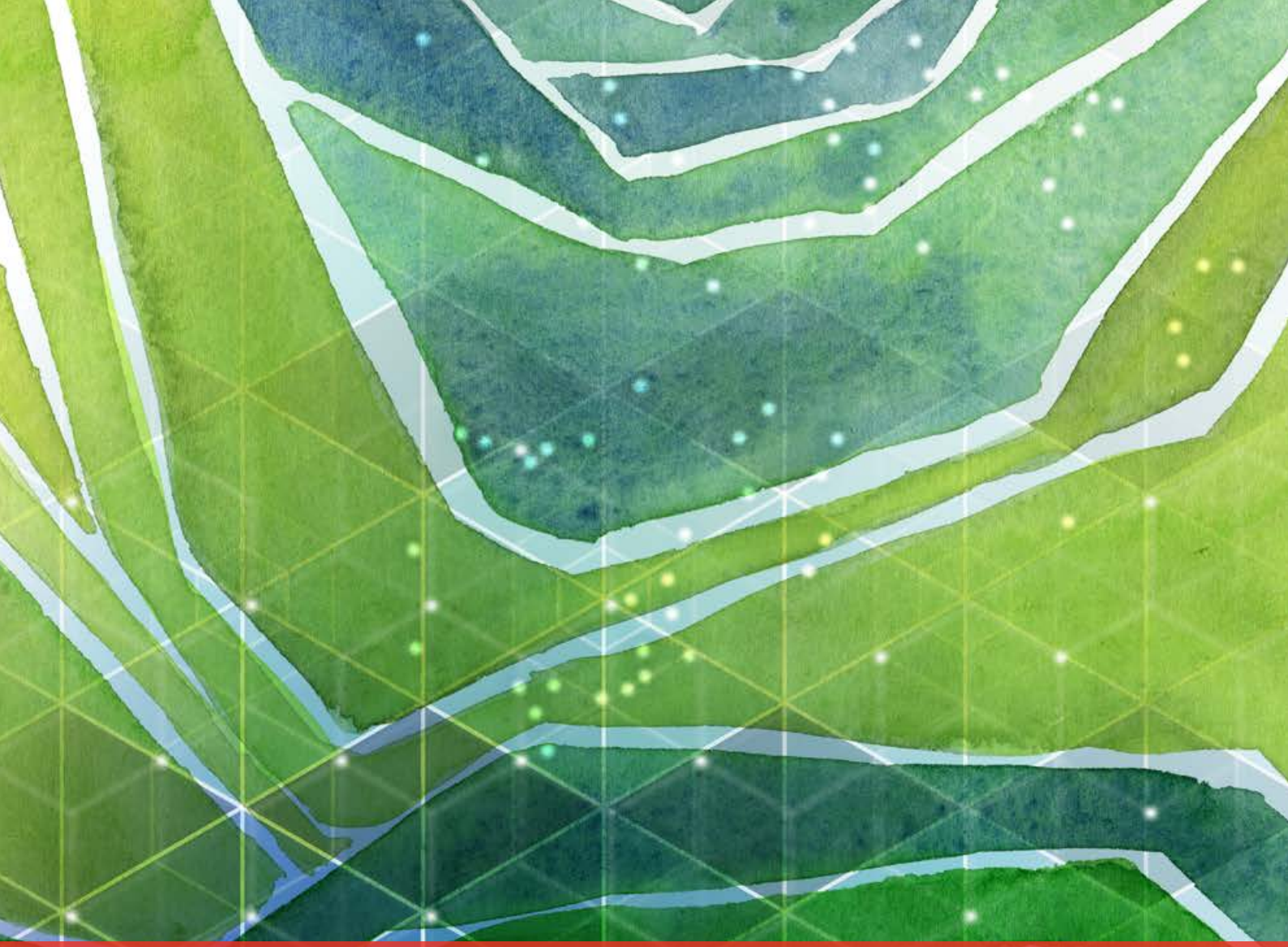

Strengthening Victoria's
Connections with Southeast Asia:

Industry 4.0 **in Viet Nam**

Opportunities for Australian Business

THE AUSTRALIAN APEC STUDY CENTRE
Asia Pacific Economic Cooperation
In partnership with RMIT UNIVERSITY
RMIT UNIVERSITY Asia Trade and Innovation Hub
VICTORIA State Government | Education and Training
ASIA SOCIETY AUSTRALIA

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The Victorian Government has funded the activation of the RMIT Asia Trade and Innovation Hub (ATIH) to undertake cross-border research and consultation to assess Industry 4.0 (I4.0) opportunities in Viet Nam for Australian business. The Victorian Government is committed to strengthening economic engagement with Viet Nam and its ASEAN counterparts, with four priorities to enhance trade and investment between Victoria and the ASEAN countries: Facilitate Market Entry, Promote Victorian Capability, Identify Emerging Opportunities, and Strengthen Ties. Global Victoria, the State's trade facilitation agency and gateway to global economies and communities, maintains an active program of engagement and an office in Ho Chi Minh City (HCM). Melbourne is proud to host the Viet Nam-Australia Trade and Investment Promotion Centre to promote Vietnamese trade with Australia.

RMIT Asia Trade and Innovation Hub

RMIT University and the Asia Society Australia have partnered to advance Australia's economic, educational, and people-to-people engagement with Asia and strengthen Victoria as a centre of Asia insights and capabilities. The partnership underpins a new Asia Trade and Innovation Hub at RMIT. The activation of the Hub has been funded by the Victorian Government's Higher Education State Investment Fund (VHESIF), to foster greater connectivity with Asia.

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Methodology

This study aims to identify potential business opportunities relating to I4.0 technologies in three key focus areas: agriculture, logistics, and higher education followed a 3-stage methodology:

- Desk-based literature review to collect information and data on the I4.0 technologies which are currently being adopted by Australian/Victorian and Vietnamese organisations in the three focus areas to the detailed levels of sub-sectors and processes. Frequency tables were generated to generate heatmaps rating the adoption levels or provision capability. These ratings were adjusted after a secondary data analysis from public sources on digitalisation and Industry 4.0.
- Direct input from virtual knowledge exchanges, meetings, and consultation with experts from the private sector/ academia, as well as multilateral agencies who possess expertise in digital technologies and digital transformation.
- Interviews of key Australian and Vietnamese stakeholders in each sector to discuss
  - IR4 technological capabilities and strengths in Australia in the three focus areas
  - Conditions and absorptive capacity of Vietnamese businesses in the three sectors
  - Opportunities and challenges for Australian businesses operating in these areas
  - The status of I4.0 technology adoption, current and prospective barriers and challenges, plans, and approaches to move from the current to the future state.

A roundtable validated findings and analysis and provided input to the report and recommendations.

Attribution

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The Research team expresses their gratitude to the interviewees and participants in the roundtable for valuable insights throughout this report.

Contents

Preface

Acronyms

LPI – Logistics Performance Index
VCCI – Viet Nam Chamber of Commerce and Industry
VLA – Viet Nam Logistics Business Association
ToS – Terminal Operating System
SAAS – Software As a Service
APIs – Application Programming Interfaces
PaaS – Platform As a Service
OCR – Optical Character Recognition
FMCG – Fast-Moving Consumer Goods
GTCI – Global Talent Competitiveness Index
GCI – Global Connectivity Index (GCI)
MSME – Micro and Small to Medium Enterprises
AIoT – Artificial Intelligence of Things
ANZFTA ASEAN – Australia New Zealand Free Trade Agreement
APEC – Asia Pacific Economic Cooperation
AR/VR – Augmented Reality/Virtual Reality
ASEAN – Association of Southeast Asian Nations
CHIP – Connect, Harness, Innovate, and Protect
COVID – Coronavirus
CIEM – Central Institute for Economic Management
ASLN – ASEAN Smart Logistics Network
AUD – Australian Dollar
CPTPP – Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CSIRO – Commonwealth Science and Industry Research Organisation
DFAT – Department of Foreign Affairs and Trade
DLT – Distributed Ledger Technology
EEES – Enhanced Economic Engagement Strategy
EMDEs – Emerging Market and Developing Economies
EPEs – Export Processing Enterprises
EPZs – Export Processing Zones
EU – European Union
FDI – Foreign Direct Investment
GDP – Gross Domestic Product
GSO – General Statistics Office
ICT – Information and Communications Technology
IMF – International Monetary Fund
M&A – Mergers and Acquisitions
MOF – Ministry of Finance
MPI – Ministry of Planning and Investment
SBV – State Bank of Viet Nam
SOE – State-owned Enterprises
TVET – Technical and Vocational Training System
VND – Vietnamese Dong
WEF – World Economic Forum
AI – Artificial Intelligence
FTA – Free Trade Agreement
I4.0 – Industry 4.0
IoT – Internet of Things
ML – Machine Learning
MSME – Micro - Small - Medium Enterprises
ODA – Official Development Assistance
RCEP – Regional Comprehensive Economic Partnership
SME – Small and Medium Enterprises
VET – Vocational Education Training
VIA – Virtual Irrigation Academy

Executive Summary

Australia seeks a successful transition to a post-COVID future in the Indo-Pacific region through an effective bilateral and multilateral engagement with its Southeast Asian neighbours.

Australia and Viet Nam aspire to build on 50 years of bilateral relations that span into multiple dimensional development and pathways for engagement. COVID has caused substantial loss of life and disrupted sources of livelihood for disadvantaged and marginalised communities. It also has created opportunities for businesses to accelerate digital transformation and the uptake of modern technologies.

As the world emerges from the pandemic, it has become clear that digital transformation will have an increasingly important role in the global economy.

This report adds to the growing body of research and dialogue on strengthening bilateral trade and cross-border investment between Australia and Viet Nam. In this report, we largely focus on Industry 4.0 (I4.0) applications in Vietnamese education, agriculture, and logistics, consider Australian strengths and capabilities, map opportunities, and provide market insights for Australian firms.

These three sectors have been keystones in Australia and Viet Nam's relationship, underpinned by proven complementarities. The existing high-quality engagement between the two nations can now be leveraged to accelerate I4.0 engagement.

Australia and Viet Nam are both adopting I4.0 technologies. Viet Nam has further to go than Australia but is a fast-moving digital adopter, with recognised momentum in digital transformation but variable levels of readiness for I4.0.

"Viet Nam is in a good but uneven position to become a digital powerhouse."[1]

1 World Bank, 2021. Digital Vietnam: The Path to Tomorrow

In the past year, the Vietnamese Government has increased the national focus on digital transformation to catch the I4.0 wave in all its manifestations and enable longer-term productivity and growth. Digital transformation is now a central objective in the suite of national development strategies and directives.

This includes calls for high-tech investment by both foreign large and small investors. This and Australia's relative lead implies that Australian companies may be well-placed to act on emerging opportunities for digital-I4.0 trade and investment.

Most Vietnamese enterprises are strongly aware of and relatively positive about I4.0. In practical terms, needs vary along a spectrum from digitisation through digital transformation to the adoption of I4.0 technologies. Readiness is highly variable. Cross-sector opportunities to build digital/I4.0 readiness, and for products and services to digitise and digitalise abound and will continue throughout this decade.

Uptake of I4.0 has been strongest by foreign-invested enterprises, State Owned Enterprises (SOEs), the leading local conglomerates, and globally exposed enterprises. Beyond this, Viet Nam remains a largely developing market for I4.0 technology.

Demand is now beginning to expand for cloud computing, the Internet of Things (IoT) and smart sensors, with an acknowledged need for cybersecurity tools and skills. At present, there are only small pockets of demand for automation, blockchain and big data analytics, but demand will strengthen and expand over the next five years. Demand for robotics/ advanced automation is likely to strengthen later this decade.

Identifying channels and customers can be challenging and requires adaptation to the Vietnamese market but Australia has a lot to offer including industry-specific advice and training, with digital/I4.0 products, and services along the transformation spectrum in education, agriculture, and logistics.

In each sector, current market opportunities reflect variable levels of readiness, and absorptive capacity. The sectoral overviews, case studies and analysis clarify the areas where Australian businesses could offer suitable I4.0 solutions and services.

In the education sector, an accelerating transition in Vietnamese universities to move to Education 4.0 provides opportunities for Australian universities, VET providers, and edtech. Opportunities are becoming clearer as needs are prioritised and readiness improves.

Agriculture is a key economic sector for Australia and Viet Nam with a proud history of bilateral engagement. Viet Nam agriculture faces many challenges to jump the divide between the status quo and Agriculture 4.0. There are many identifiable needs for suitable I4.0 technologies but commercial opportunities are still evolving.

Logistics is a sector which has attracted investment from leading Australian companies and has emerging opportunities for technology and services. A market for I4.0 solutions is emerging and is likely to expand quickly.

Australian companies active in the region and those developing Viet Nam literacy will find the sector profiles and discussion of opportunities illuminating. The next step is to nurture and support Australian businesses to act on opportunities in Viet Nam.

Success calls for collaborative leadership by Australian governments and industry to leverage positive conditions and sharpen the focus on I4.0 opportunities.

At both levels of government, we should raise the profile of Australian capabilities in I4.0 and increase investment promotion and attraction efforts in Viet Nam.

At the Federal level, we should expand the focus and resources around I4.0 in the bilateral relationship. At the State level, it is time to develop singular Viet Nam strategies, including an explicit I4.0 focus.

Critically, the time is now for the Australian industry to work with the government to prepare a strong Australia Inc. push around I4.0. towards Viet Nam.

I4.0 could create the next generation of business engagement in this dynamic neighbouring economy in the fast-growing and increasingly integrated region of the world.

INDUSTRY 4.0: Shared opportunities

Key findings

Viet Nam is an I4.0 adopter, with digital momentum but fragmented readiness for I4.0.

I4.0 is an accelerating, expanding priority in Viet Nam, indicating long-run opportunities.

Australia is an I4.0 frontrunner: building expertise in I4.0 technologies with diffusion across all industries, including education, agriculture and logistics.

Australia's relative lead in I4.0 positions firms to market suitable training, technology, and services in Viet Nam

Viet Nam's I4.0 market is largely incipient with niche opportunities and potential in time.

Viet Nam has prioritised education, agriculture, and logistics for digital transformation.

Bilateral complementarities in agriculture, education and logistics translate to I4.0.

FDI provides knowledge and technology transfers subject to the absorption capacity.

Success in Viet Nam can be leveraged in other increasingly integrated regional markets.

There is a strong framework that should be sharpened to increase the focus on I4.0.

I4.0 involves linked systems of data, analytics, and automation for efficient and sustainable production, driven by the use or integration of several technologies: next-generation networks (currently 5G); cloud computing, encryption; the Internet of Things (IoT); big data and analytics; blockchain; Artificial Intelligence (AI); Machine Learning (ML); Virtual/ Augmented Reality (V/AR); simulation; robotics; 3D printing; enhanced materials; and quantum computing.

Viet Nam is a thriving middle-income socialist-oriented market economy, lauded for uninterrupted development since the 1980s. Since 2015, digital transformation has been acknowledged as a key enabler of stronger productivity and growth.[1] In 2019, CSIRO forecast that Viet Nam's GDP could rise by an additional $162 billion within 20 years with effective digital transformation.[2]

By 2020, Viet Nam was a recognised digital adopter, ranked fifth in the world for digital momentum reflecting investments and rolling reforms.[3] Stakeholders – government authorities, collectives, and industry/ digital associations - are working concurrently across I4.0 and its precursors to industrialise, modernise and digitalise industries, leapfrogging where readiness allows. Viet Nam's tech sector is expanding with local startups focused on domestic and regional opportunities.

Australia is an I4.0 frontrunner with improving digital infrastructure, positive governance, and ongoing uptake of intermediate technologies across government and industry.[4] Australia has strengthening capabilities in AI, blockchain, and quantum computing with a mature innovation system, linked to domestic and international industry, developing applications through test labs and demonstration sites. Work continues to lift the ability of small and medium enterprises (SMEs) ability to adopt I4.0 business models and technology with tools, support, and training.

Workforce skilling is benefiting from future-focused options from high-tech apprenticeships to specialist degrees. A burgeoning tech sector, including edtech, agtech, and logistics-tech is increasingly seeking offshore growth.

In Viet Nam and Australia, the pace and degree of I4.0 transformation have increased since the global pandemic hit. In both countries, companies that had been grappling with rising interconnectivity and the technologies that epitomise I4.0 were driven to make key investments to manage disrupted operations and supply chains.

This changed experience of digitisation and innovation is continuing in capabilities, systems, and business models. Leading companies are increasingly integrating core I4.0 technologies to realise smart automated systems. Others are transforming across a spectrum from digitisation through digitalisation to adopting basic to intermediate I4.0 technologies. It is useful to look at Australia's and Viet Nam's relative progress in I4.0 to identify opportunities for Australian business in Viet Nam.

1 World Bank, 2018. Industry 4.0 – Harnessing Disruption for Vietnam's Development.

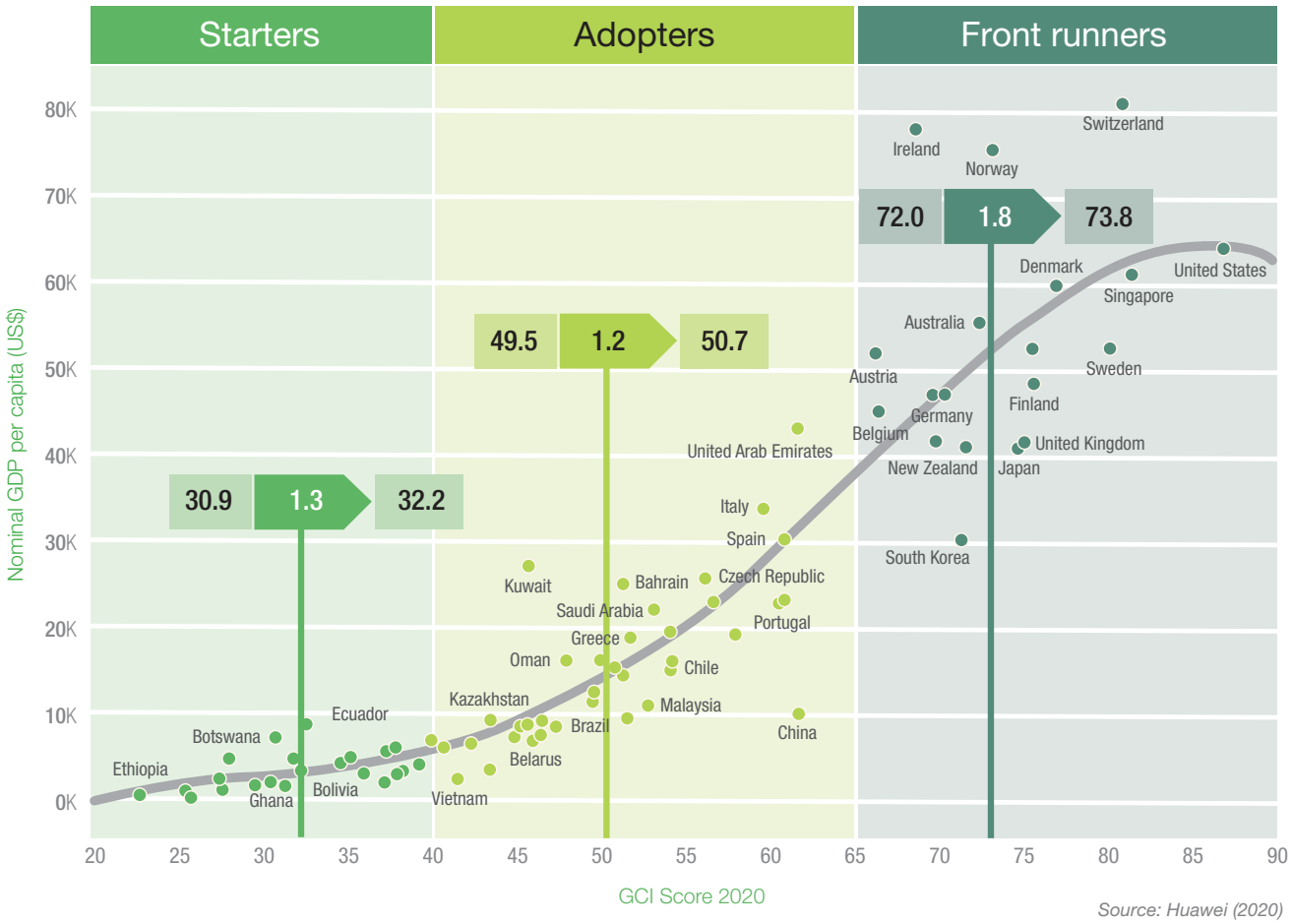
2 CSIRO, Data61 & (Vietnam) Ministry of Science and Technology (MOST), 2019. Vietnam's Future Digital Economy

3 2020 Digital Intelligence Index

4 2020 Digital Intelligence Index

Australia and Viet Nam compared

GCI 2020 versus GDP per capita/s curve



Source: Huawei (2020)

Global Connectivity Index (GCI) (2020): global connectivity and enablers

- Viet Nam is an Adopter ranked 55/79
- Australia is a frontrunner ranked 11/79

Fletcher School's Digital Intelligence Index (2020)

- Viet Nam – 60/ 90 - 'Break Out' economy – ranked fifth globally for digital momentum
- Australia – 17/ 90 – 'Stall Out' economy – digitally advanced with slowing momentum

Cisco Global Digital Readiness Index (2019)

- Viet Nam – ranked 70th in digital readiness – Accelerate stage.
- Australia – ranked 12th in digital readiness – 'Amplify' group

Global Talent Competitiveness Index (GTCI) (2021): workforce digital skills in 134 countries

- Viet Nam – 82/134
- Australia – 11/ 134

Viet Nam Industry 4.0: Forward momentum

Viet Nam identified digital transformation as the key to long-run productivity and growth around 2015 and is now approaching a tipping point in its journey to I4.0.

In the past two years, the Vietnamese Government revitalised policies to realise I4.0 in its multiple manifestations, clarifying national goals, plans, and responsibilities. Goals include building a digital economy worth 20 per cent of GDP, being a lead ASEAN digital economy, reaching 100,000 technology firms including ten unicorns, and ranking in the top 20 globally for AI by 2030.

A web of partnerships, MoUs and pilots has been set up to advance the legal and regulatory framework to promote transformation. Enabling infrastructure is in place and being gradually optimised for I4.0. The deployment of homegrown 5G and access to broadband internet is being actively expanded.

Coordinated government execution is more visible. Officials at all levels talk of balancing limited resources, building demonstration models, accessing knowledge and technologies through high-tech foreign investment, and supporting private sector innovation.

Most Vietnamese firms are aware and relatively positive about the potential benefits of I4.0 but practical uptake varies considerably. Some foreign corporations invested in Viet Nam are modernising plants, production, and logistics. I4.0 innovation pockets are developing around SOEs and larger Vietnamese conglomerates. For example, Viettel led the development of Viet Nam's 5G network. PetroVietnam, the oil and gas SOE is investing in AI and ML for exploration via the Viet Nam Petroleum Institute. IT multinational FPT is investing in AI and big data.

Globally active Vietnamese conglomerates have imported or transferred I4.0 technologies. Vinamilk has automated mega-dairies and factories in Viet Nam. VinFast operates smart factories with Siemens technology in the US. Hoa Phat is harnessing expertise from Japan's CMC and Primetals Tech. to build I4.0 readiness to operate modern metallurgical plants.

Outside of these segments, a wide swathe of companies is still to act. Viet Nam's numerous micro- and small-and-medium enterprises (MSMEs), particularly those operating in the informal economy, are constrained by financial and skills shortages.

Viet Nam preconditions for digital transformation

Resilient GDP growth:
2.9% (2020) 2.58% (2021) forecast 7.5% (World Bank 2022)

Inflation rate:
holding markets stable 1.8% (2021) forecast to be 3.8% (World Bank 2022)

State Bank of Viet Nam Inflation Target: 4%

Upward trending trade
(24% increase in 2021) including with Australia

15 ratified Free Trade Agreements with two in negotiation

The 2020 Viet Nam Free Trade Agreement Portal launched

Total registered **FDI inflow** of US$38 billion (2021) from 106 countries. FDI value was led by Asian economies – Singapore, South Korea, Japan, China, Hong Kong, Taiwan (MPI)

Lower middle-income GDP/Capita 2021 US$3700.
Increased 3.6 times from 2002

Poverty has declined from 32% (2011) to below 2% (2021)

Aim to be a **high-income country by 2045** (
requiring annual average growth of 5% p.a.)

Will continue rolling domestic reforms and welcome FDI

- WEF Global Competitiveness – ranked 67th (2019) up 10 levels from 77th (2018)
- Most improved globally in 2019

World Bank Ease of Doing Business – 70th (2020) up from 92nd (2010)

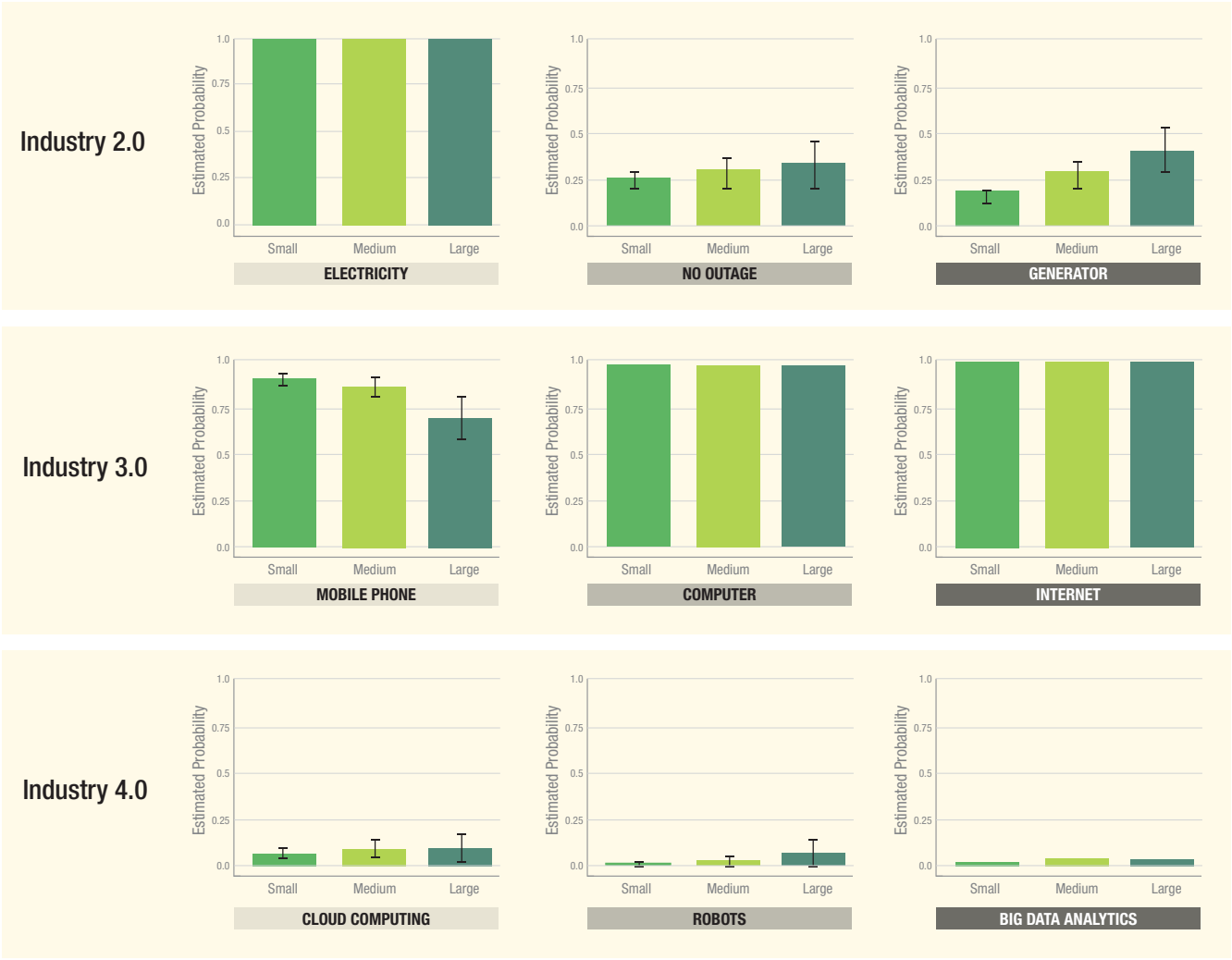
Key Digitisation and I4.0 Directives and Investments

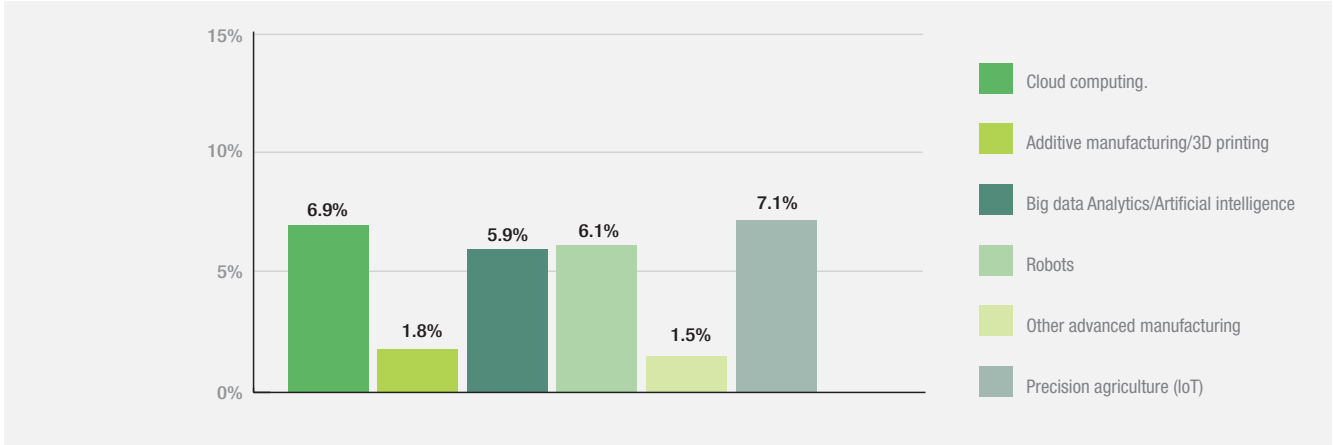
- PM Decision No. 2289 National Strategy on I4.0 to 2030
- National Digital Transformation Roadmap 2025 to 2030
- The National Committee on Digital Transformation
- National E-Commerce Development Strategy 2021-2025 with a focus on SMEs
- The 'Make in Viet Nam' Strategy was re-released in 2021 with a focus on digital technology
- Connection including homegrown 5 G – About 70 million mobile broadband subscribers
- Most affordable lowest fixed broadband prices in the region are 3-5G with 4G – 89% currently.
- Mobile and internet subscription per capital – 100%
- Value of the digital economy in 2021 – US$$21 billion (6.1% GDP)

2021 Cushman & Wakefield Global Outsourcing Index:
Viet Nam ranked No. 1

2021 A.T Kearney Outsourcing Index:
Viet Nam ranked 6th

Technology Adoption in Viet Nam by firm sizes/Adoption of I4.0 Technologies





Source: World Bank Group (2021)

Forecasting Industry 4.0 opportunities

Australia's relative lead in governance, technology, innovation, skills development, and uptake aligns well with Viet Nam's most pressing needs. At face value, Australian companies are well-placed to act on I4.0 opportunities in Viet Nam or likely to emerge over the coming decade.

Industry 4.0 outlook

There is addressable demand for technology and associated services around:

- Digitisation: (converting from analogue to digital, basic business ICT)
- Digitalisation: (connectivity, software to manage operations, establish online presence, or market links, e-commerce, e-finance, social media).

Immediate and ongoing cross-sector opportunities abound to help Viet Nam businesses expand digital and data literacy and readiness for I4.0 technologies. Demand is high for advice and access to higher education, vocational, and digital learning.

Demand is expanding for I4.0 solutions to transform people, operations, and technologies.

There is a growing demand for cloud computing. Viet Nam leads ASEAN expenditure on cloud with a compound average growth rate of 32% between 2018-2022.[5]

IoT and sensors uptake is being encouraged and expanding albeit off a low base.

The appetite for suitable and affordable IoT and big data solutions is increasing with comprehensive support requirements.

Demand for I4.0 tech will mount and become more sophisticated in the next 5-10 years.

Demand for automation, blockchain and big data analytics will strengthen in the short term (next 2-5 years) as the digital infrastructure, skills, and standards strengthen.

Readiness for AI, simulation and early-level automation in logistics, education, and agriculture will strengthen in this period.

Robotics and advanced automation opportunities are likely to emerge at scale in the medium term later in the decade.

Bilateral relations: Is the current framework enough?

In the past five decades, alongside advancing globalisation, urbanisation and technology, Australia and Viet Nam have expanded cooperation and economic engagement in many areas. There is a strong mutual appreciation of the benefits of engagement and the potential to realise more by working together.

Both economies are party to plurilateral FTAs: the Regional Comprehensive Economic Partnership (RCEP), the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the ASEAN Australia New Zealand Free Trade Agreement (AANZFTA), which provide positive conditions for companies in our respective markets.

In 2018, the bilateral relationship was upgraded to a Strategic Partnership and since 2021 has been powered by an Enhanced Economic Engagement Strategy (EEES) to become top ten trade partners and double bilateral investment.

During the pandemic, the relationship came to the fore with vaccine assistance. Trade proved robust. Australian exports to Viet Nam grew by more than 51 per cent (2020-2021) and Viet Nam has become Australia's tenth largest export destination.

However, border closures decimated student flows and stymied business engagement. Bilateral investment activity flatlined and continues to appear flaccid. It has been the most modest element in engagement and is in danger of falling further.

In 2019, the Ministry of Planning and Investment (MPI) reported pioneering foreign direct investment (FDI) by Vietnamese firms in Australia, and more than 550 Australian projects in Viet Nam worth US$2 billion (representing 0.5 per cent of total FDI in Viet Nam) in manufacturing, processing, logistics, accommodation, agriculture, health, mining, and education.

More than half of Australia's 40 universities are delivering education through various arrangements in Viet Nam, with virtually all hosting Vietnamese students who come to study in Australia. A diverse cohort of over 450 Australian firms has invested in Viet Nam. Manufacturing SMEs have cost-effective offshore production. Australian tech companies, including unicorns Atlassian and Go1, maintain digital development centres in Viet Nam.

5 Dr. Vu Minh Khuong, 2018. *Fourth Industrial Revolution: Fostering Digital Transformation with Cloud Computing*

Business associations and official representation are active in each economy. Specialist bodies such as AusCham Viet Nam, the Australia Viet Nam Business Council (AVBC), and the Australia Viet Nam Policy Institute (AVPI) maintain a positive business-to-business architecture, membership base and business ties. A web of people-to-people ties from the diaspora, migrant workers and students underpin the bilateral relationship.

The Enhanced Economic Engagement Strategy and Implementation Plan

The Australia – Viet Nam EEES Implementation Plan focuses on cooperation around science, technology, innovation, digital economy and I4.0 to support industrial development, competitiveness, sustainable growth, and prosperity.

The following activities indicate the emergence of I4.0 in education, agriculture and logistics in the bilateral context:

- A Digital Economy MoU to support regulatory reform, digitalisation plans, cross-border data flows, e-commerce, consumer protection and best practice 5G implementation.
- Cooperation on cyber and critical technology standards, infrastructure, human rights, ethical use of AI, and international law and cyber norms.
- Australia-Viet Nam Science, Technology, and Innovation Cooperation grants to businesses, universities, and research institutions.
- Aus4Innovation to assist Viet Nam's innovation systems to embrace I4.0.
- Australian pilot forum to connect SMEs from both countries and promote greater uptake of technology use through a technology transfer model.
- Australia mentoring and skills development in knowledge-intensive industries.
- Australia to support Viet Nam's capacity building in higher education through the Aus4Skills Program for the period 2021 to 2025.
- Australia and Viet Nam to undertake a Digital Transformation in TVET pilot program to position Australia and Viet Nam as key knowledge partners and create further partnership opportunities between Australian and Vietnamese TVET providers.
- Connecting educators, edtech entrepreneurs and institutions focused on education innovation in a technology-focused pilot project to explore key trends in each market.
- Endeavours to promote industry linkages with TVET providers, initially in logistics and allied sectors, through a further phase of Aus4Skills investment.
- Desire to implement education quality frameworks and skills development in Viet Nam's logistics and allied sectors through targeted TVET centres and enterprises through Aus4Skills.
- Through CSIRO, multilateral and local partners, tackle institutional complexities and capability gaps to increase digital collaboration and transform connectivity in the transport, logistics and agriculture sectors in Viet Nam.
- Aus4Innovation to support enabling sustainable socio-economic growth of the agriculture sector through the application of innovative science and technology.
- Collaborate on agricultural e-certification to increase mutual acceptance of electronic documentation, and on high-tech agriculture, including through Australian farm visits.
- Australia Viet Nam Enhanced Economic Engagement Grant Pilot Program (see case studies in later sections of this report).

This has been a positive start and there is scope to build on this in a strategic and focused way to alert and position more Australian firms to realise I4.0 opportunities.

Education, Agriculture and Logistics 4.0

Education, agriculture and logistics are key sectors in both economies, and the bilateral engagement has helped to secure Australian FDI with beneficial knowledge and tech transfer to Viet Nam.

Viet Nam has marked these sectors for digital and I4.0 transformation. Demand for innovations and skills is mounting if off a low base.

The next generation of FDI could be around I4.0 in these sectors, if Australian companies can compete to provide technology and services to Viet Nam.

The following sections provide insights into education, agriculture, and logistics, drawn from recent cross-border research and consultation.

Analysis of technology uptake in each sector by Australian and Vietnamese entities, and capabilities in the associated technology sector on both sides, confirmed Australia's comparative advantage around I4.0 suggesting a strong position to compete in the emerging market in Viet Nam around digital transformation and I4.0.

It also provides insights into which Australian technological capabilities are strongest and the extent of their alignment with Vietnamese priorities and needs.

Key findings are summarised for each sector.

The analysis, along with sector summaries, is presented in the appendices.

EDUCATION 4.0:
A transition underway

Key Findings

The market for Education 4.0 in the Vietnamese university sector is open and expanding.

Vietnamese universities are critical to building national readiness for I4.0.

The Government has prioritised comprehensive digital transformation of universities.

Digital transformation in Viet Nam universities ranges from nascent to intermediate.

Australia has a strong lead in implementing Education 4.0 and a strong edtech sector.

Post-secondary education has been a keystone of the bilateral relationship.

I4.0 training and qualifications can attract Vietnamese students in the post-COVID era.

Australian universities, training providers and edtech can act on B2B, collaboration and partnership opportunities in the university sector in Viet Nam.

Industry 4.0 in the university sector: Viet Nam and Australia

Education 4.0 is an evolving concept that covers the integration of I4.0 technologies in the development of competencies and delivery of the curriculum.

A consideration of Education 4.0 opportunities across the whole education sector in Viet Nam is beyond the scope of this paper. Given the importance of deep science and technology knowledge to the application of I4.0, this section examines opportunities in the university sector - a keystone in Viet Nam and Australia's bilateral relationship – which represents an estimated 40 per cent of Viet Nam's edtech market.

An ideal digital university delivers well-planned, designed, and pedagogically effective online courses, in a hybrid environment including technologically enabled campuses, fostering 21st-century skills to meet industry needs.

COVID turned the spotlight onto university digital capabilities everywhere as they were forced to move to online teaching to limit mass contacts.

Some of Viet Nam's 236 universities moved online for the first time during the pandemic. COVID forced the quintessential leapfrog. The Ministry of Education and Training (MOET) estimated only 45 per cent of Vietnamese universities were able to provide advanced online or hybrid teaching during COVID. Others relied on analogue study materials and conferencing tools to maintain class contact. In 2022 MOET assessed university digital transformation as basic to intermediate.

2022 MOET Evaluation of Digital Transformation in Universities across six levels

- 100% of universities have electronic portals, email, Wi-Fi, electronic document systems
- 55% across Level 1 (no idea) 2 (desire) or 3 (base digital transformation plans)
- 45% across Levels 3 (digital transformation plan) 4 (piloting transformation)
- In teaching, around 50% of universities have implemented online LMS systems
- No universities are yet at Level 5 (expanding deployment) or 6 (accruing benefits)

Australian universities, with longer lead time, higher investment, and adoption over time, fared better in delivering online continuity to domestic and international students. Institutions pivoted quickly and at scale to remote delivery. COVID did however highlight shortcomings and gaps for institutions. It also heightened interest in normalising blended learning environments and further investments in the range of online and campus-based Education 4.0 technologies.

Both Viet Nam and Australia have growing edtech sectors. Australia has more than 600 edtech companies including start-ups, publicly listed firms, and unicorns, with increasing international activity and evolving relationships (as suppliers, partners, or competitors) with education incumbents around the world. Nearly 40 per cent are exporting, including in the region. Viet Nam has more than 260 edtech companies, less than half of which are focused on the university sector. Many local start-ups are still to prove profitable, repeatable, and scalable business models. International edtech companies are active in both the Viet Nam and Australian markets.

Research, consultation, and comparative analysis of university use of I4.0 technologies in both countries were conducted across the three phases of a student experience: (1) management services such as registration, enrolment, and administration; (2) learning phase, which includes learning, assessments, and grading; and (3) graduation and alumni services.

It highlights Australia's lead in the uptake of smart technologies and applications, and which in Viet Nam is still to be adopted at scale. Australian universities have a strong lead in providing future relevant, flexible online and personalised offerings reflecting earlier investment and adoption of digital and I4.0 educational technologies. Experience with outsourcing and partnering with domestic and international edtech providers is deeper and more widespread. Australian universities are now striving to enable high-quality and distinctive 'learning from anywhere' options to stay globally competitive and attract students into the future.

Comparative analysis of Australia and Viet Nam's edtech sectors confirms Australian strengths in cloud computing, IoT, and analytics, across all phases of student engagement with pockets of AI, ML, AR, and blockchain. This suggests potential comparative advantages to meet Vietnamese needs in these areas.

In consultation, edtech firms stressed the importance of engaging thoroughly with stakeholders to understand local requirements and preferences, and tailoring solutions for affordability in the Vietnamese context. Heat maps presenting the analysis can be found in Appendix A. A gap analysis of the uptake of I4.0 technologies by Australian and Vietnamese universities found that opportunities exist for:

- Intuitive and easy-to-understand AI in instructional and institutional operations, for example, leveraging cognitive technologies in admission processes to optimise recruitment of students with competitive skills sets, admission and administrative processes, chatbots to answer student enquiries, and automation of manual tasks such as admissions, class registration, scheduling, attendance and processing student grades, and management of library and lab resources.
- AR, AI, blockchain and machine learning in learning services, for example, AI-enabled LMS to monitor student progress and improve engagement and performance based on online behaviour patterns and responsive assistance.
- Cloud computing, IoT, and blockchain in graduation services to verify the authenticity and keep track of university student and graduate academic achievements and manage access rights.
- VR technology to extend the capacity of students to study remotely.

Accelerating Digital Transformation in Viet Nam Universities

The focus on the digital transition in Viet Nam's university sector is ramping up. Pressures for comprehensive digital transformation have never been higher. Population growth and expansion of the middle class in Viet Nam continue to drive growing demand for tertiary education.

Domestic universities are expected to meet demand and provide future-focused qualifications and skills to increase national readiness for the I4.0 industry. The Asian Development Bank (ADB) says many Vietnamese universities are struggling to offer future-focused learning.

The Government is urging universities to experiment and adopt digital technologies. Ink is drying on new initiatives. The National Committee on Digital Transformation working with five public universities to design a digital university model by 2025, to be applied to half of all public universities by 2030. Levels of adoption and absorptive capacity vary across universities, spawning an array of emerging needs.

Foreign universities, including RMIT in Viet Nam, private universities, and leading public universities are leading the development of effective hybrid learning and teaching systems to meet the expectations of digitally savvy Gen Z students, authorities, and industry in Viet Nam. Hanoi Open University spent more than US$5 million to upgrade infrastructure to create smart facilities and upgrade smart teaching programs. The Hanoi University of Science and Technology has adopted a FPT-designed digital admissions system. Universities with overseas university partners have adopted LMS systems from their partners. Authorities are increasing options for partnering including for direct delivery of online learning by overseas universities, with knowledge and technology transfer.

CASE STUDY: FPT Group driving Industry 4.0

FPT Group, the global IT conglomerate, operates seven campuses and international partnerships for 40,000 students. FPT Education is a leader in online learning in Viet Nam. Staff receive training from Coursera, the global OPM, accessing the global MOOC and a virtual internship program. FPT maintains an AI education complex in Quy Nhon. FPT University Australia was set up in 2018 to build partnerships with Australian providers. These include delivery of business and IT undergraduate programs through Swinburne University, using the Online Learning Management System and advanced digital tools such as gamification. FPT has advanced R&D collaborations with Monash and Melbourne Universities on smart cities, smart transport, and IoT applications. FPT developed FUNiX to deliver online IT courses for employability and work readiness, partnering with Deakin in 2021 to offer a combined Bachelor of IT. Students study for the first 1.5 years through FUNiX then transfer to Deakin for the final two years graduating with FUNiX certificates and a Deakin degree. Most recently Melbourne Polytechnic and FPT Education signed an MOU to set up Melbourne Polytechnic Viet Nam to provide VET diplomas to Australian standards in HCMC.

Education

Population 98 million. 70% under 35 years. Only 28.3% have university degrees

2 million tertiary students. 236 universities.

Between 15-20% of public expenditure is directed to the education system

Families readily spend nearly 1/3 of disposable income on their children's education

In 2021 nearly 25,000 Vietnamese students were enrolled in Australia.

There are an estimated 700,000 alumni in Viet Nam.

The potential digital education market in Viet Nam (valued at US$3 billion in 2021) with growing student consumer markets and increasing B2B opportunities

The potential overall education market in Viet Nam is drawing FDI and driving growth of the local edtech sector with increasing venture capital from local and foreign funds

MPI reported 309 FDI projects in edtech with registered capital of US$767 million

More than 260 edtech businesses in Viet Nam with a focus on:

- business to consumer offerings
- digital content products with an emphasis on K-12 and English language
- LMS platforms again largely centred on schools and private providers

Viet Nam Universities move up in International Rankings

2021 Times Higher Education World University Rankings:
Five in the top 2000: Viet Nam National University - Hanoi; Ton Duc Thang University; Duy Tan University; Viet Nam National University - HCMC; Hanoi University of Science and Technology

2021 Times Higher Education Impact Index:
Viet Nam National University - Hanoi; Ton Duc Thang University; Hanoi University of Science & Technology; and Phenikaa University

2021 QS Global Rankings:
11 universities in the top 500 in Asia led by Hanoi University of Science and Technology; Viet Nam National University - Hanoi; Viet Nam National University - HCMC; Can Tho University then Duy Tan University; Ton Duc Thang University; Hue University; University of Da Nang; Hanoi Pedagogical University; Industrial University of HCMC; and University of Economics HCMC.

Viet Nam Higher Education:
Key I4.0 Stakeholders

Authorities	
MOET	International Cooperation Dept.
Higher Education Dept	– MPI
IT Dept.	– DOET Province
	– People's Committee Province
Funds/Associations Public unis	
Viet Nam Education Fund	Viet Nam Association of Universities and Colleges
Edtech Agency	
Public unis	
National Uni Ha Noi	National Uni HCM
Foreign Trade Uni	Qui Nhon Uni
Nong Lam Uni	Can Tho University
Van Lang Uni	Hue Agriculture Uni
Uni of Economics	National Economic Uni
VN Corporations	
Vin Uni (VinGroup)	FPT Uni (FPT Group)
FLC Group	Hoa Sen Uni (Nguyen Hoang Edu Group)
Masan Group	
Tan Tao Group	
Foreign	
RMIT (Au)	Viet Nam-Japan University (VJU) (Japan)
BUV (UK)	
Fulbright VN	

Many universities are still deciding what technologies will best deliver benefits of speed, scale, reach and cost, but even the most traditional universities are now developing plans to upgrade technology applications and systems over the next five-10 years – subject to constraints. Many universities are sensitive about costs and the effectiveness of foreign solutions in the Vietnamese context. Other constraining factors include residual analogue processes, legacy IT systems, limited expertise in selecting, implementing and integrating technologies, and constrained procurement and training budgets.

Pre-COVID, between 12-20 Vietnamese universities had adopted MOOC platforms to empower Open/ Distance Education models – many utilising the open-sourced Australian-designed Moodle platform. Leading public universities such as HCMC University have built VMOOCS (Viet Nam Massive Open Online Courses) providing free online training courses, and an in-house foreign language training system.

CASE STUDY: Australian Edtech in Viet Nam

Moodle (Modular Object-Oriented Dynamic Learning Environment) is an open-source online learning platform developed in Perth with more than 300 million users, 100 certified service providers and 180,000 registered user organisations worldwide. The system is used in Viet Nam by around 800 entities to provide focused learning packages. Reports suggest that as many as 40 Vietnamese universities use Moodle including the University of Hai Phong, Quy Nhon University, Foreign Trade University, University of Transport of HCM, Uni of Nong-Lam Hue, Van Lang University, Can Tho University, International Uni (VNU of Ho Chi Minh), Viet Nam- Japan Uni (National Uni of Hanoi), and Fulbright University. The open-source platform provides access to content, a Learning Management System (LMS) some analytics, and virtual learning environment capabilities. Users can access over 300 3rd party plug-ins, including Vietnamese language plug ins created by the Viet Nam Moodle community since it commenced in 2005. Moodle has no licence fees, is easily customisable to fit requirements, and provides access to over 37,000,000 online courses from 186,000 different websites. Moodle is partnering with leading edtech companies to incorporate advanced technology including AI and automation, big data for administration and the IoT for online LMS, remote studies and conferences.

Australia's latest unicorn is edtech company Go1 one of the largest global workplace training platforms providing upskilling and reskilling resources, founded in Brisbane by Andrew Barnes, Dr Vu Tran, Chris Eigeland and Chris Hood. Go1 Is active in the US, Europe, South Africa and increasingly in Southeast Asia. The company maintains regional offices in Singapore, Viet Nam and Viet Nam, including a 500-strong development centre in HCMC linked to development teams in Brisbane and Perth. Go1 aims to make it easy for organisations to learn by aggregating on-demand training content from providers all over the world. It is a Moodle Certified Service Provider creating unique LMS to meet organisational needs.

All Viet Nam universities are grappling with buy, build and/ or partnering approaches in collaboration or competition with edtech suppliers. Combined with expanding interest across the broad spectrum of technologies and applications encompassed in the concept of a digital university, this creates an array of potential opportunities.

Education 4.0 opportunity forecast: Viet Nam

The relative lead of Australia's universities, VET providers, registered training organisations (RTOs) and edtech in the development, adoption, and application of Education 4.0. means they are well-placed to act on strengthening opportunities in this field.

Education 4.0 outlook

Demand for delivery of qualifications, training, and skills around I4.0 in Viet Nam highlights options to market Australia's strengths around I4.0 to attract Vietnamese students.

Partnerships to increase upskilling in Viet Nam from offering digital skills short courses, and micro-credentials, to specialist degrees and sector specific skills and training to meet industry needs, systems for Internships, pedagogy, and curriculum development.

There is addressable demand for technology and services to catch up and implement the spectrum of applications encompassed in the concept of a smart or digital university:

Digitisation in the classroom: content and use of ICT in delivery and administration.

Digitalisation to build connectivity and online activities for learning, peer (student, graduate, and alumni) connection and integration with university services.

Digital Advisory services to advise universities on business, operations, human resources, strategy, and technology architectures in the Education 4.0 era.

Personnel need to improve data and digital literacy and ease with Education 4.0 technologies, pointing to opportunities for Education 4.0 upskilling / 'train the trainer'.

Demand across the spectrum of digital-Education 4.0 solutions and support will strengthen over the coming decade through 'buy', build and partnership activities.

Collaboration opportunities for Australian universities and edtech providers able to align with needs to jointly develop smart hybrid systems and 'fit for purpose' affordable solutions.

New options for Australian universities to partner to provide online education in Viet Nam.

Tertiary Education: A keystone in the relationship

Through 40-plus years of cooperation, Viet Nam and Australia have become close education partners, sharing many of the challenges of delivering quality, relevant education in a rapidly changing world.

Department of Education (Australia)

Education has been a keystone area of bilateral cooperation between Viet Nam and Australia. Australian and Vietnamese Universities (and VET providers) have strong linkages and a diverse range of business approaches from "bricks and mortar" fully-owned campuses to branch and partnership arrangements in Viet Nam. More than 20 Australian universities are operating in Viet Nam, bringing capital, knowledge, and learning, directly or through arrangements with Vietnamese partners.[6]

Australia has also been a leading international education choice for Vietnamese students at all levels of study. COVID interrupted established patterns of Australia's trade in education stalling international student movements including from Viet Nam. There is substantial knowledge transfer when Vietnamese students study in Australia, contributing to skills development in Viet Nam. It is to Australia's advantage that it has been a key English-speaking destination for Vietnamese tertiary students, is highly regarded in Viet Nam, and now has a flourishing Australian alumni community in Viet Nam. As Australia acts to rebuild the disrupted flows of international students, it would be strategic to further emphasise the options to gain digital and I4.0 skills, experience, and qualifications at our universities.

CASE STUDY: RMIT and online education

RMIT is the first and largest autonomous campus-based foreign university in Viet Nam, it has extensive experience delivering online education, and has three digitally enhanced campuses in Viet Nam. In Viet Nam, RMIT blends world-class online and digital learning with a campus experience, enriching the student experience and enabling global connection. Students enjoy blended digital and campus-based learning interactions for students, reflecting carefully crafted curricula, resources, and assessments. Students have opportunities to opportunities to engage with RMIT's specialist hubs such as the Centre for Digital Excellence (CODE) and the RMIT Blockchain Innovation Hub. In Viet Nam, RMIT has spearheaded ongoing policy engagement between the Vietnamese Government, the Australian and Victorian Governments, with Vietnamese and Australian higher education institutions, in the online and digital education space to develop I4.0. best practice, action plans, transition paths, toolkits, and capacity building.

In edtech, connections are growing between authorities, institutions, and industry and expanding opportunities around digitally enhanced learning. Initiatives under the EEES Implementation Plan include grants for pilots to link Australian and Vietnamese EdTech companies, and to raise awareness of Australian firms.

6 RMIT research

CASE STUDY: EduGrowth tracks opportunities

A new initiative funded by DFAT, the Australia-Viet Nam EdTech Innovation Exchange Program, has been launched to foster connections between the Australian and Vietnamese edtech sectors over the coming two years. The program convener, EduGrowth aims to illuminate key trends, capabilities and needs in each market through dialogues and workshops. The hope is that closer contact and regular exchange will build fruitful partnerships focused on the education sector from K-12 through to tertiary education. EduGrowth is Australia's leading edtech industry hub. Based in Melbourne, EduGrowth maintains a global focus on its support for Australia's edtech sector. The organisation was selected by the Victorian Government for the Global Victoria EdTech Innovation Alliance to activate pilots and run efficacy trials of Victorian products in domestic and international education settings.

New partnerships are facilitating the pooling of resources, facilities, LMS systems, courses and staff. In 2020 the Vietnamese Government passed Circular 38 setting a quota for foreign universities to provide online and blended courses in Viet Nam to secure delivery and ongoing internationalisation of students that represents vital knowledge transfer for the economy. In 2021, a pilot was approved for five Australian universities (Monash, Deakin, Swinburne, Griffith and Southern Queensland) to offer online and blended degree courses with local university partners. These arrangements show how Vietnamese universities can access or acquire skills, technologies, and learnings from their Australian partners.

AGRICULTURE 4.0: Reseeding an old bond

Key Findings

Agriculture 4.0 is a challenging but unfolding reality in Viet Nam, while Australia is an emerging leader in the development and uptake of Agriculture 4.0.

Government prioritisation of digital transformation of agriculture is strengthening rural connectivity, awareness, and potential benefits of adopting digital solutions.

In Viet Nam, practical uptake is in its infancy and the market is fragmented with only small pockets of active commercial adoption of digital technologies.

Small farmers have limited capacity to adopt I4.0 technologies.

In Australia, public-private pilots, collaborating with key stakeholders, are promoting digital/agtech awareness and readiness, and demonstrating the value of digital technologies

Viet Nam's agtech companies are acutely focused and active on local issues. Australian firms have capacity to provide solutions to meet Vietnamese needs. There are opportunities to build digital readiness and supply basic mobile-enabled solutions

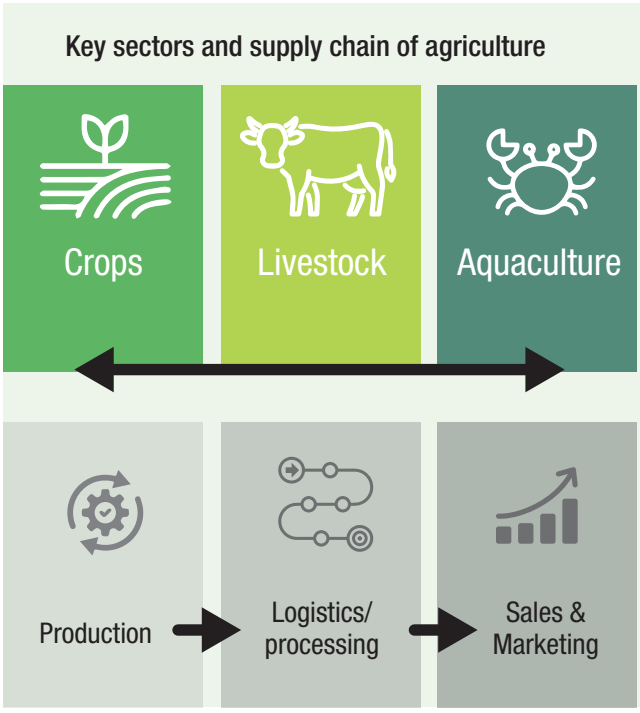
Agriculture is an enduring element of bilateral cooperation which provides a positive framework for bilateral activity around Agriculture 4.0.

Qualifying addressable market opportunities, building connections, and marketing frontier technology are challenging in Viet Nam's complex agri-system.

Market opportunities are emerging for commercially patient firms with an eye to longer-term opportunities at scale, in Viet Nam and the wider region.

Industry 4.0 in Agriculture: Viet Nam and Australia

Agriculture 4.0 harnesses I4.0 technologies along agricultural supply chains to improve efficiency and profitability, reduce risks, develop novel production systems, and enhance community wellbeing. In this report we focus on production, logistics, and market processes of three sub-sectors: crops, livestock, and aquaculture.



Agriculture 4.0 involves the application of inter-connected technology to create new production and supply chain management options, such as:

- Sensors and the IoT to improve on-farm management.
- Robotics to reduce labour intensity in production and logistics operations.
- AI and big data to inform production decisions and optimise yield.
- Distributed Ledger Technology (DLT) (blockchain) to track provenance.

Both Viet Nam and Australia are major global agricultural players with diverse and export-oriented cropping, livestock, and aquaculture[7]. Agriculture is a critical sector in both economies and faces similar pressure to enhance productivity, competitiveness, and sustainability in the face of the compounding challenges of COVID, climate change and conflict[8].

Agriculture 4.0 could help manage these challenges and is an emerging element in Australia and Viet Nam's bilateral relationship, building on established agricultural cooperation.

Agriculture is the least digitised sector in both countries however, in relative terms, Australia has a significant lead over Viet Nam, with expanding development and adoption of I4.0 solutions to improve farm practices[9]. Our analysis confirmed the wide use of smart machinery, satellites, sensors, IoT, cloud computing, AI, big data, and biotechnology with expanding uptake of cloud computing, blockchain, robotics and automation in cropping, livestock and aquaculture in Australia. Strengths included using predictive data analysis and AI for grazing, animal nutrition, safety, growth and methane reduction, and determining horticultural ripeness. Smart sensors to measure soil moisture and detect pests to save water, pesticides, and fertilisers. Biotechnology has been widely used to develop new, disease and pest-resistant crops and animal varieties. The use of drones and robotics for weed identification; remote water tanks, robotic milking and autonomous trucks for livestock are evident.

Australia has developed a network of demonstration farms to encourage uptake at scale. New qualifications such as digital agronomy are in place. Agricultural research strengths have extended into Agri4.0 with strong links to agricultural users. There is strong Federal and State support for agtech development. Solutions are widely available from international providers and more than 160 domestic agtech companies. There are 15 agtech incubators and accelerators involved with corporates, innovators, and investors. Our analysis found that the Australian industry is strong in cloud computing, AI, robotics and big data across production, logistics and marketing. See Appendix A.

Viet Nam is working on multiple fronts to restructure, modernise, and adapt agriculture to reduce poverty, ensure food security, grow exports, and manage climate change. Agriculture plays a vital role in the economy, accounting for 15 per cent of GDP and employing 37 per cent of the workforce (in contrast in Australia only about 3 per cent of the workforce is employed in agriculture due to higher levels of automation and larger farm sizes)[10]. Viet Nam is the world's 16th largest agriculture exporter, in the top five for rice, coffee, pepper, rubber, cashews, catfish and shrimp. An overview of Viet Nam's agriculture is in Appendix B.

Digital transformation could help to drive agricultural development and improve social and economic resilience in rural Viet Nam. It could make agriculture more efficient and resilient by better balancing productivity and sustainability. It could contribute to climate change mitigation and improve food security. It could lessen the divide between urban and rural societies. It could support action to stop the excessive use of chemicals and poor waste management. It could support trade, linking farmers to new markets locally and

7 Viet Nam's forestry is largely State managed so was excluded from this report
8 ACOLA 2020, The Future of Agriculture Technologies
9 ACOLA 2020; AUSGOV 2021; AUSTRADE 2022; ABARE 2022
10 (WorldBank 2020a) (Asialink 2021) International Labour Organisation (2022)

overseas. It could improve connections along the currently highly fragmented value chains. Digital transformation, therefore, offers the chance to leapfrog several stages of agricultural development if farmers can make the jump.

Official commitment and prioritisation of digital transformation in agriculture are clear. The Central Institute for Economic Management (CIEM) states that the application of medium-level technologies could enable strong growth by 2030 including in agro-forestry-fishery[11]. The Government maintains directives focused on people, processes, and technologies to drive digital transformation. This includes work to maintain the affordability of, and close remaining gaps in rural connectivity (broadband, Wi-Fi, mobile), agricultural data infrastructure (open source data, public access services), enabling policies and regulation (standards, data ownership, governance, interoperability, privacy, security) encouraging digitalisation of farm production systems (the Internet, mobile technologies, the cloud, AI and analytics etc), and building workforce capacity (skills, empowerment and trust)[12].

Digital transformation of agriculture in Viet Nam is occurring in conjunction with the ongoing structural transformation that will continue over coming decades with varying impacts on Viet Nam's small farmers. Currently, while rural connectivity is good, and most farmers own mobile phones, few use them as a management tool, due to low digital and data literacy, and very limited access to capital to upskill or invest in technology. In 2021, the Food and Agriculture Organisation (FAO) observed that "Viet Nam has laid a strong foundation for digital agriculture and the digital agriculture ecosystem is growing rapidly"[13].The 2021 Overview Report of Viet Nam Agricultural Digital Transformation noted the percentage of enterprises adopting digital technology remains very low[14].

Connected Farms

Data collection with edge sensor deployments, drone flights and farm equipment.

Ai Based Precision Farming

Real-time, actionable insights based on the ground conditions combined with remote sensing and weather patterns to inform irrigation, planting and fertilising.

Yield Optimisation farming

Microclimate weather for ai generated predictions.

Robotics

Autonomous or remotely operated robotics for both sea and land.

11 MPI/ Central Institute for Economic Management, 2019. Draft national strategy on Industry 4.0, Vietnam Investment Review

12 OECD 2021. Status of Digital Agriculture in 18 Countries. OCED 2021 Digital Opportunities for Better Agriculture Policies Chapter 5 Realising Digital Opportunities for Agriculture requires a data infrastructure; (MOT 2021) Decision Promulgating the *National Strategy on Industrial Revolution 4.0 until 2030*

13 Vietnam Digital Agriculture Profile (FAO 2021)

14 Vietnam Agriculture Digital Transformation International Forum 2021

Agriculture in Viet Nam

- 12.36% of Viet Nam GDP (2021) growth 2.7% p.a.
- Employs 37% of the national workforce (2022 ILO)
- Share of agricultural land 39%
- 16th largest global agricultural exporter – US$56.3 billion U(2021)
- Top five exporter of rice, cashews, coffee, pepper, rubber, fish and shrimp
- Has secured 1% of FDI – US$$3.6 billion – 505 projects (2021)
- Taiwan, Singapore, and Thailand = +50% of FDI into agriculture

Structure 2020 (GSO)

- 34,348 farms, 17,000 agricultural cooperatives outside forestry, 7471 enterprises
- 10% applying technology, mainly in the Central Highlands and Mekong Delta.
- 9 million household farms (average size <0.5-2 hectare)
- Small farms around 4.5 million (<0.5 hectare)
- Crops: 37.5% of land (2019) includes Rice, Sugar Cane, Corn, Vegetables, Pepper, Cassava, Maize, Cashews, Banana, Coffee Coconut, Sweet Potato, Watermelon, Rubber, Oranges, Mango, Dragon Fruit, Pineapple, Spices, and Tea
- Livestock: Pigs (62%) Poultry (29%) Cattle (7%) Other (3%)
- Aquaculture: 4th largest Asian aquaculture producer: Shrimp - Mekong Delta, North/ Central Coast, Red River Delta, SE; Pangasius and Finfish: Mekong Delta, Red River Delta, North/ Central Coast Areas, Northern Mountains, and Marine Products.

Digital/ Hi Tech Agriculture

- 90% of farmers have a mobile phone
- 35 high-tech agricultural zones, 193 high tech communes
- 46 agtech companies
- IFC agtech Viet Nam Acceleration Program for small farmers
- Government incentives and concessional loan programs
- Decision No. 575/2015/QD-TTg plan for hi-tech agricultural areas 2020-2030, and a master plan to build **high-tech agriculture** zones for large-scale and modern **agriculture** production methods with ten more by 2030.
- Ministry of Agriculture & Rural Development (MARD) has MOUS with Japan, Ireland, the Netherlands, and Australia on high technology-based agricultural systems.
- Viet Nam is not an established market for carbon trading, which discourages some overseas agtech providers from transferring their technologies to Viet Nam.

Viet Nam Agriculture: Key I4.0 Stakeholders

	Authorities	SOE	Associations	
Crops	MARD Dept of Cooperatives & Rural Development	Northern Food Corp (Vinafood 1) Southern Food Corporation (Vinafood 2)	Viet Nam Digital Agriculture Assoc (VIDA) Viet Nam Food Association Viet Nam Food Import Export Association	Viet Nam Farmers Union
Livestock	MARD Dept of Cooperatives & Rural Development	Vinamilk (36% state owned)	Viet Nam Dairy Association Animal Husbandry Association (AHAV)	
Aquaculture	MARD – Directorate of Fisheries		VASEP (Viet Nam Association of Seafood Exporters and Producers)	To grow and diversify advanced aquaculture

The Government is working with agricultural and digital partners to shift mindsets from traditional farming, beyond adopting hybrid seeds, pesticides, and fertilisation, to enable digitally enabled innovation.[15] Digital training for farmers is expanding with Google and other partners. The Government has prioritised digitisation of relevant data sets to facilitate partnering with technology providers. MoUs are in in place with countries including Australia to assist digitalisation of agriculture. Official development assistance, including from Australia, is a key driver of progress around Agriculture 4.0, supporting projects involving small farmers, collectives, and hi-tech agricultural provinces, and providing avenues for local and overseas agtech companies to work with users and key stakeholders.

Whilst the challenges are substantial, the commitment is now evident, and it is inevitable that Agriculture 4.0 will develop gradually. This is already evident in some emerging pockets of stronger adoption of digital technologies. Certified organic agriculture using digital technologies by younger, digitally savvy farmers is expanding as is urban agriculture employing novel technologically equipped cultivation.

The most meaningful adoption of the full stack of I4.0 technologies is limited to 15-20 leading agricultural companies or conglomerates (such as Vingroup, TH True Milk, Vinamilk, Loc Troi, and Pan Group) with strategic investments to create a digitalised supply chain, minimise costs, and enhance productivity.[16] The development or uptake of digital technologies by private enterprises has helped to lift the profile of Agriculture 4.0 nationally and feature prominently in the media and public awareness campaigns.

CASE STUDY: Pan Group embraces technology

The Pan Group is a leading agriculture enterprise supplying local and international markets. The Group's agribusiness arm has invested in high-value agriculture products, including seafood, flowers, and rice and is incrementally adopting technology to improve sustainability and profitability, with some automated processing systems, IoT and smart sensors to monitor processing. However experimental aquaculture sensor monitoring was too expensive for wider uptake, and use of data analytics and AI has been hampered by limited access to relevant data. Pan reports that pressure to implement certification and blockchain is increasing from overseas customers. The Group works with local and overseas universities, and strategic international partners to incrementally try out and then adopt digital technologies.

Our analysis of the evolving landscape of digital adoption in Vietnamese agriculture suggests four trends: solid uptake of biotechnology across three sub-sectors, expanding use of sensors and IoT in larger commercial farms and in aquaculture, including dispersion to some smaller contract producers, limited automation concentrated in dairy, and initial use of DLT/blockchain uptake in a few livestock/crop value chains. There was almost no digital adoption in logistics and marketing.

15 Small farms in Vietnam use improved seeds, fertilizer and pesticides and other biotechnologies extensively. See Appendix Current Use of I4.0 by Small Farms by Rural Households in Vietnam. (FAO 2018; WorldBank 2016)

16 Morris 2019

There is a concerted effort to foster local agtech commercialisation. For example, the Viet Nam Research Institute of Electronics, Informatics and Automation, one of 13 MOIT-managed research institutes, has designed, manufactured and installed an automatic control monitoring system using IoT and AI for tea production and processing in Lai Chau province, an automatic feed control and ventilation system using IoT technology for dairy farms, a smart goods loading and unloading systems for fertiliser and animal feed operations costing 40-60 per cent less than imported products.

Our research found Viet Nam's has about 50 agtech firms with a strong focus on sensor use in cropping, irrigation and aquaculture; biotech; and renewable energy technology. More start-ups are developing mobile-enabled options tailored to Vietnamese conditions and issues which are suitable for small farmers. MimosaTEK has built a smartphone monitoring app coupled with smart remote sensors operating in the cloud to enable smart irrigation systems to optimise water, electricity, and fertilizer usage, achieve optimum crop yield and provide full traceability to commercial partners. MiSmart, winner of the 2020 Viet Solutions is developing carbon fibre drones to survey crop health and to carry cheap hi-res cameras.

Agriculture 4.0 Opportunity Forecast: Viet Nam

In 2021 the FAO identified four categories of digital end users in Vietnamese agriculture: input suppliers (providers of agricultural inputs); producers (mainly small farmers with few large-scale producers); distribution users (processors, traders, transporters, distributors); and consumers. All four categories had low levels of digital and data literacy, except for younger and more affluent users.[17]

Priority needs were identified including solutions to create information channels across production, distribution and purchase (QR codes, smartphones apps, and online platforms to link to markets and access information); advisory data and decision support services (utilising mobile networks, SMS, cloud to collate, store and share data), physical and remote monitoring systems (IoT, sensors, UAV, drones, data analytics, cloud-based); and information exchange between producers and input suppliers (smartphone digital diaries and blockchain).

In 2021 Australian agtech consultants Beanstalk assessed Viet Nam agriculture as being at an inflection point, with unfolding needs and potential opportunities across the production chain for Australian agtech to provide solutions to mounting challenges including sustainability, climate resilience, productivity, food quality, and safety.[18]

Our comparative/gap analysis of Agriculture 4.0 uptake and development in both countries across the value chains in the nominated sub-sectors highlights Australia's lead and suggests Australian business is well placed to meet many identifiable needs in Vietnamese agriculture indicated on the following page.

Agriculture has been a longstanding pillar in the bilateral relationship, and is now extending into digital agriculture, leveraging connections and channels built through agricultural trade, development cooperation, joint research and more recently reciprocal FDI. Bilateral engagement will continue to grow across conventional areas of trade and investment and increasingly around Industry 4.0. There are sweet spots where Australia can increase engagement now, based on clear needs (demand) and capabilities (supply).

There is growing opportunity for Australian agtech enterprises with commercial patience and a long-term vision to work in partnership with Governments, the private sector, NGOs, regional organisations and other donors to explore opportunities in Viet Nam. Australia has increased support for bilateral business programs under the EEES to connect Australian firms with Viet Nam. Companies can compete to win tailored immersion opportunities to validate their offerings in the Vietnamese context. There are new grants for agtech pilots. A number of Australian agtech firms are already leveraging Australia's reputation in agriculture, bilateral ties, and local connections to realise early mover advantages.

CASE STUDY: Hillridge technology insures the food harvest

Hillridge Technology is an Australian agtech provider exploring opportunities in Viet Nam agriculture for an AI crop insurance platform for the millions of currently uninsured small farmers. The solution provides access to online pricing of weather index insurance, monitors the weather for the Policy, and has self-executing contracts based on blockchain so farmers can mitigate the financial impact of adverse weather events. In Australia, Hillridge has commercial partnerships with Mitsui Sumitomo Insurance, Marsh, and Nutrien. Following participation in the Australian-supported 2021 Viet Nam GRAFT challenge, Hillridge is building partnerships with the Centre for Hydro-Meteorological Technology Applications, local insurance underwriters and mobile micropayments providers in Viet Nam. Hillridge aims to be the "go-to" microinsurance solution for Viet Nam farmers and has been awarded a grant by Swiss-based NEAR Foundation to develop a blockchain-based parametric insurance platform for tropical storms to be piloted on typhoons in Viet Nam.[19]

In the medium term there will be greater opportunity for Australian businesses, equipped with local knowledge and relationships, to offer products and services both directly to smallholder farmers through a business-to-consumer (B2C) model, and indirectly as enterprise solutions targeting agricultural value chain actors such as agribusinesses and cooperatives under a business-to-business-to-consumer (B2B2C) model.

17 Vietnam Digital Agriculture Profile (FAO 2021) The World Bank Digital Agriculture Transformation initiative

18 Beanstalk Accelerating AgTech: Australia's Opportunity in Vietnam.

19 Hillridge Blog "Partnership with NEAR Foundation", GRAFT Vietnam Challenge website

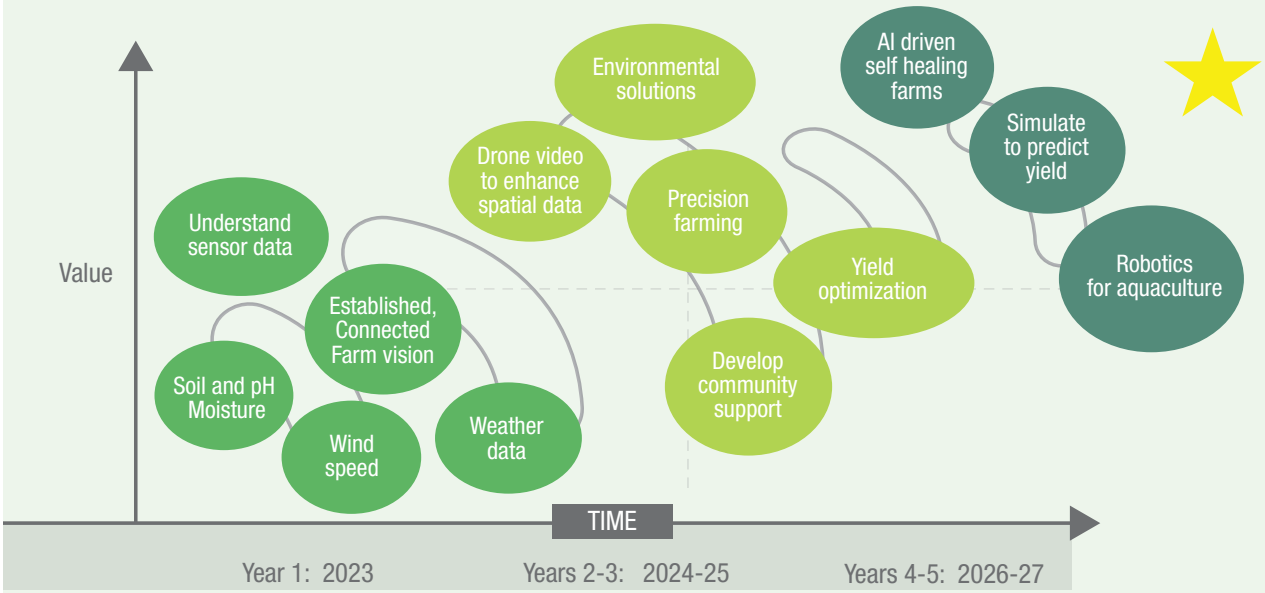
Agriculture 4.0 outlook

- Conventional agricultural opportunities will continue for Australian business. There is ongoing interest in Australian biotechnology around disease, drought- and pest-resistant crops and animal varieties.
- Opportunities to advance mechanisation by supplying appropriate machinery and equipment enabled with technology to automate farm work to Vietnamese agribusiness.
- New opportunities are plentiful to help build readiness in Viet Nam and enable digital transformation of agriculture. There is strong demand for digital and data literacy, training, and skills to build readiness and enable uptake of Agriculture 4.0 technologies in Viet Nam.
- Cross-linked to the education sector, there is a market for specialised knowledge pertinent to Agriculture 4.0 including digital agronomy and I4.0 technologies.
- There are mutual benefits to be gained under the Agricultural Visa scheme including for Viet Nam a 'brain gain' of agricultural workers exposed to technologically and knowledge enabled agriculture in Australia and alleviating labour shortages in Australian agriculture.
- After a slow start, digital financial services are growing rapidly. Opportunities exist for mobile-based digital advisory services for Vietnamese farmers covering advice, best-practice, data, pricing, and forecasts. The need is for intelligent and intuitive digital services providing localised, granular agronomic, market and weather data to support decision making, with referrals to relevant and qualified service providers on demand.
- Opportunities are emerging to supply mobile-enabled applications for market connection, production, procurement, and supply chain management.
- Solutions to build agricultural digital, e-commerce, market and e-trade channels in Viet Nam will grow over time.
- There are niches where the demand for smart farming sensors, mobile IoT, cloud computing, drones, AI, big data, and distributed ledger technology (DLT) / blockchain exists.
- There has been interest and uptake in technology enabled novel production systems.
- There are potential opportunities for Australian agtech providers to develop DLT/blockchain- solutions for automated tracking and tracing of provenance along the supply chain from farm to plate to meet customers' rising needs for food safety.
- Currently, opportunities will be linked to exporting enterprises but will in the future expand as domestic demand for traceability increases. Proof of origin, smart contracting, and stock management for the agriculture industry.
- Smart/remote sensors and IoT technologies with cloud computing to help on-farm management of environmental risks, difficult weather conditions, optimise inputs and save resources (water, pesticides, fertilisers) will strengthen over the next five years.
- Different types of drones and robotics for weed, pest identification, crop production, livestock and aquaculture in crops, livestock and aquaculture.
- Technologies involving AI and big data to help production decisions (spraying, mustering, harvesting or dairy) could be adapted and transferred to Viet Nam's commercial farms to enhance their productivity, and deliver cost efficiencies.
- AI applied to Big Data to optimise yield, reduce waste and improve decision-making (e.g: irrigation water, fertiliser use, demand prediction, supply chain)

A horizon scan of Agriculture 4.0 opportunities is depicted below.

Horizons based transformation

The horizon based framework provides a structure for Australian Agtech to work within Vietnam's current situation of adoption of industry 4.0 techniques in agriculture.



Horizon 1

Connected

Begin by using simple sensors for monitoring.

Horizon 2

Precision agriculture

Look to combining data with sensor data to get enhanced views an understanding.

Deploy microclimate model for yield optimization.

Horizon 3

Advanced robotics and simulations

Digital twin for transmission

Optimization with machine

Learning and space data

Agriculture in the bilateral relationship

Australian support for digital transformation of agriculture

- ACIAR since 1993 has completed over 200 projects, training activities and partnership activities to foster agricultural development, working with government agencies and research institution, agribusiness, and farmers. ACiAR has provided scholarships for Vietnamese officials and researchers and runs a powerful alumni network.
- Since 2016, Australia has supported the Water Efficiency Improvement in Drought Affected Provinces (WEIDAP) project with the ADB to modernise irrigation and support the production of high-value crops in the Central Highland and Central Coastal Regions.[20]
- The long partnership between the CSIRO and Viet Nam based Viet Uc, a shrimp producer has introduced advanced hatchling production, and shrimp farming automation which tracks each crustacean by code throughout the growing process.[21]
- Australian horticulturist Duy Ly, founder of 4 Ways Fresh Produce brokered new opportunities to train Vietnamese market gardeners in Australia under the Australian Vocational Scholarship program. Participants will achieve TAFE Diploma in Horticulture and work placements in commercial scale production in South Australia.[22]
- Australian agtech company FluroSat won the Future Food Asia 2020 for its full crop-cycle analytics reports and alerts.[23]
- The Aus4Innovation Partnership Grants supports digital innovation in Viet Nam and fosters partnerships between Australian and Vietnamese entities, including in agriculture. A 2021 project introduced a **Smart Eye** system incorporating drone technology and artificial intelligence of things (AIoT) to farmers in Thanh Hoa province to monitor nutrition levels and disease in sugarcane fields. **The project was jointly delivered by** the University of Wollongong and the Vietnamese IoT tech company VIGREEN.
- Orlar Viet Nam, the Viet Nam based subsidiary of Orlar International is expanding digitally to enable vertical farming commercially and with Australian government support.
- Under the DFAT GREAT program, Australian consultancy Applied Horticulture Research has been providing training and technical support to greenhouses in Son La for certified safe vegetable, and advanced postharvest management. Under the Aus4Innovation program, the group is also working with local farmers, the private sector and government to build an innovative low-cost CoolBot controller.
- AgUnity is an Australian agtech/fintech company building its profile in Viet Nam after winning the 2018 MATCH market immersion program to validate its package of a smartphone, apps and a blockchain platform for farmers. AgUnity is partnering with Action on Poverty to deploy its technology with the Da River Fisheries Association.
- Australia has supported the Viet Nam GRAFT Challenge, 15 weeks of tailored support coordinated by Beanstalk with advice from in-market experts to validate technologies and a roadshow to present solutions to Vietnamese agricultural corporations.
- The Virtual Irrigation Academy (VIA) - a not-for-profit CSIRO spin-off funded by ACIAR has run projects in Viet Nam implementing Wi-Fi / mobile-enabled Chameleon sensors and Wetting Front Detectors - affordable, high-quality equipment and data analytics that builds knowledge using a simple colour language to visualise data online. During COVID VIA built online training for farmer users vulnerable to climate variability and change.

20 *https://waterpartnership.org.au/helping-vietnam-modernise-irrigation-for-high-value-crops/*
21 Viet – Uc Group: Transforming Vietnam's Shrimp, *http://vietuc.com/en/*
22 The Leader SA "Australian trains new generation of Vietnamese farmers"
23 *https://futurefoodasia.com*

LOGISTICS 4.0: Managing change

Key Findings

Australia has a dynamic and innovative logistics sector.

There is a growing appetite for I4.0 technologies across Viet Nam's logistics sector, however, market demand and readiness are segmented in Viet Nam.

Australian providers are in an advantageous position to explore emerging opportunities around digital transformation in Viet Nam logistics - likely to solidify shortly.

The burgeoning demand for logistics reform in Viet Nam provides opportunities for businesses in both countries to trade, invest and collaborate.

Competition is dominated by regional logistics companies with rising domestic suppliers.

There are significant niches of opportunity for Australian logistics and technology providers with an appropriate strategy and approach.

The logistics industry around the world is undergoing a rapid transformation towards Logistics 4.0. Multiple factors are driving this trend including increased trade and the rise of e-commerce, reflecting the rise of a growing, digitally connected, and urbanised middle class in Asia.

The trend accelerated during the pandemic to deal with capacity constraints, congestion, and labour shortages along supply chains and is expected to continue over the coming decade.

Logistics 4.0 involves the adoption of ICT and I4.0 technologies by logistics companies across operations to facilitate coordinated, efficient, and sustainable management of operations within the company and across supply chains. The process ranges from shifting from analogue to IT platforms, through to the adoption of current I4.0 technologies across the supply chain: procurement for warehousing, inventory management, transportation (road, rail, sea, air) and reverse logistics.

I4.0 technologies include digital and data technologies: spatial mapping technologies, sensors and IoT, blockchain, smart contracts, AI, cloud computing, big data analytics, automation, virtual reality, and energy technologies.[24]

Industry 4.0 in Logistics: Viet Nam and Australia

The global Logistics Performance Index (LPI) consistently shows the lead of developed economies over emerging economies in logistics performance. In the most recent LPI Index in 2018, Australia ranked 18th of 167 countries while Viet Nam ranked 39th, up 25 levels from 2016, moving to 3rd place in ASEAN, and assessed as a standout in its income group.[25] Viet Nam ranked 11th in the 2022 Agility Emerging Markets Logistics Index, falling three places following the inaugural inclusion of digital readiness metrics in the index, including skills, training, internet, e-commerce, investment, start-ups, and sustainability (renewable energy and emissions).[26]

Australia's logistics industry contributes 8.6 per cent to Australia's GDP and employs half a million workers.[27] Logistics infrastructure is well developed with increasingly digitalised air, ports, warehouses, intermodal nodes, and transport. There is strong government support for logistics innovation, standardisation, and interoperability in the sector. Though, the sector is plagued by driver shortages with some shortfalls in specialist skills. Australia has built a strong web of logistics, supply chain management and technology training in Australian VET and universities, accessed by domestic and international students, and anchoring Australia's Aus4Skills program of logistics VET assistance to Viet Nam (see case study).[28]

In sectoral terms, the adoption of Logistics 4.0 is well-advanced in mining and resources (an early adopter of cloud computing, AI, big data, autonomous vehicles, and robotics), retail, and agriculture. For example, Rio Tinto, develops and applies I4.0 across its mining operations, including end-to-end digital connection from mines to ports and beyond, autonomous trucks and rail operations, GPS mapping, drones and remotely operated vehicles for exploration and maintenance operations.

Broad technology adoption, supplier innovation, and business model transformation are unfolding at pace in larger firms, and increasingly across medium-smaller firms. There is however a sizeable tail of SMEs yet to digitalise.

A cadre of over 550 logistics technology start-ups has grown up in Australia such as unicorn WiseTech, a global logistics software provider; MTData (part of Telstra Connected Vehicle portfolio), an advanced fleet telematics company integrating IoT technology into operations; and LinFox's Smart Fox Digital Freight Network, a leading Australian logistics firms operating in Viet Nam.[29] Start-ups like Shippit and Yojee (see case study) are expanding across the region, focused on emerging digital opportunities in South East Asian logistics, supported by strong institutional investment from Australian and international sources.[30]

24 Australian Academy of Technological Sciences & Engineering, 2019 – Transport Industry Technology Readiness Report

25 The World Bank 2022, Aggregated LPI 2012-2018; Tralac Trade Logistics Gap Persists 2018

26 Agility Emerging Markets Logistics Index - top emerging markets by infrastructure, business conditions & digital readiness.

27 Infrastructure 2020

28 Australian Industry and Skills Committee 2019 Transport and Logistics Skills Forecast

29 Business News Australia WishTech Profit Surges, 24 August 2022, IoT Hub Telstra helps LinFox Monitor its Fleet Feb 2018; Australian Academy of Technological Sciences and Engineering (ATSE), 2019. Shifting Gears preparing for a transport revolution

30 Smart Company, 2022. Shippit sets its sights on south-east Asia; Yojee SaaS Logistics 2022. See the World Flow

Viet Nam has prioritised the transformation of logistics, recognising its essential contribution to growth, competitiveness, productivity, and integration into global value chains, and is acutely aware of the potential for Logistics 4.0 to alleviate many issues.[31] The sector is expected to continue growing, with increased FDI in production and infrastructure, trade, and e-commerce growth. Alongside ongoing work to upgrade infrastructure and regulation, the government is encouraging the private sector to embrace Logistics 4.0.

Logistics technology adoption across specific sub-sectors and in terms of company size is an uneven picture in Viet Nam. The Viet Nam Logistics Business Association (VLA) reports a membership of 550 of the estimated 4000 enterprises – 87 per cent of which are MSMEs - involved in logistics services in Viet Nam.[32] The companies that dominate (in revenue terms) domestic transportation and forwarding services across all segments include - dominant global multinationals (e.g: DHL); Japanese, South Korean and Chinese operators servicing global manufacturing supply chains (e.g: Yusen); State Owned Enterprises, foreign third party logistics (3PL) providers in FMCG, e-commerce and exports, including Australia's Linfox and Toll Holdings (see case study); and growing domestic operators (e.g: Transimex Saigon JSC, Indo Trans Logistics, Saigon Newport, and Bee Logistics (see case study).

CASE STUDY: Bee Logistics turns to Australia

Profile

Bee Logistics was established in 2004 in Ho Chi Minh City.

Top ten largest logistics enterprises in Viet Nam.

Ranking 39th out of top 500 fastest growing enterprises in 2022 with nearly 900 employees working in 22 domestic offices and 13 offices in 8 foreign countries, annual revenue estimated of US$190 million.

The company start its business in Australia by opening a branch in Sydney in 2021.

Services

Provides integrated and state-of-the-art logistics services, container transportation, mass multimodal transport, rail, cross-border transportation, door-to-door oversized and oversized goods and value added services such as warehousing, packing and labelling.

IR4 technologies used

iCloud: Nearly 90 to 95% of the logistics activities are carried out on ERP software using cloud computing, artificial intelligence, loTs to exchange, store and search for order information between business and partners and customers.

Smart sensors: Track customer information, shipment documents such as bill of lading, manifest, L/C exchange emails, bank or money transfer orders, etc. Trucks are equipped with smart sensors that allows Bee Logistics to re-route, trace and track cargoes when needed.

Digital platform: which has the potential to be commercialised according to Bee Logistics.

Challenges

Connecting and sharing information between government authorities; Custom clearance, import, export dept, taxation office.

Future

Build own logistics centre equipped with new technology 4.0 with focus on using blockchain.

Upgrade existing ERP system (blockchain focus)

Established own software tech company.

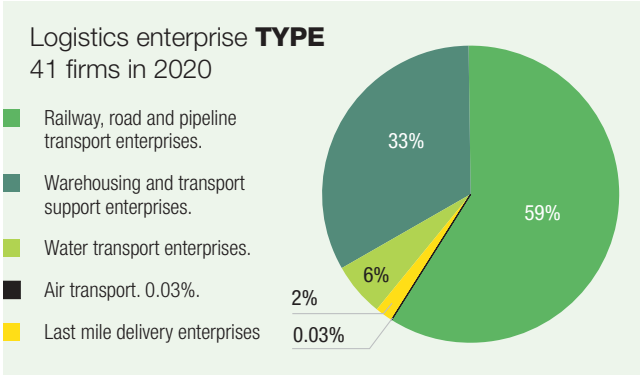
Viet Nam has high-profile projects such as the 2020 ASEAN Smart Logistics Network (ASLN) which launched with a project to promote interconnectivity in the region Vinh Phuc ICD Logistics Centre with investment by T&T Group (Viet Nam) and YCH Holdings (Singapore) to create a technologically advanced port and container centres.[33]

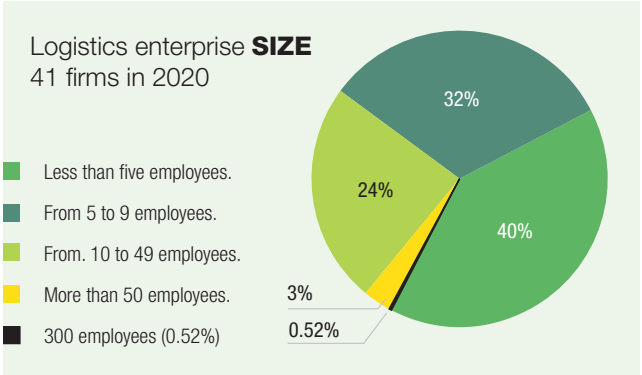
31 The World Bank 2014, Efficient Logistics: A key to Vietnam's Competitiveness; Decision No 221/QD-TTg (February 2021) Action Plan to improve efficiency, competitiveness and growth of Vietnam's logistic services by 2025;

32 Vietnam Logistics Association Logistics Report 2021

33 ASEAN Briefing, 2021 The ASEAN Smart Logistics Network; an overview

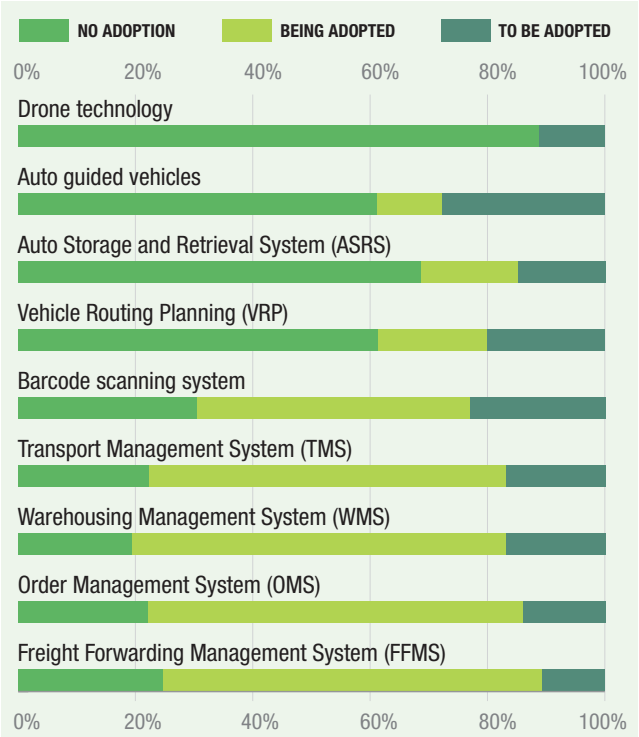
Viet Nam moving to Logistics 4.0





Source: VLA (2021) and GSO (2020)

I4.0 technology adoption in Viet Nam's logistics sector



Source: VLA (2021)

Viet Nam Logistics Key I4.0 Stakeholders

Logistics 4.0							
Private Corporations				SOEs			
Authorities	**Association**	**Corporations**	**Technology**	**Corporations**	**Technology**	**Foreign**	**JVs**
Ministry of Planning & Investment Ministry of Transport Ministry of Trade and Industry	Viet Nam Logistics Business Association Viet Nam Seaports Association Viet Nam Shipowners Association	Viconship Vinafco Gemadept Transimex Bee Logistics T&M Forwarding Viet Nam Maritime Corporation Vinafreight	SmartLog FPT Software TMS solutions Winta TMA ELCOM Logistics Stars Link	VNPost (100% state-owned) 13 Haiphong Port (100% state-owned)14 Danang Port (100% state-owned)15 Logistics Centre of Saigon New Port Corp. (100% state-owned)	Viettel Business Solutions Corp (100% state-owned) Viet Nam Posts and Telecommunications Group (VNPT)	DHL FedEx Kuehne + Nagel Schenker Linfox Toll	Tan Cang Cai Mep International Terminal Co., Ltd (TCIT)19 Cai Mep International Terminal

- The logistics industry contributes 2.8% of Viet Nam's GDP (OECD 2021). Forecast to contribute 8-10% of GDP by 2025.
- Logistic costs account for about 22% of GDP.

Foreign investment in the sector is pulling digital transformation forward, building strategically located institutional-grade logistics facilities in new industrial precincts to meet the growing demand for modern warehouses and facilities.

Viet Nam's large enterprises, especially third party logistics enterprises, are relatively ready to apply or are already upgrading their ICT and technology, with longer-term plans. However, IT applications and digital transformation are nascent in most micro-SME operators. They still use manual and analogue systems for hyper-local operations, are yet to build the required familiarity, skills, and capital for digital steps, and risk being locked out of the digital logistics ecosystem as it matures. The most proactive companies are taking incremental digital steps by adopting software modules, building an initial online presence, or purchasing hourly digital services. The government is increasing support to SMEs to improve digital readiness and adopt tools and solutions.

Building digital readiness and accelerating uptake is the 'need of the hour' for Viet Nam logistics. Research conducted for this report finds that technology readiness and adoption are higher in seaport, road transport, and warehousing. It lags in domestic shipping, rail transportation and across the MSMEs. A common constraint is a shortage of logistics, supply chain, or digital skills, restricting readiness and hindering digital investment, transfer, and collaboration. This combines with a low level of digital and data fluency within companies, management transformation capabilities and risk management.

Disruptive start-ups providing value-added services, technologies for last mile services or Software as a Service (SaaS) subscription services are beginning to penetrate the market. Domestic and international technology solution providers have started to develop and provide B2B SaaS services such as "Base.vn" with low cost and favourable customer service.

CASE STUDY: Yojee on the move

Australia's Yojee is a public logistics enterprise Software as a Service provider in Australia, Singapore, Australia, Malaysia, Viet Nam, and the Philippines. Yojee offers bespoke solutions for large 3PLs, freight forwarders, and global e-commerce companies, whilst enabling SMEs with their standard products. Client companies (predominantly 3PL and 2 PL companies) access Cloud-based delivery management systems to help them automate operations with visibility from the first to the last-mile of deliveries. Yojee has offices and local partnerships laying foundations for regional growth, including a development team in HCMC and a focus on growing with existing and prospective clients in the SME space. In 2021, Yojee reported key partnerships with Here Technologies to enhance smart warehousing, UPS, Sinotrans, Schenker Asia Pacific and Kuehne + Nagel.[34]

Analysis of uptake and technology use in Australia and Viet Nam logistics for this report suggests that Australia leads in the overall use of cloud computing, smart sensors, IoT and AI in warehousing, rail, sea, air, and intermodal transport; retail tech for real-time data and AI on the shop floors and along the supply chain; autonomous vehicles and robotics in intermodal transport; using real-time data analytics via IoT to support decision making in freight transport systems; VR/AR in intermodal transport in training applications; and cybersecurity to detect/ respond to breached security of logistics systems. Australian solution providers had noted strengths in applying these I4.0 technologies in bespoke and standard products, with over half providing comprehensive solutions along supply chains.

In Viet Nam, the research, analysis, and consultation showed an enterprise pattern of adopting cloud computing, sensors, IoT, big data, and AI at a lower level and often not seamlessly integrated. Cloud computing is adopted at a moderate level in procurement, warehousing, and transportation including road, air, and multimodal transportation. Leading air and port nodes, and new industrial precincts with FDI have the highest level of adoption of sensors, IoT and cloud. Leading air and port operators capture and track cargo volume status and movements at terminals and across associated warehouses.

Many container ports in Viet Nam use the ToS (Terminal Operating System) built on the cloud combined with IoT and big data to connect various port stakeholders. Some facilities have issues interfacing with all the various user systems for administration, transactions, and operations and providing one unified system network. AI is used in air and multimodal transportation including Chatbot for customer information and bookings. Big data analytics is implemented in warehouses, air transportation and retail logistics. A few digital platform markets have been created to maximise vehicle capacity and connect shippers and 3PL service providers. e.g., SmartLog is a system for real-time freight market information for businesses to select the shipping line based on the lowest freight rate.

34 *https://yojee.com*

Logistics 4.0 Opportunity Forecast: Viet Nam

Viet Nam is a large emerging market open to Australian Logistics 4.0 expertise, and Australia is in an advantageous position with experience and capabilities to meet emerging needs and demand in Viet Nam logistics now and over time.

Logistics 4.0 outlook

Opportunities for providers of affordable advice, support, training, and qualifications to build workforce and management readiness in all sub-sectors to adopt and integrate technology, with an emphasis on enterprise software, cloud computing, and IoT.

There are opportunities for Australian companies with expertise to collaborate with Vietnamese software developers and local partners to build and market solutions tailored to Vietnamese pain points and fragilities, including SaaS and API's (application programming interfaces), and Platform as a Service (PaaS) for local customers.

- API opportunities will be more realisable in larger enterprises already employing various applications with defined needs for unified digital platforms to create single windows to coordinate supply chain and logistic operations.
- On-premises software for warehouse and transport management automating operations, and blockchain for transactions, track and trace and administration.
- The growth of SaaS models instead of on-premises models. Only 5-7 per cent of Vietnamese enterprises use SaaS.[35] Some medium Vietnamese logistics enterprises are buying hourly services from local technology providers. SaaS opportunities stretch to suitable (mobile-enabled) and affordable licensed and subscription-based software and smart (AI-enabled) solutions, including hardware and sensors technology for SMEs wanting to adopt technology in an accessible and cost-effective fashion.

Emerging technology opportunities are concentrated on the effective adoption of:

- cloud computing, smart sensors and IoT for efficiency, connectivity, and visibility.
- semi-automated systems for medium-smaller container ports, airport freight terminals, warehousing, and intermodal nodes for containerised cargo.
- demand analytics, real-time track-trace, AI for demand forecasting and route optimisation, and to some extent, semi-automation at the forefront of retail logistics.
- build on and better integrate current sensor, IoT, AI and OCR (Optical Character Recognition) technologies for container operations at key ports.
- technology solutions for coastal shipping and rail transportation aligned with government ambitions to increase the modal share of these transportation modes.

In the medium term, opportunities will strengthen for blockchain, analytics, AI and more advanced automation (particularly in fast-moving consumer goods (FMCG) and retail) over the next 2-5 years.

The low cost of labour is likely to inhibit wide demand for advanced robotics and full automation technologies and opportunities are unlikely to strengthen until later in the decade, although larger firms have earmarked these technologies for adoption.

Digital transformation will accelerate in Viet Nam and lift demand in the next few years. While the use, readiness, and absorptive capacity of I4.0 are uneven within the sector, factors are coalescing to drive improvements in the coming years. Increased government leadership and support for private sector digitisation is raising awareness and appetite for technology uptake by lead companies.

35 *https://congthuong.vn/70-doanh-nghiep-tren-the-gioi-su-dung-saas-doanh-nghiep-viet-van-moi-me-113611.html*

Logistics: Australian and Vietnamese collaboration

Australia has a longstanding involvement in terms of official development assistance and commercial engagement with the logistics sector in Viet Nam. The Aus4Skills program for example has built a strong record of achievement in the logistics sector through collaboration on logistics VET training, improving the capacity of Vietnam colleges, trainers, and curriculum to provide modern qualifications.

Australian logistics businesses operating in Viet Nam include LinFox, the Toll Group (see case study) and the Australian real estate group Logos which is investing in institutional-grade logistics facilities in **Viet Nam with** four major projects including a joint venture in Da Nang with Manulife Investment Management for build-to-suit facilities designed to accommodate smart/ automation technology.[36]

CASE STUDY: Toll Group loads up

The Toll Group is an Australian 3PL provider supporting a broad range of retail, FMCG, chemicals and industrial customers in Viet Nam since 2004 with freight, transport, and logistics services. The Group provides over 400 domestic and cross-border freight forwarding, transportation and supply chain management services including customised storage, warehousing and inventory management, nationwide transportation, import/export services, distribution, and collateral management services. Toll runs over 450 trucks and a national network of strategically located warehouses and distribution centres.

An example of Toll's partnership is the successful partnership with Dairy Farm Viet Nam (in alliance with a local transport service provider) to build a new advanced distribution centre and operations in HCMC to support retail distribution across the country. The partnership has grown in terms of technology, capability, and scale.[37] In 2021, the Toll Group in partnership with Asialink undertook a review of Viet Nam's logistics, funded by DFAT, to identify areas for potential engagement under the bilateral relationship.

36 LOGOS Property company website
37 Toll Group company website

NEXT STEPS

I4.0 is an expanding reality in both economies, it will become more important in the bilateral context and increasingly influence bilateral trade and investment.

As we approach the 50th anniversary of diplomatic relations between Australia and Viet Nam, there is a window for policymakers to strengthen their focus on Viet Nam and amplify the focus on I4.0.

It is also a chance for the Australian industry to adopt a bold, best-practice strategic approach towards Viet Nam, to lift business awareness of and interest in digital and I4.0 opportunities in Viet Nam.

Australia I4.0 Inc. could build a non-State based consortium approach to inspire and position Australian tech companies looking offshore for growth to compete for I4.0 opportunities in Viet Nam now and as they strengthen in coming years.

If Australia does not act to approach digital and I4.0 engagement positively and proactively, it will fall behind and possibly fall aside. Companies from other countries are already realising success with first-mover advantages.

Viet Nam is a distinct, dynamic, and formidable market with more opportunities for Australian trade and investment than business typically realises. Australian firms are generally underprepared, overstate difficulties and do not properly comprehend opportunities. They overlook Viet Nam, overstate challenges, discount the positive framework, and underutilise assistance.

Recommendations for Australian business and policy makers

For Policy Makers:

Government leadership is a key ingredient for success. Viet Nam deserves singular and ambitious engagement with expanded investment and attention to the I4.0 dimension to drive trade and investment. There is a window to influence Australian technology business ideation around opportunities in Viet Nam and support expanded trade and investment in coming years.

- Amplify the I4.0 focus in the bilateral context and scale up associated activities around Agriculture 4.0, Logistics 4.0 and Education 4.0.
- States should articulate post-COVID singular Viet Nam strategies including recognising digital transformation and I4.0 possibilities.
- Build a Digital and I4.0 Trade Network piloted in Viet Nam with initiatives to drive engagement around digital and I4.0 opportunities in coming years.
- Support one or more Australian technology incubators to develop expertise in Viet Nam in partnership with the Australia Viet Nam Policy Institute.
- Critically appraise support for tech business readiness engagement and increase support for I4.0 companies to act on opportunities with minimised transaction costs of searching for customers, understanding local markets, adapting to local needs, and overcoming cultural differences.
- Allocate funding and resources for a rolling program of activities to push Australian digital and I4.0 companies to focus on defining practical business opportunities, and link with potential users in Viet Nam to test products and services to secure customers, partnerships, sales pipelines, and growth.
- Review relevant education, agricultural and logistics policies, and programs to include or enhance digital and I4.0 aspects and identify compelling opportunities matched to Australian capabilities.
- Work with Vietnamese authorities and stakeholders to foster digital/I4.0 trade, FDI and OFDI. Raise Viet Nam's appreciation of Australia's capabilities. Sharpen investment attraction efforts to win Vietnamese offshore investment.

For Business:

Australian digital and I4.0 companies should not view Viet Nam as a moon-shot. Opportunities are realisable and success can be leveraged in the region.

- Build a consortium of industry leaders to develop an Australia Inc. approach to build channels to market and lift business interest and understanding.
- Companies should build knowledge and familiarity through strategic immersion in activities to clarify prospects, challenges, and ingredients for success.
- Business leaders should focus on building Viet Nam-focused relationships:
- In Australia, this includes peer companies, Australia-Vietnamese businesses, business councils, official representatives and peak bodies. They should not overlook soft assets.
- In Viet Nam, this includes connections in key sectors with stakeholders at all levels
- Technology sector organisations should focus on Viet Nam opportunities and support their members to grow capabilities and engagement.

Annex 1

Sector Overviews

Education Sector Profile

Economic role/contribution (% of GDP, employment); Key industry performance indicators

Criteria	Vietnamese Education	Source
% GDP	4.03% in 2021	(Statista 2022)
Valuation	over VND326 trillion in 2021	(Statista 2022)
Adult Literacy Rate (15+) 2011-20	95.4%	(Statista 2022)
World Bank Human Capital Index	48/157	(WorldBank 2020)
Average years of schooling	10.2 years/2nd in ASEAN countries	(WorldBank 2020)
Government spending	18% in 2020	(WorldBank 2020)
Competitiveness index: human resources	3.39/10 points	(TalentNet 2021)
Human resources in terms of university graduates' skills	Ranked 84/137 countries	(TalentNet 2021)
Human resources in terms of innovation capacity	Ranked 79/134 countries	(TalentNet 2021)
Market value of E-learning	US$2 million(40% growth in language and soft skills	(Pham 2021)

Industry sub-sectors

Criteria	Vietnamese Tertiary Education	Source
Tertiary enrolment in 2020	2.2 million	(WorldBank 2020)
% GDP of HE	0.33%	(WorldBank 2020)
Government spending on HE	6.1% in 2020	(WorldBank 2020)
No of university lecturers	73,312 in 2019	(Statista 2019)
Gross enrolment rate (GER) HE	<30%, lowest among the East Asian countries	(WorldBank 2020)
Gross graduation ratio (GGR)	19%	(WorldBank 2020)
Per student public spending on tertiary education	US$316	(WorldBank 2020)
% population with university degrees	28%	(Tran, H 2019)
% of tuition fees in the total revenues for public universities	55%	(WorldBank 2020)
No. of qualified universities based on national standard	149	(MET 2020)
No. of qualified universities based on international standard	07	(MET 2020)
No. of qualified private universities based on national standard	31	(MET 2020)
No. of qualified private universities based on international standard	02	(MET 2020)
No. public universities taken part in the autonomy pilot reform	23/171	(WorldBank 2020)
No. PhD students enrolled	13,000	(WorldBank 2020)
No. PhD degree graduates p.a.	1,200	(WorldBank 2020)

Scale/size

Criteria	Vietnamese Higher Education	Source
No. of universities and academies (excluding HE institutions in defense – security sector)	236	(Cheng et al., 2021)
No. of vocational schools	236	(Cheng et al., 2021)
No. of public universities	171	(Cheng et al., 2021)
No. of private universities	60	(Cheng et al., 2021)
No. of 100% foreign-owned universities	5	(Cheng et al., 2021)

Current level of I4.0 technology adoption

Criteria	Vietnamese Higher Education	Source
% of R&D, technology transfer, and other services in the total revenues for public universities	23%	(WorldBank 2020)
Population internet use	52%	(Cheng et al., 2021)
% population working age/ still working for another 20 years	60%	(Cheng et al., 2021)
Capital investment edtech Startups	US$1.4 billion in 2021	(Statista 2021)
Technology output	1.24 patents per million of population	(WorldBank 2020)
% IT graduates need to be retrained for business practices	70%	(MoC 2022)

Growth forecast/projection

Criteria	Viet Nam Higher Education	Source
Gross graduation ratio (GGR) by 2035	100%	(WorldBank&MPIV 2016)
Gross enrolment rate (GER) target by 2030	45%	(WorldBank 2020)
Tertiary education enrolment by 2030	3.6 million students, 1.3 million of them 'new'	(WorldBank 2020)
% new students enrol in public universities by 2030	6%	WorldBank 2020)
% new students enrol in private universities by 2030	25%	WorldBank 2020)
% new students enrol in colleges (TVET and professional under MOLISA) by 2030	43%	WorldBank 2020)
% new students enrol in alternative mode of education (open university, remote/distance learning platforms in mostly public institutions) by 2030	25%	WorldBank 2020)

Key players:

Vietnam National University (VNU), Ho Chi Minh City (UIT), Hanoi Polytechnic University, Dai Technology University – VNU-UET (VNU-UET), Academy of Posts and Telecommunications, Military Technical Academy, FPT University) have applied I4.0, especially in foundation IT subjects – maths and coding.

VVNU-Hanoi in the top 1,000 of 2021 Times Higher Education (THE) (WorldUniversityRanking 2021);

VNU Ho Chi Minh City and VNU-Hanoi in the top 1,000 of the 2021 Quacquarelli Symonds (QS) World University Ranking (QSWorldUniversity 2021) , and Ton Duc Thang University in the top 1,000 of the 2020 Shanghai World Ranking (ShanghaiWorldRanking 2020).

Hanoi University of Science and Technology (HUST) ranks as the top Vietnamese university in the Webometrics university ranking (Webometrics 2021).

Viet Nam Agriculture Sector Profile

Economic role/contribution (% of GDP, employment, etc.) Key industry performance indicators

Criteria	Viet Nam Agriculture	Source
% GDP	12.36% (2021) – 19.57% (2011)	(WorldBank 2022)
Exporting	US$56.3 billion (2020) (up 2.5% from 2019) World 16th largest global agriculture exporter	(WorldBank 2020a) (Britcham 2021)
Labour (% of workforce)	71% (1991) 37% (2019) 30% (2020)	(WorldBank 2020a)
Land used for agriculture	39%	(WorldBank 2020b)
Increase of land productivity	79% from 1991 to 2016	(OECD 2020)

Industry sub-sectors

Criteria	Viet Nam Agriculture	Source
Livestock production in 2021	Pig 62.4% Poultry 29% Beef 6.8% Buffalo 1.8%	(Statista 2022)
Rice exports	3rd World ranking; 6.5 million metric tons worldwide in 2021	(USDA 2022)
Land used for rice production	94%	(Britcham '21)
Coffee exports	2nd World ranking (after Brazil). 2021 revenue over US$ 3 billion	(Viet News 22)
Seafood export	US$8.9 billion in 2021, an increase 6% compared to 2020, Shrimp (US$3.9 billion up 4%), Pangasius (over US$1.6 billion, up 8.4%), Marine products (US$3.4 billion, up 7%). Largest value worth US$11.5 billion in 2020	(VASEP 2022) (GSV 2020)
Fish	World's fifth largest; 2,987.7 thousand tons in 2021 (increased 1.8%)	(UNCTAD & GSO 2018)
Aquaculture	World's 4th largest (giant tiger prawn & pangasius (catfish)	(Atlas 2019)
Proportion of global pangasius (catfish) producer	50%	(Asialink 2021)
Catfish exports	90%	(Asialink '21)
Growth of animal/crop	200% in production from 1991-2016	(OECD 2020)

Agriculture is Viet Nam's 3rd largest sector (Shira 2021)

Average farm size (ha)	averaging 0.4 (Small farms); 2.5 (Others)	(FAO 2018)
% small family farms on total farms	89%	(FAO 2018)
Share of food by smallholder farms	71%	(FAO 2022)
Total numbers of farms up to 2020	23,662	(GSO 2020)

Viet Nam's preparedness for Agriculture 4.0		
Criteria		Source
Agtech investments	US$39 million (2019) (4th in ASEAN	(AgFunder 2020)
Farmers own a mobile phone	90%	(FAO 2022)
Google & Viet Nam Farmers' Union: digital training 2017-20	30,000 farmers	(Britcham 2021)
Mobile phone users have 3G or 4G connections	42%	(FAO 2022)
Access to electricity across both rural and urban areas	99%	(FAO 2022)
Use broadband internet	46%	(FAO 2022)
Mobile subscription rates per capita	100%	(FAO 2022)
Level of applying equipment of Viet Nam's agriculture	Av. 1.3 horsepower (CV)/ha	(WorldBank 2020c)
Number of Certified high-tech agriculture areas	12	(Britcham 2021)
Numbers of AgriTech enterprises in Central highlands	>20	(Britcham 2021)
IT adoption by agriculture households	25%	(CSIRO 2019)

Top five largest agriculture companies in Viet Nam		
Company	Main Products	Exporting
Viet Nam Southern Food Corporation JSC (Vinafood II)	Rice, coffee, cashew nuts, cassava chips, corn and beans.	3 million tonnes rice to global markets
Hoang Anh Gia Lai Agricultural Joint Stock Company (HAGL Agrico)	**Rubber and fruit trees**	**Fruit**
Agrex Saigon Food JSC (AGREX SAIGON)	–	–
Vilaconic Joint Stock Company	Rice, cinnamon, pepper, cashew, coffee, coconut, copra, tapioca, tea	–
Intimex Group Joint Stock Company (Intimex Group)	Coffee, pepper, rice, cashew	Agricultural exports/ 570,000 tonnes/year; export turnover US$1 billion/year. Annual turnover over VND40 trillion VND; 11 high-quality processing factories in the Central Highlands

Largest seafood enterprises in Viet Nam (VNC 2019)		
Company	Main Products	Revenue
Minh Phu Seafood Joint Stock Company	Black Tiger and White Vannamei	US$ 616 million (2020)
Hung Vuong Joint Stock Company	Biggest exporter of catfish	US$729,082 (2020)
Vinh Hoan Joint Stock Company	Basa fillet	VND 7,037 billion (2020)
International Development & Investment Corporation (IDI)	Export of catfish and catfish-related products	VND 1.41 trillion (2021)
Soc Trang Seafood Joint Stock company	Black tiger shrimp	VND 7,328 billion (2021)

Examples of AgriTech startups in Viet Nam		
Companies	I4.0 Products	Focus
Demeter	IoT-driven system	Automate farm operations
MimosaTEK	Cloud-based system	USAID Water Food Award 2017
Hachi	IoT-driven hydroponic farming	Water and input management
Sero.ai	AI-driven	–
Naturally Viet Nam	Online grocery store	Transparency to the food market
CricketOne	–	–
Foodmap	–	–
Tep Bac	–	–

Growth forecast/projection / Environmental pressures threaten agriculture outputs

Daily food availability in Viet Nam by 2030 will increase by 0.54% (WorldBank 2016).

Demand for meat in quantity/capita expected to double between 2015 and 2030 (World Bank 2016)

Fish consumption/capita expected to increase by 50% between now and 2030 (World Bank 2016)

Dairy products expected to be the fastest-growing food category by 2030 (World Bank 2016)

By 2030, rice's share is expected to decline to just over one third of the total (World Bank 2016).

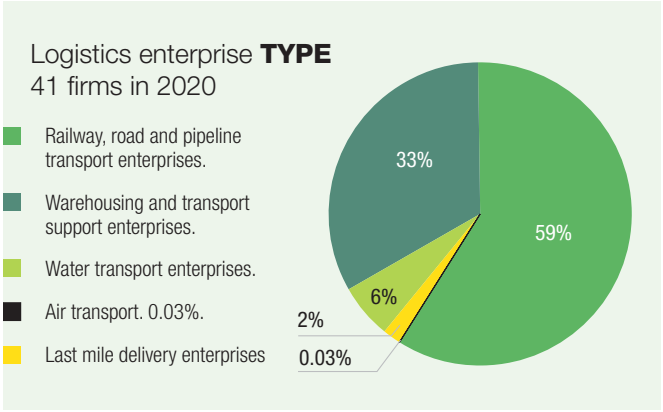
Real prices for rice are likely to decline by 10% from US$423/ton (2014) to US$380/ton in 2025 (World Bank 2016).

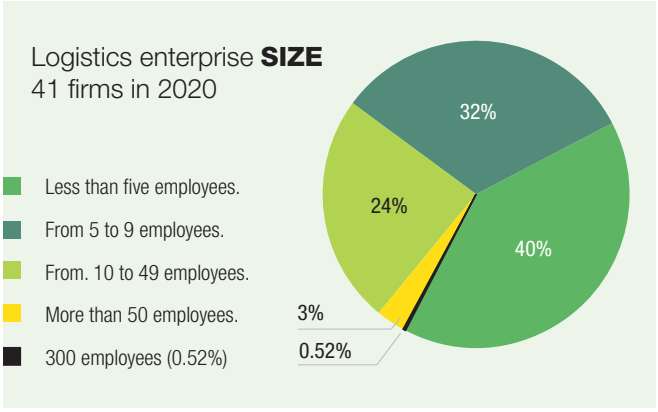
Robusta coffee price to decline from US$2,200/ton in 2014 to US$1800/ton by 2025 (World Bank 2016).

The UNDP estimates that environmental/ climate change pressures could reduce GDP by up to 2.4% by 2050. Pressures include salinity and drought. Thirteen dams along the Mekong are damaging ecosystems and reducing agricultural outputs. Reduced freshwater is also exacerbating the issue of salinity intrusion in the Delta. These trends are exacerbated by unsustainable agricultural practices: tenfold increase in pesticide use during 1990-2015, (100,000 tons of pesticide a year in 2015 compared with 10,000 tons in 1990) (Lam 2020); ongoing dumping of an estimated 36% of untreated animal faeces waste generating water and air pollution. The World Bank estimates 25% of all food production in Viet Nam each year is being lost or wasted. Production of this wasted food uses 10% of land and contributes to around 6% of Viet Nam's greenhouse gas emissions.

Viet Nam Logistics Sector Profile

A fast-growing economy in transition Viet Nam is improving infrastructure connected to industrial and manufacturing facilities. Viet Nam's logistics costs are high compared to other countries in the region and are officially prioritised for reform. Leading logistics enterprises in Viet Nam by revenue are mostly SOEs. Advantages: Strong domestic growth with high demand; geographical advantage with connections to Southeast, East and South Asia. Disadvantages: The system of seaports and docks is dispersed, as planners focus on quantity over quality, leading to oversupply (especially in the southern port area). Highway projects serving traffic flows between inland industrial zones, seaports, and airports are not well planned, with slow construction, lack of connectivity between modes of transport that causes traffic congestion; limitations in skills and technology application; degraded warehouse system, lack of high-quality labour etc. However, Viet Nam was the chosen country for investment after COVID-19 when investment moved out from China.





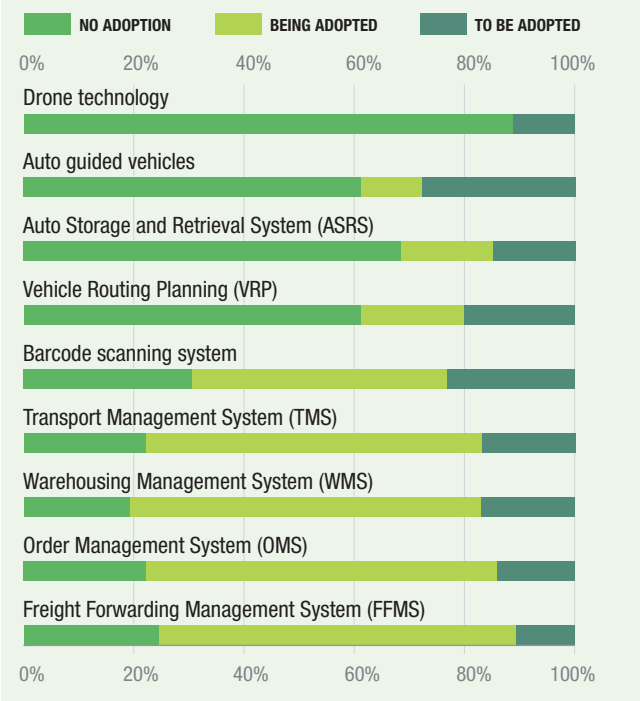
Criteria	Viet Nam's Logistics
% of GDP	4.5%
Revenue (2020)	US$23.29 billion down 12.2% compared with 2019
Number of companies	33,881 in 2019, 35,744 in 2020, and 41,000 in 2022
Overall growth rate	14 - 16%/year (in value: more than US$40 billion/year)

Industry sub-sectors

Criteria	Viet Nam Agriculture
Road freight	The prioritised transportation mode despite higher cost and risk. Number of trucks: 432,406 over one-ton weight, 81,096 companies carry 74%-76% of total goods.
Rail freight	Carries 1% (agri products) of freight. Diesel system across 7 main routes (3,162.9 km). Four international transport stations in the North, none in the central and southern parts.
Shipping freight	National shipping fleets – 1,576 ships. 35th largest shipowner worldwide. Carry 100% of domestic cargo by sea, 10% of the market share. Mainly through routes to China, Japan, Korea and Southeast Asia. Container transport (Gemadept JSC, Vinafco JSC, Viet Nam Shipping Joint Stock Company). Bulk transport (Viet Nam Shipping JSC, Viet Nam Shipping and Chartering JSC). Oil transport (Vitaco Petroleum Transport JSC).
Seaports	397 million tons of goods throughput in 2020. 82.6 km of port wharves and bridges. Capacity 600-650 million tons. 286 seaports in 6 groups (Decision No. 1037/QD-TTg). Some major seaports in the country e.g. Cat Lai, Dinh Vu, Tan Vu have gross profit margin: 35% - 37%. Northern Viet Nam: Hai Phong seaports have 44 general cargo berths, 24 specialised wharfs, 8 other service wharfs and 15 pontoon berths. 2020 throughput: 131 million tonnes, 32.99% of the total cargo throughput. Expected to gain 178.5 million tons in 2030. Main seaport corporation: MVN (Vinalines), PHP (Hai Phong Port), GMD (Gemadept), etc. Central Viet Nam (Group 2, 3, 4): 1,200 km of seaway with a seaport in every 30-40 km, handled 42.6 million tons, 10.72% of total throughput. Southeast Viet Nam (Group 5): Ho Chi Minh City and Dong Nai area (Ho Chi Minh City seaports) Ba Ria –Vung Tau area (Cai Mep – Thi Vai seaports), the most dynamic high-capacity ports in Viet Nam. Handled 223,7 million ton 56.29% of total national cargo throughput, 90% of Viet Nam's total container volume. Mekong Delta (Group 6): handled 66.5 to 71.5 billion tons each year, 20-25% of the total southern cargo throughput.
Warehousing	More than 70% of warehousing area is in the South divided into two main segments of dry goods storage and cold storage: 48 cold storages with capacity of more than 600,000 pallets; 700 refrigerated trucks and 450 train carriages transporting refrigerated containers. Ownership: 48% are domestic manufacturing companies, 24% are foreign companies, 14% are logistics companies and other business types are 14%. 66.7% of exporting companies apply cold chain. In June 2020, HVG had put into cold storage with designed capacity of 60,000 pallets, 2nd largest cold storage by capacity in the world. Many cold storages being under construction in 2020 AJ Total Long Hau with 32,000 pallets, AJ Total Hung Yen with 25,000 pallets, etc. Distribution Center (DC) is a popular trend in global logistics and especially large companies in Viet Nam, leading manufacturers Samsung, Unilever, P&G, Vinamilk, Masan, etc. own DC.
Air transport	Viet Nam has 235 civil aircraft and 32 helicopters registered as Vietnamese. 80% of airfreight market share owned by foreign airlines. Only 0.015% of goods volume transported by air in the first 9 months of 2021 (Viet Nam Airlines, Vietjet Air, Jetstar Pacific, Vasco, Bamboo Airways). 70 commercial international airlines flying to and from Viet Nam. 12 international airports and 10 domestic airports. 5 new domestic airports are coming. Viet Nam only has two cargo warehouse centers at Tan Son Nhat and Noi Bai airports. Viet Nam Airlines to establish a cargo airline. Bamboo to develop Bamboo Airways Cargo. IPPG to develop IPP Air Cargo (recently suspended). Total investment US$105 million.
Freight forwarding	80.3% of logistics enterprises provide international and domestic freight forwarding services. Employed population 2020: 40,229. Revenue: US$512 million - down 20.4% compared to 2019.
Logistics centers	7 major logistics centres nationwide are in operation. The total area of the centres: 23.3 hectares ranging from 2-5 ha each. Most centres are multifunctional and serve diversified services. Long An Centre specialises in the automotive industry.

Logistics technology providers/startups in Viet Nam

Although the proportion of enterprises that applied I4.0 technologies in their operations increased to almost 50 per cent, the efficiency of the existing logistics technology in Viet Nam is still in the early stage. New technologies used in the logistics industry in the world such as full automation or advanced robotics have not been popular in Viet Nam. The use of blockchain, augmented reality and 3D printing, or drones has not been addressed in any technology deployment plan. Advanced robotics in warehouses has been applied by two companies in Viet Nam, Schenker (a German logistics firm) and Vinamilk (a large dairy manufacturer). Large domestic transport businesses are still using manual handling instead of automation in warehouses and distribution centres.



Source: VLA 2021

Companies	I4.0 solutions/products	Revenue
SmartLog	Big data and AI platform for optimisation, container swap platform Transport/ WHS Exchange Platform E2E Supply Chain Control Tower Supply Chain Finance, FMS OMS WMS (Smartlog Warehouse Management System), IoT and Telematics TMS (Smartlog Transport Management System)	Revenue US$ 7 million Employees 50-100
FPT software	Cloud, mobility, analytics & IoT; Product engineering: embeded system, CAD, CAM IC design; and other application services	Revenue US$513 million Employs 30,000
TMA	With heavy investment in navigation & map technology, TMA developed applications for transportation & logistics including real-time traffic analysis; online & offline maps; smart traffic; bus route; field force automation; asset tracking systems; asset management; and commodity & bulk handling control	Revenue US$31 million 3,000 employees Market: 30 countries
ELCOM	Automatic vehicle load control; Weighing-in-Motion; VTS ship monitoring and operation system for inland waterways and sea lanes; non-stop electronic toll collection; iTMON System for monitoring & handling violations of road traffic safety orders; Intelligent Traffic System	Revenue US$15 million Employees 201-500
Winta	It is an ERP solution that manages the overall logistics supply chain. Meets all management activities for all departments and runs on any device in just one set of Winta Logistics products. Key subsystems Winta Logistics: Sale – CRM Sub-system, Customs – Customs – Customs Service Sub-system, Trucking – Road Transport Sub-system, Shipping – International Transport Subsystem, Warehouse – Warehouse – Warehouse Division, HRM – Human Resources Division, Accounting – Next sub-system to Software Logistics transportation management, Transportation and delivery service Winta Logistics. It is an ERP solution that manages the overall logistics supply chain. Meets all management activities for all departments and runs on any device in just one set of Winta Logistics products.	Revenue US$ 5-10 million Employees 20-40

Annex 2

Heatmaps and Gap Analysis

Explanatory Notes: I4.0 gap analysis: Blue cells indicate the same level of use of I4.0 technologies, meaning neither Australia nor Viet Nam has any comparative advantage. Pink and red cells suggest a marginal and significant advantage in the use of I4.0 technologies in Australia over Viet Nam.

Education Heat Maps

Level of Technologies I4.0 provided by **Australian Edtech Providers**

Tech providers / University	AU Tech Providers		
Phase	Phase 1	Phase 2	Phase 3
Cloud computing	5	5	3
IoT's	4	5	4
Argumeted Reality	2	4	2
Artificial intelligence	3	4	2
Blockchain	3	4	2
Machine learning	3	3	1
3D printing	1	3	1
Simulation	2	4	2
Robotics	1	4	1
Big data	3	5	3
Biotech	1	2	1
Sensors	3	4	3

Level of I4.0 technology adoption at **Vietnamese Universities**

Tech providers / University	VN Uni		
Phase	Phase 1	Phase 2	Phase 3
Cloud computing	4	4	3
IoT's	4	4	2
Argumeted Reality	1	2	1
Artificial intelligence	2	2	1
Blockchain	1	2	1
Machine learning	1	1	1
3D printing	1	1	1
Simulation	1	2	1
Robotics	1	2	1
Big data	3	3	1
Biotech	1	2	1
Sensors	2	3	2

Level of I4.0 technology adoption at **Australian Universities**

Tech providers / University	AU Uni		
Phase	Phase 1	Phase 2	Phase 3
Cloud computing	5	5	4
IoT's	5	5	4
Argumeted Reality	2	4	1
Artificial intelligence	4	4	1
Blockchain	1	4	3
Machine learning	1	3	1
3D printing	1	3	1
Simulation	1	4	2
Robotics	1	4	1
Big data	1	5	1
Biotech	1	3	1
Sensors	3	4	3

LEGEND for Universities	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

I4.0 technology gap between **Australian-Vietnamese universities**

Tech providers University	AU Uni			VN Uni			CAP Matching		
Phase	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Cloud computing	5	5	4	4	4	3	1	1	2
IoT's	5	5	4	4	4	2	1	1	2
Argumeted Reality	2	4	1	1	2	1	1	2	0
Artificial intelligence	4	4	1	2	2	1	2	2	0
Blockchain	1	4	3	1	2	1	0	2	2
Machine learning	1	3	1	1	1	1	0	2	0
3D printing	1	3	1	1	1	1	0	0	0
Simulation	1	4	2	1	2	1	0	1	0
Robotics	1	4	1	1	2	1	0	3	0
Big data	1	5	1	3	3	1	0	3	0
Biotech	1	3	1	1	2	1	0	1	0
Sensors	3	4	3	2	3	2	1	1	0

LEGEND for Universities	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

LEGEND for AU tech supply capability	
Able to supply at a marginal scale	1
Able to supply at a small scale	2
Able to supply at a medium scale	3
Able to supply at a large scale	4
Able to supply full scale	5

LEGEND for CAP Matching	
No advantage for Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

I4.0 technology gap between **Australian edtech providers-Vietnamese universities**

Tech providers University	AU Tech Providers			VN Uni			CAP Matching		
Phase	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Cloud computing	5	5	3	4	4	3	1	1	0
IoT's	4	5	4	4	4	2	0	1	2
Argumeted Reality	2	4	2	1	2	1	1	2	1
Artificial intelligence	3	4	2	2	2	1	1	2	1
Blockchain	3	4	2	1	2	1	2	2	1
Machine learning	3	3	1	1	1	1	2	2	0
3D printing	1	3	1	1	1	1	0	2	0
Simulation	2	4	2	1	2	1	1	2	1
Robotics	1	4	1	1	2	1	0	2	0
Big data	3	5	3	3	3	1	0	2	2
Biotech	1	2	1	1	2	1	0	0	0
Sensors	3	4	3	2	3	2	1	1	1

LEGEND for Universities	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

LEGEND for AU tech supply capability	
Able to supply at a marginal scale	1
Able to supply at a small scale	2
Able to supply at a medium scale	3
Able to supply at a large scale	4
Able to supply full scale	5

LEGEND for CAP Matching	
No advantage for Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

Agriculture Heat Maps

Use of I4.0 in Agriculture Companies/Farms in Australia by sectors

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	4	2	2	4	2	2	4	2	2
Internet of things (IoT')s	4	2	2	4	2	2	4	2	2
Cloud Computing	3	3	3	3	3	3	3	3	3
Advanced Robotics	3	2	2	3	2	2	3	2	2
Artificial intelligence (Ai)	4	3	3	4	3	3	4	3	3
(Big) Data Analytics	4	3	3	4	3	3	4	3	3
Biotech	4	1	1	4	1	1	4	1	1
Nano Technology	2	2	2	2	2	2	2	2	2
Distributed Ledger Technology (DLT) (Blockchain)	3	3	2	3	3	2	3	3	2
Additive Manufacturing (3D Printing)	2	1	1	2	1	1	2	1	1
Energy Technology (Wind and Solar Energy)	3	2	2	3	2	2	3	1	1

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Use of I4.0 in Agtech Providers in Australia by Sectors

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	4	3	3	4	3	3	4	3	3
Internet of things (IoT')s	4	3	3	4	3	3	4	3	3
Cloud Computing	4	4	4	4	4	4	4	4	4
Advanced Robotics	4	3	3	4	3	3	4	3	3
Artificial intelligence (Ai)	4	4	4	4	4	4	4	4	4
(Big) Data Analytics	4	4	4	4	4	4	4	4	4
Biotech	4	1	1	4	1	1	4	1	1
Nano Technology	2	2	2	2	2	2	2	2	2
Distributed Ledger Technology (DLT) (Blockchain)	4	4	2	4	4	2	4	4	2
Additive Manufacturing (3D Printing)	2	1	1	2	1	1	2	1	1
Energy Technology (Wind and Solar Energy)	3	2	2	3	2	2	3	2	2

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Use of I4.0 by Agriculture Companies/Commercial Farms in Viet Nam by Sectors

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	3	1	1	2	2	1	3	2	1
Internet of things (IoT')s	3	2	1	3	1	1	3	1	1
Cloud Computing	3	1	1	3	1	1	3	1	1
Advanced Robotics	2	1	1	2	1	1	2	1	1
Artificial intelligence (Ai)	2	1	1	2	1	1	2	1	1
(Big) Data Analytics	2	1	1	2	1	1	2	1	1
Biotech	3	1	1	3	1	1	3	1	1
Nano Technology	1	1	1	1	1	1	1	1	1
Distributed Ledger Technology (DLT) (Blockchain)	2	2	2	2	2	2	2	2	2
Additive Manufacturing (3D Printing)	2	1	1	2	1	1	1	1	1
Energy Technology (Wind and Solar Energy)	1	1	1	2	1	1	1	1	1

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Use of I4.0 by Agtech Providers in Viet Nam

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	3	1	1	2	2	1	3	2	1
Internet of things (IoT')s	3	2	2	3	3		2	2	
Cloud Computing	3	2	2	3	2	2	2	2	2
Advanced Robotics	2	2	1	3	2	1	2	1	1
Artificial intelligence (Ai)	3	2	2	2	2	1	2	2	1
(Big) Data Analytics	3	2	2	2	2	1	2	2	1
Biotech	3	1	1	3	1	1	3	1	1
Nano Technology	1	1	1	1	1	1	1	1	1
Distributed Ledger Technology (DLT) (Blockchain)	2	2	2	2	2	3	2	2	2
Additive Manufacturing (3D Printing)	2	1	1	2	1	1	1	1	1
Energy Technology (Wind and Solar Energy)	1	1	1	3	2	2	1	1	1

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Capability Matching - Australia and Viet Nam (Agtech Providers)

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	1	1	1	2	0	1	1	0	1
Internet of things (IoT')s	1	0	1	1	1	1	1	1	1
Cloud Computing	0	2	2	0	2	2	0	2	2
Advanced Robotics	1	1	1	1	1	1	1	1	1
Artificial intelligence (Ai)	2	2	2	2	2	2	2	2	2
(Big) Data Analytics	2	2	2	2	2	2	2	2	2
Biotech	1	0	0	1	0	0	1	0	0
Nano Technology	1	1	1	1	1	1	1	1	1
Distributed Ledger Technology (DLT) (Blockchain)	1	1	0	1	1	0	1	1	0
Additive Manufacturing (3D Printing)	0	0	0	0	0	0	1	0	0
Energy Technology (Wind and Solar Energy)	2	1	1	1	1	1	2	0	0

LEGEND for CAP Matching	
No advantage for Both Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

Capability Matching – Australia and Viet Nam (Agriculture Companies/Farms)

IR 4.0 Technologies	CROPS			LIVESTOCK			AQUACULTURE		
	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing	Production	Logistics	Sales & Marketing
Smart Sensors	1	2	2	2	1	2	1	1	2
Internet of things (IoT')s	1	1	1	1	0	2	2	1	2
Cloud Computing	1	2	2	1	2	2	2	2	2
Advanced Robotics	2	1	2	1	1	2	2	2	2
Artificial intelligence (Ai)	1	2	2	2	2	3	2	2	3
(Big) Data Analytics	1	2	2	2	2	3	2	2	3
Biotech	1	0	0	1	0	0	1	0	0
Nano Technology	1	1	1	1	1	1	1	1	1
Distributed Ledger Technology (DLT) (Blockchain)	2	2	0	2	2	-1	2	2	0
Additive Manufacturing (3D Printing)	0	0	0	0	0	0	1	0	0
Energy Technology (Wind and Solar Energy)	2	1	1	0	0	0	2	1	1

LEGEND for CAP Matching	
No advantage for Both Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

Logistics Heat Maps

Current Use of I4.0 by logistics firms in Australia

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
Australian Logistics										
Autonomous/ Advanced Robotics	1	1	3	2	2	1	2	3	2	2
Artificial intelligence (Ai)	3	4	3	3	2	2	4	3	2	2
Cloud Computing	4	4	3	3	2	3	4	4	3	2
Internet of things (IoT')s	2	3	4	3	3	3	4	4	3	2
Blockchain	1	1	1	1	1	2	1	1	2	1
Additive Manufacturing (3D)	1	1	1	1	1	1	2	1	2	1
Virtual /Aug Reality	1	1	2	1	2	3	4	4	2	1
(Big) Data Analytics	3	3	3	2	3	3	4	4	4	2
Autonomous Vehicle	1	1	3	2	2	2	3	4	2	2
Smart Sensors/Tracking	1	3	4	3	4	4	4	4	3	2

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Current Use of I4.0 by logistics firms in Viet Nam

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
Vietnamese Logistics										
Autonomous/ Advanced Robotics	1	1	2	1	1	1	2	1	2	1
Artificial intelligence (Ai)	2	2	2	2	1	2	3	2	2	1
Cloud Computing	3	2	3	3	2	2	3	3	3	2
Internet of things (IoT')s	2	2	3	3	1	2	3	3	3	2
Blockchain	1	1	1	1	1	1	1	1	2	1
Additive Manufacturing (3D)	1	1	1	1	1	1	1	1	1	1
Virtual /Aug Reality	1	1	2	1	1	1	3	2	2	1
(Big) Data Analytics	2	2	3	2	2	2	4	2	3	1
Autonomous Vehicle	1	1	2	2	1	2	3	3	2	1
Smart Sensors/Tracking	1	2	3	3	2	2	4	3	2	2

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Capability Matching – Australia and Viet Nam (Logistics firms)

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
CAP Matching AU – VN										
Autonomous/ Advanced Robotics	0	0	1	1	1	0	0	2	0	1
Artificial intelligence (Ai)	1	2	1	1	1	0	1	1	0	1
Cloud Computing	1	2	0	0	0	1	1	1	0	0
Internet of things (IoT')s	0	1	1	0	2	1	1	1	0	0
Blockchain	0	0	0	0	0	1	0	0	0	0
Additive Manufacturing (3D)	0	0	0	0	0	0	1	0	1	0
Virtual /Aug Reality	0	0	0	0	1	2	1	2	0	0
(Big) Data Analytics	1	1	0	0	1	1	0	2	1	1
Autonomous Vehicle	0	0	1	0	1	0	0	1	0	1
Smart Sensors/Tracking	0	1	1	0	2	2	1	1	0	0

LEGEND for CAP Matching	
No advantage for Both Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

Current Supply of I4.0 Technologies by LogTech Providers in Australia

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
Australian Tech providers										
Autonomous/ Advanced Robotics	1	2	4	2	3	2	3	3	3	2
Artificial intelligence (Ai)	4	4	3	4	4	4	5	4	4	3
Cloud Computing	4	4	5	4	4	4	5	4	5	4
Internet of things (IoT')s	4	3	5	5	4	4	4	4	5	4
Blockchain	3	3	4	3	3	3	3	4	4	3
Additive Manufacturing (3D)	1	1	2	1	1	1	1	1	1	1
Virtual /Aug Reality	2	3	3	3	3	3	4	3	3	2
(Big) Data Analytics	3	3	4	4	4	4	4	4	5	2
Autonomous Vehicle	2	3	4	3	3	3	4	4	4	2
Smart Sensors/Tracking	4	4	5	5	4	4	4	4	5	3

LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Current Supply of I4.0 Technologies by LogTech Providers in Viet Nam

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
Viet Nam Tech providers										
Autonomous/ Advanced Robotics	1	1	2	1	1	1	2	1	2	1
Artificial intelligence (Ai)	2	2	3	2	1	2	2	2	3	1
Cloud Computing	3	3	3	3	2	2	3	3	4	2
Internet of things (IoT')s	3	2	3	3	1	2	3	3	4	2
Blockchain	1	1	1	1	1	1	1	2	2	1
Additive Manufacturing (3D)	1	1	1	1	1	1	1	1	1	1
Virtual /Aug Reality	1	1	1	1	1	1	2	2	2	1
(Big) Data Analytics	2	2	3	2	2	2	2	3	3	1
Autonomous Vehicle	1	1	2	1	1	2	2	2	3	1
Smart Sensors/Tracking	2	2	3	3	2	2	2	2	3	2

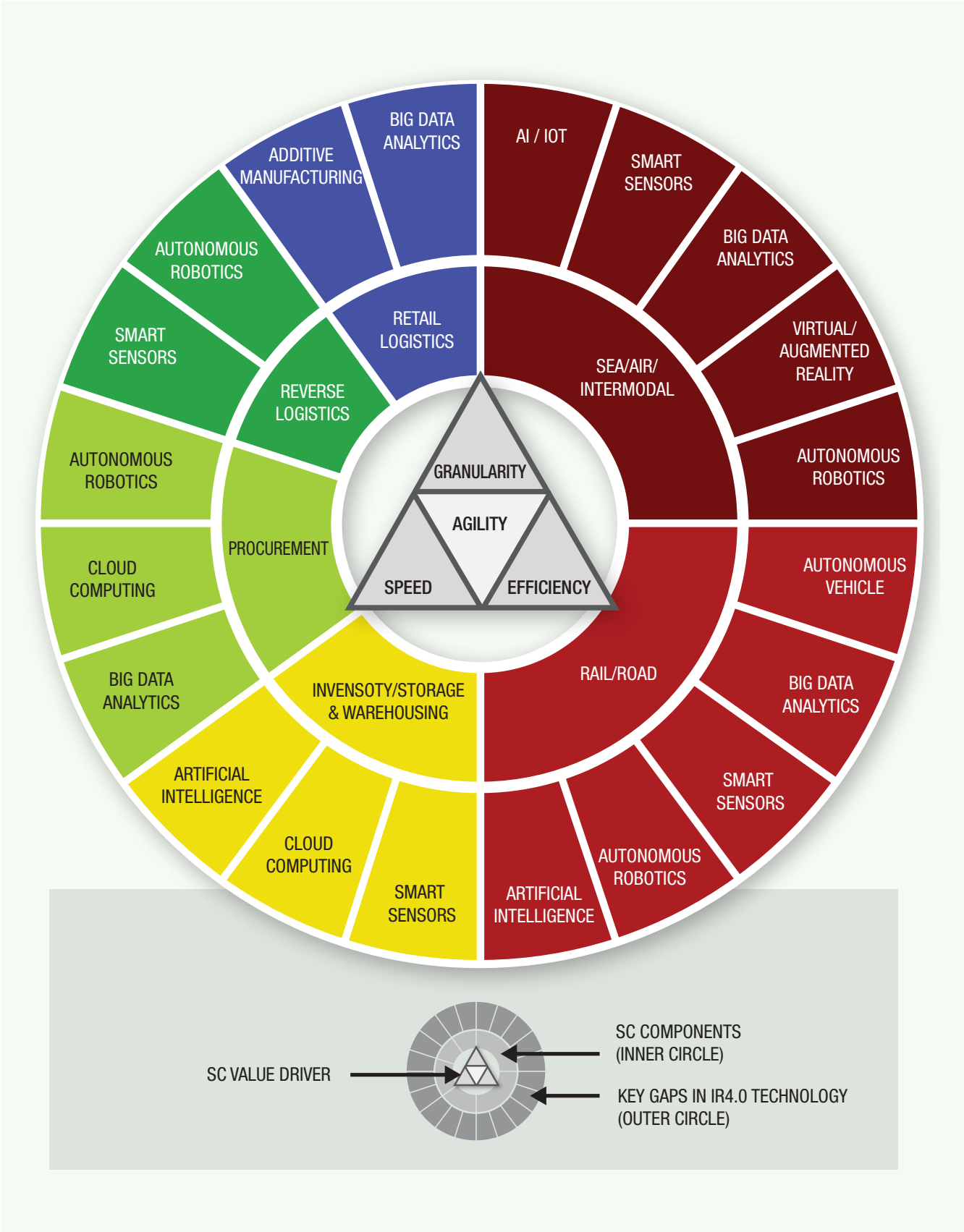
LEGEND	
No Use	1
Rarely Used	2
Partially Used	3
Highly Used	4
Fully Used	5

Capability Matching – Australia's and Vietnam's Logistics Technology Providers

IR 4.0 Technologies	Procurement	Inventory management	Storage/ Warehousing	Road	Rail	Transportation Sea	Air	Intermodal	Retail logistics	Reverse logistics
CAP Matching AU – VN										
Autonomous/ Advanced Robotics	0	1	2	1	2	1	1	2	1	1
Artificial intelligence (Ai)	2	2	0	2	3	2	3	2	1	2
Cloud Computing	1	1	2	1	2	2	2	1	1	2
Internet of things (IoT')s	1	1	2	2	3	2	1	1	1	2
Blockchain	2	2	3	2	2	2	2	2	2	2
Additive Manufacturing (3D)	0	0	1	0	0	0	0	0	0	0
Virtual /Aug Reality	1	2	2	2	2	2	2	1	1	1
(Big) Data Analytics	1	1	1	2	2	2	2	1	2	1
Autonomous Vehicle	1	2	2	2	2	1	2	2	1	1
Smart Sensors/Tracking	2	2	2	2	2	2	2	2	2	1

LEGEND for CAP Matching	
No advantage for Both Australia and Vietnam	0
Marginal advantage for Australia	1
A significant advantage for Australia	2
More significant advantage for Australia	3

Logistics 4.0 gaps: Australia-Viet Nam



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