Fourth Industrial Revolution and Knowledge Economy

Education in an AI World

A Cisco Perspective for Global Higher Education Forum 2018

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Agenda

1. Modelling the Impact of Technology on Labour Market (ASEAN and Malaysia)
2. Evolving Student Opportunity
3. Digital Disruption in Higher Education
4. Summary
Education is Cisco’s past, present, and future

Ever since two university professors started Cisco in 1984, Education has been in our blood.

Each year, Cisco employees

- Donated Millions to schools and universities
- Volunteered nearly 20,000 hours

- Over 20 years, Cisco Networking Academy has trained nearly eight million students in 180 countries
- STEM Training and Empowerment
- CSR Partnerships

- More than 30 years serving education customers
- An Education Practice led by educators for educators
- Research Grants and Partnerships with global universities
Cisco Networking Academy - Global Impact

Since program inception in 1997

- **180** Countries
- **24,700** Instructors worldwide
- **1.87 million** Students worldwide each year
- **9.26 million** Students enrolled since 1997
- **11,400** Academies worldwide
- **19** Course languages
Every country, city, government, and business will become digital
Digitization

Governments and organizations leverage digital/computer tools, data and analysis

IoT (Internet of Things)

Billions of software-driven connected devices gather and share data

What this means for all of us

The rapidly changing nature of technology and automation is affecting all jobs. Now everyone needs digital skills, not just employees in technology jobs. This sudden demand must be addressed by a holistic approach to education – one that leverages both traditional and non-traditional learning environments.
We modelled the Impact of Technology on the Labour Market in ASEAN

Across ASEAN’s large and diverse economy, many businesses are already pushing at the frontiers of digital transformation and innovation.

Widespread adoption of technologies, coupled with advances in the use of artificial intelligence (AI) through software, hardware, and robotics, has the potential to transform business capabilities.

To better understand these opportunities and challenges, Cisco has worked with Oxford Economics to explore what the next decade of technological change will mean for ASEAN workers.

We assembled a multi-disciplinary team of experts from across the region to advise on the role technology will play in different industries and occupations. We then leveraged data on 433 occupations across 21 industries to model the impact of these technology adoption patterns on the 275 Million full-time equivalent (FTE) workers employed in the six largest ASEAN economies by 2028.
We followed a 5 step process to assess the impact on jobs and associated skills implications.

1. **2028 Technology landscape**
   - Define the potential technological change that could be achieved by 2028 as the modelling scenario.

2. **Productivity implications for workplace tasks**
   - Explore the impact of technological change on the tasks and functions performed in the workplace.

3. **Short-term “displacement” effect**
   - Model the short-term “displacement” of jobs as a result of the labour saving productivity gains.

4. **Long term “income” effect**
   - Model the long-term recalibration of the labour market-new workers move into growth sectors and reallocating redundant workers from shrinking sectors.

5. **Skills implications**
   - Model the movements workers make through the labour market to meet the needs of the new economy.
   - Analyse the skills gaps they need to bridge across skill-types, occupations, industries and countries.
Technology leads not only to automation – but also new jobs

Displacement vs. Income Effects

Displacement Effect (loss of jobs)
Tasks replaced by AI, automation or digital technology change the nature of work we do every day.

Income Effect (new opportunities)
Labor saving technology innovations passed onto the consumer will increase spending power and demand for new goods and services.
Substantial productivity gains, with 28 million fewer workers across the ASEAN-6 required to produce the same level of output as today

- This equates to more than 10 percent of the current ASEAN-6 workforce.
- The bulk of these workers come from the two largest ASEAN-6 labour markets, with 9.5 million based in Indonesia and 7.5 million based in Vietnam. In relative terms, the Malaysian labour market is expected to see the least disruption.

Displacement, millions of full-time equivalent (FTE) workers

- Indonesia: 9.5m (8.1%)
- Malaysia: 1.2m (7.4%)
- Philippines: 4.5m (10.1%)
- Singapore: 0.5m (20.6%)
- Thailand: 4.9m (11.9%)
- Vietnam: 7.5m (13.8%)
- ASEAN-6: 28.0m (10.2%)

Source: Oxford Economics, Cisco
The same technological progress will cut production costs, raise spending power of the population and allowing them to consume more goods and services. This in turn will create demand for new jobs.

Our 10-year technology scenario reveals that jobs will not likely be created in entirely the same place as where they are displaced.

Certain sectors (such as agriculture) will need to shrink their workforces, while others (such as wholesale & retail) will need to expand.
Our modelling identifies that, for some 6.6 million workers across the ASEAN-6 region, the new technology scenario will render their jobs redundant.

Agriculture will be the major source of these redundancies, as new developments — for example in global positioning systems, telematics and smart sensors—are deployed to greater effect.

In contrast, many sectors will experience a net increase in their demand for jobs by 2028, because the rise in spending power through increased productivity more than offsets the jobs directly displaced by technology.

The largest number of vacancies (1.8 million) are predicted to emerge in wholesale and retail, with a further 0.9 million in manufacturing.

Source: Oxford Economics, Cisco
At the occupational level, our 10-year new technology scenario reveals that the burden of transition will fall most heavily on elementary workers and skilled agricultural workers.

- This equates to more than 10 percent of the current ASEAN-6 workforce.
- The bulk of these workers come from the two largest ASEAN-6 labour markets, with 9.5 million based in Indonesia and 7.5 million based in Vietnam. In relative terms, the Singaporean labour market is expected to see the greatest disruption.

### % Change

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Displacement Effect</th>
<th>Income Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>-7.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Professional</td>
<td>-7.0%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Technicians and junior professionals</td>
<td>-8.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Clerical support workers</td>
<td>-7.7%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Service and sales workers</td>
<td>-8.9%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Skilled agricultural workers</td>
<td>-12.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Craft and related trades workers</td>
<td>-10.1%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Plant and machine operators, and assemblers</td>
<td>-10.6%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Elementary workers</td>
<td>-12.0%</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

**Source:** Oxford Economics, Cisco
Our technology scenario suggests a shift in the traditional path to non-agrarian employment for these workers.

Developing economies have traditionally seen employment shift out of low-value agricultural jobs into low-value manufacturing as a stepping stone to higher-value production and service sector jobs, as the economy develops.

In our future scenario, however, only 40 percent of new jobs are created in the manufacturing sector, while the rest appear in services. Developing ASEAN economies must increasingly leapfrog the manufacturing sector to secure service sector employment. In many cases, this will represent a more difficult transition.

Source: Oxford Economics, Cisco

<table>
<thead>
<tr>
<th>Sector</th>
<th>Millions of FTE workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Mining</td>
<td>-5.8</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2.1</td>
</tr>
<tr>
<td>Services</td>
<td>3.7</td>
</tr>
</tbody>
</table>
The application of technologies in the ASEAN-6 over the next 10 years will alter the nature of work for all occupations

- 433 unique occupational task profiles were constructed as the basis for our modelling exercise. Each of them contains the tasks deemed “important” to performing that job. Some more complex occupations require a balance of multiple important tasks. Others are more straightforward and require fewer.

- The charts below illustrate the changing nature of work for two occupations – one at high risk of disruption (farm labourer) and one less vulnerable to disruption (primary school teacher).
Governments, businesses, and workers have a shared stake in ensuring the ASEAN-6 workforce is ready for the demands of the future economy

- Our modelling shows that the general stock of skills in the labour market will have to rise significantly to accommodate the demands of the new technology scenario.

- Despite its already highly-skilled workforce, our analysis suggests it is Singapore that faces the biggest skills challenge due to the rate of digital transformation predicted to take place.

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![Average skill level (0-100)](source: Oxford Economics, Cisco)

- **Indonesia**
- **Malaysia**
- **Philippines**
- **Singapore**
- **Thailand**
- **Vietnam**

Source: Oxford Economics, Cisco
IT skills stand out as a major challenge. IT-related occupations are growing, but the workforce is currently acutely lacking the necessary skills.

- Around 41 percent of ASEAN-6 workers leaving redundant jobs have what we classify as an “acute” skills mismatch with vacant positions in the broader category of IT skills.

- The IT skills challenge is not exclusively a problem of recruiting highly-specialised programmers, however; it spreads across all sectors of the economy in the future.

### Percentage of "large" skills mismatches

- **2%** Are acutely lacking Foundational skills
- **3%** Are acutely lacking Cognitive skills
- **1%** Are acutely lacking Interactive skills
- **12%** Are acutely lacking Operations skills
- **41%** Are acutely lacking IT skills
- **10%** Are acutely lacking Management skills

Source: Oxford Economics, Cisco
Despite the disruption being technology-based in nature, the ASEAN-6 workforce’s most significant challenge is to upgrade its softer, foundational and interactive skillset.

- Fulfilling these skills challenges will require a different approach to delivering the more technical, acute skills identified above. It might require a greater commitment to on-the-job training, more flexible online courses and experience, to complement or substitute for formal classroom education.

| 1.7 million More workers will need Foundational skills |
| 250,000 More workers will need Cognitive skills |
| 1.9 million More workers will need Interactive skills |
| -750,000 More workers will need Operations skills |
| 800,000 More workers will need IT skills |
| 1.0 million More workers will need Management skills |

Change in skills points per worker

Source: Oxford Economics, Cisco
Malaysia

In our 10-year scenario, Malaysia has excellent data infrastructure and has achieved fairly advanced automation of low-value, routine and hazardous work. However, labour regulations slow the business case for more widespread automation.

250,000 existing roles will disappear from the labour market, requiring workers to transition into other industries and occupations.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Agriculture &amp; Mining</th>
<th>Manufacturing</th>
<th>Utilities</th>
<th>Construction</th>
<th>Wholesale &amp; Retail</th>
<th>Transport &amp; Tourism</th>
<th>Business Services</th>
<th>Government &amp; Community Services</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>-1,739</td>
<td>-256</td>
<td>36</td>
<td>155</td>
<td>5,810</td>
<td>1,341</td>
<td>4,768</td>
<td>1,117</td>
<td>11,233</td>
</tr>
<tr>
<td>Professionals</td>
<td>-1,697</td>
<td>3,117</td>
<td>-54</td>
<td>496</td>
<td>2,573</td>
<td>1,978</td>
<td>17,771</td>
<td>26,948</td>
<td>51,132</td>
</tr>
<tr>
<td>Technicians and junior professionals</td>
<td>-2,060</td>
<td>-2,144</td>
<td>-539</td>
<td>67</td>
<td>9,169</td>
<td>1,785</td>
<td>11,081</td>
<td>6,591</td>
<td>23,950</td>
</tr>
<tr>
<td>Clerical support workers</td>
<td>-1,608</td>
<td>497</td>
<td>-36</td>
<td>1,040</td>
<td>8,809</td>
<td>3,694</td>
<td>6,907</td>
<td>4,806</td>
<td>24,110</td>
</tr>
<tr>
<td>Service and sales workers</td>
<td>-1,732</td>
<td>35</td>
<td>-117</td>
<td>-139</td>
<td>62,859</td>
<td>10,648</td>
<td>6,931</td>
<td>1,102</td>
<td>79,587</td>
</tr>
<tr>
<td>Skilled agricultural workers</td>
<td>-68,239</td>
<td>-162</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>6</td>
<td>210</td>
<td>-24</td>
<td>-68,162</td>
</tr>
<tr>
<td>Craft and related trades workers</td>
<td>-1,867</td>
<td>-15,008</td>
<td>-196</td>
<td>-5,963</td>
<td>8,548</td>
<td>-73</td>
<td>499</td>
<td>-192</td>
<td>-14,251</td>
</tr>
<tr>
<td>Plant and machine operators, and assemblers</td>
<td>-8,579</td>
<td>-24,527</td>
<td>-707</td>
<td>-1,233</td>
<td>1,992</td>
<td>3,971</td>
<td>184</td>
<td>-619</td>
<td>-29,518</td>
</tr>
<tr>
<td>Elementary workers</td>
<td>-74,413</td>
<td>-2,369</td>
<td>-904</td>
<td>-1,509</td>
<td>3,359</td>
<td>355</td>
<td>669</td>
<td>-3,269</td>
<td>-78,081</td>
</tr>
<tr>
<td>Total</td>
<td>-161,933</td>
<td>-40,817</td>
<td>-2,518</td>
<td>-7,085</td>
<td>103,167</td>
<td>23,705</td>
<td>49,019</td>
<td>36,462</td>
<td>-0</td>
</tr>
</tbody>
</table>

The transition out of agriculture, leapfrogs manufacturing and shifts straight into services

...Opportunities are not limited to retail: 20 percent of vacancies will be created in higher-value business services

Source: Oxford Economics, Cisco
Success Looks different Today than in the Past

AI & Automation
Reshaping labor markets

Computer & Data Skills
Digital fluency necessary and insufficient

The Human Touch
Soft skills + continuous reinvention

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Successful Students Learn How to Learn

- Inquire
- Initiate
- Adapt
- Create

- Research
- Reinvention
- Critical Thinking
- Self-Assessment
The Digital Transformation of Learning
What’s to focus on Education Today?

• Little ability to personalise
• Class time not engaging for students
• Efficiency and Effectiveness issues
Blended Learning Strategies for Education

- **Flipped** - students review lecture content prior to class; class time focuses on discussion and application of lecture.

- **Virtual** - face-to-face classroom experience is replaced with virtual classroom.

- **Hybrid** - integration of multiple teaching methods into the course pedagogy.

- **Online** - content delivered online; student self-study oriented approach with minimal teacher interaction (e.g., MOOC).

- **Traditional** - in-person, typically lecture-based courses.
Stages of Evolving Student Opportunity

Access
- All students have equity of access to resources for learning and sharing knowledge

Engagement
- Students are equipped to use resources effectively as active learners

Experience
- Students encounter opportunities for transformative, holistic development

Innovation
- Students take the initiative to create and give back

Learning Opportunity

Student Success
Day-in-a-life of: Lecturer, Student, Industry Partners

Pre-class (Students):
• Pre-class enrollment
• Flipped content preview
• Self-directed learning

In-Class (Students):
• Active learning / engagement
• Remote participation
• Collaborative learning
• Engaging industry experts

In-Class – (Educators)
• Active class teaching
• Remote immersive & lifesize teacher
• Industry guest speaker
• Remote Industry experts
• Rich / engaging content

Post-Class (All)
• Review content
• Tutorial / consultation
• Research & project work
• Partner with anyone, and anywhere in the world

Pre-Class (Educators)
• Pre-class announcements
• Flipped content recording
• Prep calls with Industry Guests / Experts
AI Robot top 20% for Univ. of Tokyo Entrance Exam
Disruption in Education?
Where would it come from?
Digital Disruptors are Shaking Up Education

Source: CB Insights
Three Forms of Value

Cost Value
- Free / ultra-low cost
- Buyer aggregation
- Price transparency
- Reverse auctions
- Consumption-based pricing

Experience Value
- Customer empowerment
- Personalization
- Instant gratification
- Any device, anytime
- Automation

Platform Value
- Ecosystem
- Crowdsourcing
- Communities
- Digital marketplaces
- Data orchestrator
Digital Institution Framework

Digital Learning
- Connected Learning
- Learning Space
- Digital Platform

Digital Campus
- Smart Workspace
- Smart Facilities
- Smart Services

Digital Network Infrastructure for Education

Security Everywhere

Partner Services + Ecosystem
“I am wiser than this man, for neither of us appears to know anything great and good; but he imagines he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not imagine I do. In this trifling particular, then, I appear to be wiser than he, because I do not imagine I know what I do not know.”

SOCRATES