, archived and available on UNESCO-ICHEI's official website.

Lead with Youth

Young people are eager for their voices to be heard and to participate meaningfully in discussions on issues affecting them now and in the future, particularly education. Drawing on concrete case studies, this report traces the characteristics of youth and student participation in education legislation and policy-making around the world, and explores the challenges they face in the process. Findings from a survey of 101 youth and student organisations show that fewer than one-third consider themselves able to participate frequently in decision-making, while only one-fifth of student organisations feel valued or engaged on an equal footing during participation. In addition, the report proposes an index to measure governments' efforts to involve youth and students in education legislation and decision-making.



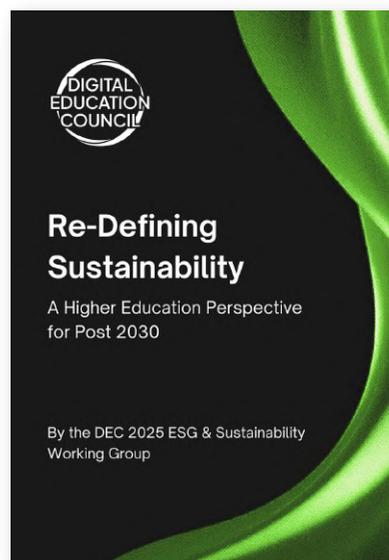
A Global Roadmap for the Future

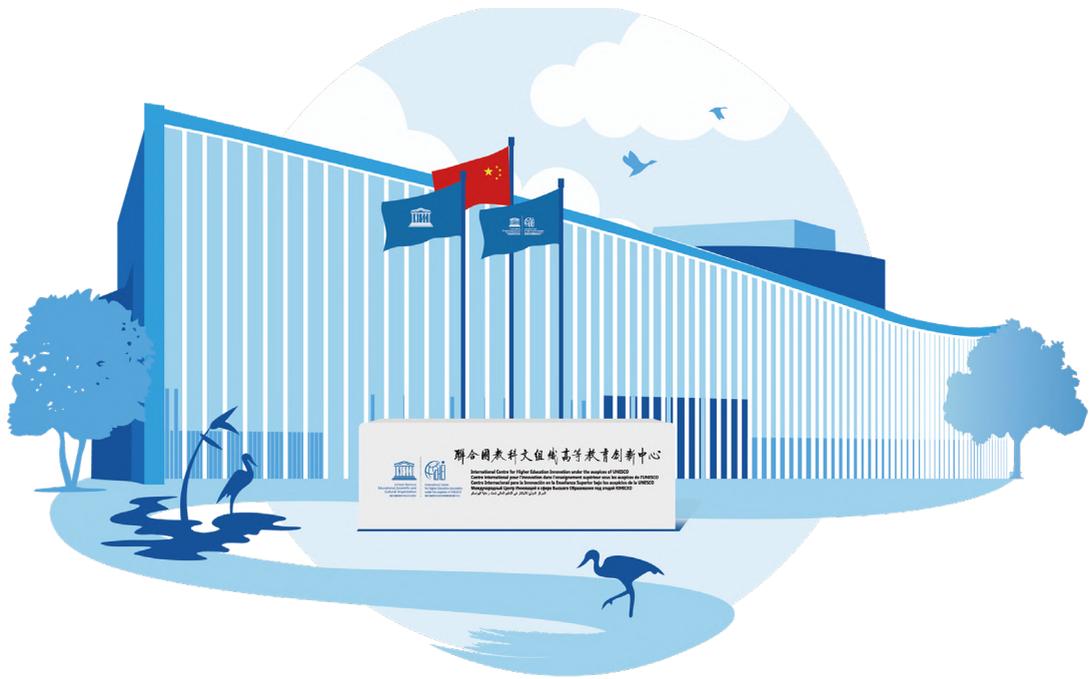


Higher education has long stood as a bridge between pasts and futures. Universities and other HEIs are places where ideas are developed, values are debated and new possibilities are imagined. Today higher education institutions have a critical role to play in responding to pressing contemporary challenges. To maximise the transformative potential of the sector, higher education itself needs to be transformed. Drawing on the 2022 UNESCO World Higher Education Conference and continued consultations, this publication translates a shared global vision into a roadmap for transforming higher education systems. It sets out seven Guiding Principles and offers a set of lines of transformation at system, institutional and learning levels, in support of a new social contract for higher education.

A Higher Education Perspective for Post-2030 Agenda

The current SDGs end in 2030, what comes next? Are these goals sufficient to drive commitment to a just, prosperous, and sustainable future? The Digital Education Council 2025 ESG & Sustainability Working Group has launched the *Re-Defining Sustainability: A Higher Education Perspective for Post-2030 Report*. Developed with the support of 44 institutions across 25 countries and regions, the report highlights emerging sustainability priorities for the post-2030 agenda, current institutional commitments and progress, innovative sustainability initiatives shaping the sector, as well as key sustainability performance drivers. Together, these insights help redefine and advance the sustainability agenda through the lens of higher education.





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