

# Future of work in the ASEAN

## A literature review of automotive manufacturing and IT services

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# Introduction

The world of work, and its future, have attracted a lot of attention in recent times. The discussion has been provoked by the confluence of recent technological breakthroughs that portend to have wide-ranging implications on work and livelihoods. In what has been termed the “Fourth Industrial Revolution” or “Industry 4.0”<sup>1</sup>, the discussion has engaged numerous stakeholders. However, no shared understanding of what this future of work will look like has materialised. Historical scholarship around technological change and its impact on the labour market was focussed in the context of high-income countries.<sup>2</sup> Contemporaneously, however, research is being produced that outlines the possible futures of work in low and middle-income contexts. It is exigent to generate scholarship dedicated to low and middle-income contexts given that in addition to technological drivers, the future of work will be mediated through region and country specific factors such as socioeconomic, geopolitical and demographic change<sup>3</sup>.

One such region that is beginning to be better studied in the discourse around the future of work is Southeast Asia. The region appears to be primed to be a site for technological uptake owing to pervading internet usage - it is the world’s fastest growing region for internet penetration, with an existing internet user base of 260 million, projected to grow to 480 million users by 2020.<sup>4</sup> The region also has a well-developed information and communications technology cluster and has historically encouraged innovation and investment in new technologies.<sup>5</sup> Additionally, the signing of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership aims to provide for an integrated regional market - the integration will result in an aggregated population of 650 million and a nominal GDP of \$6.5 trillion.<sup>6</sup>

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<sup>1</sup> The Fourth Industrial Revolution (4IR) – a term coined by the World Economic Forum after the German high-tech strategy project “Industrie 4.0” – is considered to describe the current fourth major industrial era. It contains the creation and deployment of new technologies that are merging the physical, digital and biological worlds, and are impacting all disciplines, economies and industries.

<sup>2</sup> (2016). ASEAN in transformation : perspectives of enterprises and students on future work / International Labour Office. Bureau for Employers’ Activities (ACT/EMP). Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579556.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579556.pdf)

<sup>3</sup> ILO. (2017). Inception Report for the Global Commission on the Future of Work, (Geneva)

<sup>4</sup> Google and TEMASEK. (2017). e-Conomy SEA Spotlight 2017. Retrieved [https://www.blog.google/documents/16/Google-Temasek\\_e-Conomy\\_SEA\\_Spotlight\\_2017.pdf](https://www.blog.google/documents/16/Google-Temasek_e-Conomy_SEA_Spotlight_2017.pdf)

<sup>5</sup> AT Kearney. The ASEAN Digital Revolution. Retrieved <https://www.atkearney.com/digital-transformation/article/?a/the-asean-digital-revoluti-1>

<sup>6</sup> Bharadwaj A., Tan M., Reichert T. and Rastogi, V. (2018). How the Digital Revolution is Integrating Southeast Asia’s Customers. *Boston Consulting Group*. Retrieved <https://www.bcg.com/publications/2018/digital-revolution-integrating-southeast-asia-consumers.aspx>

To better understand the regional impact of ongoing and upcoming technological change on work, this literature review will focus on the automotive and information technology services (IT) sectors. The ASEAN region has become a dominant market in the global context for both original equipment manufacturers (OEMs), auto parts suppliers and also a major assembly hub.<sup>7</sup> The IT sector, on the other hand, represents a still nascent sector in the region even though individual countries in the region are significant global providers of IT services.<sup>8</sup> However, this comparison not only allows for the study of differently economically placed sectors, but also allows for the assessment of the potential differential impact of Industry 4.0 on the organisation of work and labour in predominantly blue-collar manufacturing and white-collar services.

## Methodology and scope

The literature review will look at the impact of technological adoption on work in the ASEAN, by undertaking desk research on the broader discourse around the future of work, and more specifically in the automotive and the IT sector in the region.

This literature review seeks to lay out a research agenda for the future of work in the region by drawing out trends and providing an analysis of contextual, quantitative and qualitative data on changes to work and labour markets as a result of technological adoption. This literature review will further surface data gaps and future areas of research.

It is anticipated that comparative research can be enabled through this undertaking in other sectoral contexts in the region. The larger goal is also to enable similar approaches to generate foundational work required for granular understanding of the future of work in other, particularly middle and low-income, contexts.

## Country sample

The literature review first does a high level overview of Industry 4.0 in the ASEAN region to set the background for a later granular review of the domestic automotive and IT services sectors of specific countries within the region. For the high-level review, we look broadly at the ASEAN region without looking at only some specific countries in the region.

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<sup>7</sup> PriceWaterhouseCoopers. (2015). Riding Southeast Asia's automotive highway. Retrieved [https://www.pwc.com/gx/en/growth-markets-centre/publications/assets/Riding\\_Southeast\\_Asia\\_automotive\\_highway.pdf](https://www.pwc.com/gx/en/growth-markets-centre/publications/assets/Riding_Southeast_Asia_automotive_highway.pdf)

<sup>8</sup> PriceWaterhouseCoopers. (2017). The Future of ASEAN - Time to Act Consumer Goods. Retrieved <https://www.pwc.com/gx/en/growth-markets-centre/assets/pdf/future-of-asean-chapter-4.pdf>

For the automotive sector, the countries were identified for analysis based on the contribution of their domestic automotive sector from within the ASEAN region. At the same time, domestic automotive markets are differently structured within the region as well. **The countries chosen are Indonesia, Malaysia, Singapore and Thailand.** Thailand, Indonesia and Malaysia are the leading sales market and production powerhouses in the region.<sup>9</sup> On the other hand, the expansion of the Malaysia automotive sector is relatively recent, with the automotive sector forming a part of the domestic industrial policy only in 2006.<sup>10</sup> Singapore is emerging as the prime site for autonomous vehicle testing in its attempts at achieving a 'car-lite' future.<sup>11,12</sup>

**When it comes to the IT/IT-eS sector within the ASEAN, we have looked at Malaysia, the Philippines, Singapore and Viet Nam.** Singapore has the largest IT services market in the region, and is also called the digital capital of Asia.<sup>13,14</sup> Philippines, on the other hand, has established a very sizeable BPO sector and has been in the process of establishing an IT services sector as well.<sup>15</sup> At the same time, Viet Nam, while a major destination for offshoring electronics manufacturing, has been attempting to expand their IT services sector.<sup>16</sup> Viet Nam and Malaysia, then, are emerging as the new leading offshoring locations in the Asia-Pacific region for captive or outsourced IT and business process services.<sup>17</sup>

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<sup>9</sup> (2018, March 27). Automotive Industry ASEAN: Indonesia Lags Behind Thailand. *Indonesia Investments*. Retrieved <https://www.indonesia-investments.com/news/todays-headlines/automotive-industry-asean-indonesia-lags-behind-thailand/item8689>

<sup>10</sup> History of Malaysia's Automotive Industry . *Malaysia Automotive Institute*. Retrieved [http://mai.org.my/v5test/index.php?option=com\\_content&view=article&id=31&Itemid=181&lang=en](http://mai.org.my/v5test/index.php?option=com_content&view=article&id=31&Itemid=181&lang=en).

<sup>11</sup> Is Singapore heading for a 'car-lite' future? *World Economic Forum*. Retrieved <https://www.weforum.org/agenda/2018/05/could-singapore-sign-up-to-a-car-lite-future/>.

<sup>12</sup> (2018, June). Special Report: The ASEAN Auto Industry. *Automotive World*, Retrieved <http://www.ipsosconsulting.com/pdf/special-report-the-asean-auto-industry.pdf>

<sup>13</sup> Gia Binh, T. (2014, May 20). Big opportunity for Southeast Asia IT industry. *Rappler*. Retrieved <https://www.rappler.com/business/features/58473-southeast-asia-it-industry>

<sup>14</sup> EDB Singapore. (2017). Information & Communications Technology. Retrieved <https://www.edb.gov.sg/en/our-industries/information-and-communications-technology.html>

<sup>15</sup> Mitra, R. M. (2013). The Information Technology and Business Process Outsourcing Industry: Diversity and Challenges in Asia. *ADB Economics Working Paper Series, 365*. Retrieved <https://www.adb.org/sites/default/files/publication/30384/ewp-365.pdf>.

<sup>16</sup> Mitra, R. M. (2013). The Information Technology and Business Process Outsourcing Industry: Diversity and Challenges in Asia. *ADB Economics Working Paper Series, 365*. Retrieved <https://www.adb.org/sites/default/files/publication/30384/ewp-365.pdf>.

<sup>17</sup> Longwood, J. (2014). Leading Locations for Offshore Services in Asia/Pacific 2014: Still Growing but Facing Increasing Competition . *Gartner*. Retrieved <https://www.gartner.com/en/documents/2666815>.

## Data Sources

This research has drawn upon a range of sources to obtain insight and identify trends pertinent to the impact of technology on work. These sources include *inter alia* industry reports, news items, academic papers, developmental organisation reports, consultancy reports and government documents.

## Technological uptake in the ASEAN

Information and communication technologies (ICTs) in general have been acknowledged to have transformed how work is organised. According to the ILO, uses of software, particularly over the internet, have contributed to large increases in efficiency or industrial productivity.<sup>18</sup> Among these are online transaction and human resources software resulting from greater online security and use; improved data analysis software; and modeling software used for designing and quality control.<sup>19</sup> The World Bank similarly notes that internet-based systems integration as a key technological innovation adopted in East Asian economies.<sup>20</sup>

Contemporaneously, a host of literature suggests that the use of robotics is becoming prevalent among ASEAN countries. The ILO indicates robotics in particular as being adopted by smaller manufacturers.<sup>21</sup> The Employment Law Alliance surveyed firms on the use of new technologies affecting the future of work in the Asia Pacific region and found that almost all respondents in low or middle income countries predicted robotic automation in manufacturing and service sectors to change the nature of their firms.<sup>22</sup> According to the International Federation of Robotics, more than 250,000 units of multipurpose industrial robots will be installed in Asia on a yearly basis by 2019, with the main industries driving demand in robots being the automotive, electrical/electronics, metal, and machinery, as well as the rubber and plastics industries.<sup>23</sup> Similarly, the World Bank notes that “robotics

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<sup>18</sup> Chang, Jae-Hee. & Rynhart, Gary. & Huynh, Phu. (2016). ASEAN in transformation: How technology is changing jobs and enterprises. (Bureau for Employers' Activities (ACT/EMP) working paper; No. 10.) International Labour Office, Bureau for Employers' Activities (ACT/EMP).

<sup>19</sup> *Id.*

<sup>20</sup> World Bank. (2018). “Enhancing Potential” East Asia and Pacific Economic Update (April), World Bank, Washington, DC. Retrieved

<https://openknowledge.worldbank.org/bitstream/handle/10986/29648/9781464812835.pdf>

<sup>21</sup> *Id.*

<sup>22</sup> (October 2017). Employment Law Alliance, The Future of Work in the Asia Pacific. Retrieved [http://www.ssek.com/download/document/The\\_Future\\_of\\_Work\\_in\\_the\\_Asia-Pacific\\_189.pdf](http://www.ssek.com/download/document/The_Future_of_Work_in_the_Asia-Pacific_189.pdf)

<sup>23</sup> (March 2018), Robots and the Workplace of the Future. International Federation of Robotics. Retrieved [https://ifr.org/downloads/papers/IFR\\_Robots\\_and\\_the\\_Workplace\\_of\\_the\\_Future\\_Positioning\\_Paper.pdf](https://ifr.org/downloads/papers/IFR_Robots_and_the_Workplace_of_the_Future_Positioning_Paper.pdf)

(particularly AI enabled), digitalisation and internet-based systems integration, including sensor-using “smart factories” are key technologies being adopted in East Asian economies.<sup>24</sup>

The use of machine learning and AI software can have a major impact across several industries, particularly business or knowledge process outsourcing. According to the ILO and the Asian Development Bank, the BPO industry in the region is a prime site for technological disruption as well.<sup>25,26</sup> The adoption of big data analytics, artificial intelligence and cloud computing to improve service delivery, and in some cases to automate it, is already underway.

Research shows that 85% of businesses plan to internally implement IoT or enabled technology to improve business efficiency, or cater to a need for innovation. However, it was also observed that many business executives are presently unsure of how to effectively apply IoT to businesses, and those who succeed in implementation are cemented to gain a competitive advantage.<sup>27</sup>

In addition to the above, 3D printing is another technological innovation that is seeing uptake in various categories of the manufacturing sub-sectors. The ILO finds that 3D printing technology can have a major impact on the electrical and electronics sector, as well as in the textile and clothing sector, both of which are major industries in ASEAN countries.<sup>28</sup>

However, the uptake of technological innovations is not solely contingent on the availability of the technology itself. For instance, even if it is technologically feasible to automate a job (or some of its component tasks), it may not be economically feasible to do so. As the ADB points out, in the context of low and middle income countries, “much growth potential

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<sup>24</sup> World Bank. (2018). “Enhancing Potential” East Asia and Pacific Economic Update (April), World Bank, Washington, DC. Retrieved

<https://openknowledge.worldbank.org/bitstream/handle/10986/29648/9781464812835.pdf>

<sup>25</sup> Chang, Jae-Hee. & Rynhart, Gary. & Huynh, Phu. (2016). ASEAN in transformation: How technology is changing jobs and enterprises. (Bureau for Employers’ Activities (ACT/EMP) working paper; No. 10.) International Labour Office, Bureau for Employers’ Activities . Retrieved

[https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579553.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579553.pdf)

<sup>26</sup> AfDB, ADB, EBRD, IDB (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank). (2018). The Future of Work: Regional Perspectives. Washington, DC. Retrieved

<https://www.adb.org/sites/default/files/publication/481901/future-work-regional-perspectives.pdf>

<sup>27</sup> Id.

<sup>28</sup> Chang, Jae-Hee. & Rynhart, Gary. & Huynh, Phu. (2016). ASEAN in transformation: How technology is changing jobs and enterprises. (Bureau for Employers’ Activities (ACT/EMP) working paper; No. 10.) International Labour Office, Bureau for Employers’ Activities . Retrieved

[https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579553.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579553.pdf)

remains (even through greater use of now standard technologies such as electricity and modern transport), rising demand for goods and services offers a countervailing force to automation-driven labor displacement.”<sup>29</sup>

## Quantifying the impact of Industry 4.0 on jobs

The debate around the future of work is often occupied with arriving at accurate estimates of the quantitative impact of technological unemployment i.e. questions around the net impact on the number of jobs. Various models are used for this determination, each arriving at varying estimates, using different time periods for forecasting as well as each having their own limitations. However, there seems to be an emerging consensus on the fact that jobs existing currently will be impacted in a significant number - disagreements over how many still persist. At the same time, there is consensus over the fact that new jobs will be created as well. These arguments build off of historical experience with technological ‘revolutions’ and how mass unemployment was not caused in the long run. Additionally, an argument put forth is that entire jobs that will entirely be replaced may ultimately be fewer, what will be more common will be the change in task composition of existing jobs as workers will be increasingly required to work with newer technologies. These various arguments are fleshed out in greater detail below.

### Existing methodologies

Displacement of labour by new technologies remains perhaps the most significant question regarding the political economy of the future of work. Economists have long hypothesised that increasing adoption of technologies lead to ‘skills-biased technical change’ in that it leads to a shift in demand from lower skilled labour to higher skilled labour.<sup>30</sup> The ADB reports that for developing Asian economies which are competitive in low-skilled workers, skill-biased technological change could lead to a shortfall of high-skilled workers and a

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<sup>29</sup> AfDB, ADB, EBRD, IDB (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank). (2018). *The Future of Work: Regional Perspectives*. Washington, DC. Retrieved

<https://www.adb.org/sites/default/files/publication/481901/future-work-regional-perspectives.pdf>

<sup>30</sup> Violante, G. L. (2016). Skill-Biased Technical Change. *The New Palgrave Dictionary of Economics*. Retrieved [http://www.econ.nyu.edu/user/violante/Books/sbtc\\_january16.pdf](http://www.econ.nyu.edu/user/violante/Books/sbtc_january16.pdf).



surplus of low-skilled workers.<sup>31</sup> However, some of the assumptions made about technology being the key driver of change have been challenged as being over-deterministic and not taking into account political and social context such as law making and policy formulation.<sup>32</sup>

While most studies indicate that the use of new technologies will cause displacement of labour across industries, some studies also indicate that the growth of new industries and jobs will offset this displacement.<sup>33</sup> The extent to which such displacement will be caused, and how national and international policy should address displacement of labour is widely contested. In Singapore, for example, the government believes that adoption of automation and new technologies can solve the workforce crunch of the unavailability of low-skilled labourers available for routine tasks, and increase employment in high-skilled jobs like programming and data analysis.<sup>34</sup> However, most studies focusing on the social and economic consequences of labour displacement have found that it will disproportionately affect low wage jobs undertaken by less educated workers and socially marginalized groups.<sup>35</sup>

Another methodology that has gained purchase recently to assess the nature of jobs being impacted by technological change is to study the ‘tasks’ that are bundled up to comprise ‘jobs’.<sup>36</sup> Contrasted with the skill-biased technological change hypothesis, a tasks approach suggests that new technology does not always favour better-skilled workers but often complements workers in certain tasks of their job, while substituting for them in others.<sup>37</sup> Work using this approach indicates that routine, non-cognitive and repetitive tasks are most prone to automation, while non-routine tasks that involve a creative or cognitive process are more difficult to automate, although the rapid adoption of artificial intelligence is affecting

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<sup>31</sup> (2018). Asian Development Bank Outlook. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>

<sup>32</sup> Benkler, Y. (2018, July 25). The Role of Technology in Political Economy: Part 1. *Law and Political Economy Blog*. Retrieved <https://lpeblog.org/2018/07/25/the-role-of-technology-in-political-economy-part-1/>

<sup>33</sup> Acemoglu, D., and P. Restrepo. 2017. Robots and Jobs: Evidence from US Labor Markets. NBER Working Paper 23285, National Bureau of Economic Research, Cambridge, MA. rey C. B., and M. Osborne, 2017. The Future of Employment: How Susceptible Are Jobs to Computerization?, *Technological Forecasting and Social Change* 114: 254–80. Bessen, James E., Automation and Jobs: When Technology Boosts Employment (February 12, 2019). Boston Univ. School of Law, Law and Economics Research Paper No. 17-09. Retrieved <https://ssrn.com/abstract=2935003>.

<sup>34</sup> (2016, April 7). Industry 4.0 and Singapore manufacturing . *Future Economy*. Retrieved <https://web.archive.org/web/20181226021444/https://www.gov.sg/microsites/future-economy/press-room/news/content/industry-4-0-and-singapore-manufacturing>

<sup>35</sup> Chang, Jae-Hee; Huynh, Phu. 2016. ASEAN in transformation : the future of jobs at risk of automation. International Labour Office, Bureau for Employers’ Activities. Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579554.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579554.pdf)

<sup>36</sup> OECD, (February 2017) Future of Work and Skills Paper presented at the 2nd Meeting of the G20 Employment Working Group. Retrieved [https://www.oecd.org/els/emp/wcms\\_556984.pdf](https://www.oecd.org/els/emp/wcms_556984.pdf)

<sup>37</sup> Autor DH, Dorn D, Katz LF, Patterson C and Van Reenen J. 2017. The fall of the labor share and the rise of superstar firms. Working Paper No. 23396, National Bureau of Economic Research, Cambridge, MA.

these tasks to some extent as well.<sup>38</sup> Tasks that involve social interaction, then, such as negotiations or planning activities, are found to be more difficult to automate.<sup>39</sup> An ADB study looking at 5 developing Asian economies found that over the past decade, “Jobs with a high frequency of interactive tasks (such as internal and external negotiations or planning group activities), cognitive tasks (such as writing memos, analyzing data, and preparing charts and tables), and/or using ICT to perform complex tasks, have enjoyed relatively high growth in employment.”<sup>40</sup> The ADB expects this trend to continue with increasing adoption of new technologies. Further, the study concludes that task relocation can have a net positive effect on employment in non-routine occupations, both cognitive and manual.

## Estimations

In terms of absolute jobs at risk, various analyses have reached different estimates to empirically inform the debate around job gain and loss. An ILO study of ASEAN-5 economies<sup>41</sup>, using the Frey-Osborne methodology of occupation based automation<sup>42</sup>, finds that 56% of jobs are at a high risk of being displaced over the next decade or two due to technological implementation at the workplace.<sup>43</sup> A study of 46 developed and developing countries conducted by the McKinsey Global Institute suggests that while automation technologies will displace occupations, it will change more; they estimate that 60 percent of occupations have at least 30 percent of constituent work activities that could be automated.<sup>44</sup> As per a study by Oxford Economics and Cisco, across six of the largest economies in the ASEAN an estimated 28 million fewer workers will be required to produce the same level of output as today by the year 2028. Their research suggests that Singapore’s labour market faces the largest degree of

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<sup>38</sup> 2018. Asian Development Bank Outlook. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>; Chang, Jae-Hee. & Rynhart, Gary. & Huynh, Phu. 2016. ASEAN in transformation: How technology is changing jobs and enterprises. (Bureau for Employers’ Activities (ACT/EMP) working paper; No. 10.) International Labour Office, Bureau for Employers’ Activities.

<sup>39</sup> *Id.*

<sup>40</sup> AfDB, ADB, EBRD, IDB (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank). (2018). The Future of Work: Regional Perspectives. Washington, DC. Retrieved <https://www.adb.org/sites/default/files/publication/481901/future-work-regional-perspectives.pdf>

<sup>41</sup> ASEAN-5 includes Cambodia, Indonesia, the Philippines, Thailand and Viet Nam.

<sup>42</sup> C. Frey and M. Osborne: The future of employment: How susceptible are jobs to computerisation? (University of Oxford, 2013).

<sup>43</sup> Chang, Jae-Hee; Huynh, Phu. (2016). ASEAN in transformation : the future of jobs at risk of automation. International Labour Office, Bureau for Employers’ Activities. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579554.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579554.pdf)

<sup>44</sup> (2017). Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation. McKinsey Global Institute. McKinsey & Company.

job displacement over the next decade, with almost 21 percent of its Full Time Equivalent (FTE) workforce displaced; and Viet Nam and Thailand at 14 percent and 12 percent respectively. Despite the large numbers displaced in Indonesia, Malaysia and the Philippines, the impact in these countries is smaller as a share of the total workforce.<sup>45</sup>

Disaggregated work suggests that manufacturing remains one of the prime sites of technological uptake. An UNCTAD study looking at 64 countries found that during the period 2004-15, increased use of robots was associated with a slight reduction in manufacturing employment share and real wage growth across the sample.<sup>46</sup> A study of the manufacturing industry across developing economies in Asia by Felipe et al. finds that it may already have lost its potential as an employment generating industry, which can partly be attributed to the adoption of technologies.<sup>47</sup> The automotive industry in Indonesia and Thailand, for example, could face displacement risks of almost 60 or 70 percent respectively.<sup>48</sup> Among the service sector, a study of ASEAN economies finds that the BPO sector in Indonesia and Thailand is already facing significant pressures from automation.<sup>49</sup> Further, service-oriented industries including hotels and restaurants, retail and shopping, and clerical jobs could be at risk.<sup>50</sup> Other major industries in Asian economies, such as garments and constructions, face risks from automation too.<sup>51</sup>

At the same time, the ILO remains optimistic about the future drivers of job growth, stating that “the same process innovations that supplant human workers will at the same time create demand for individuals capable of developing, designing, building, maintaining and repairing a new generation of robots and smart machines.”<sup>52</sup> The ILO predicts that new

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<sup>45</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>

<sup>46</sup> UNCTAD. 2017. Robots, Industrialization and Inclusive Growth. In Trade and Development Report 2017: Beyond Austerity: Towards a Global New Deal. United Nations Conference on Trade and Development.

<sup>47</sup> Felipe, J., Mehta, A., & Rhee, C. (2019). Manufacturing matters...but it's the jobs that count. *Cambridge Journal of Economics*, 43(1), 139–168. Retrieved <https://academic.oup.com/cje/article-abstract/43/1/139/4872550>

<sup>48</sup> Chang, J., Rynhart, G., & Huyuh, P. July 2016. ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>49</sup> C. Chandra, A., & Pouchous, K. (2017). ASEAN in an Era of the Fourth Industrial Revolution: Prospects and Implications for Workers and Employment. *Thinking ASEAN*. Retrieved [https://www.researchgate.net/profile/Chee\\_Chan6/publication/319501972\\_Re-balancing\\_ASEAN\\_Integration\\_Medical\\_Tourism\\_vs\\_Migrants\\_Health/links/59af6c3a458515150e474870/Re-balancing-ASEAN-Integration-Medical-Tourism-vs-Migrants-Health.pdf#page=4](https://www.researchgate.net/profile/Chee_Chan6/publication/319501972_Re-balancing_ASEAN_Integration_Medical_Tourism_vs_Migrants_Health/links/59af6c3a458515150e474870/Re-balancing-ASEAN-Integration-Medical-Tourism-vs-Migrants-Health.pdf#page=4)

<sup>50</sup> Chang, Jae-Hee; Huynh, Phu. 2016. ASEAN in transformation : the future of jobs at risk of automation. International Labour Office, Bureau for Employers' Activities. Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579554.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579554.pdf)

<sup>51</sup> Id.

<sup>52</sup> Id.

occupations will be born of this movement, including big data analysts, cloud specialists, software developers and digital marketing professionals.<sup>53</sup>

## Exploring the qualitative impact on jobs

The use of new technologies in the workplace is changing not only the distribution of labour, but also profoundly impacting the nature of work that is performed itself. These technologies are having a profound impact on how work is found, the employer-employee relationship, as well as workplace conditions and employee organization.

### Hiring practices

The uptake of Industry 4.0 technologies portends to concomitantly change hiring practises as there will be a change in the demand for skills to better fit the restructured task composition of jobs. Information technology tools and networking platforms are being prominently used to connect potential employees and employers. The ILO reports that these technologies characterise access to mainstream employment market, yet access remains costly and difficult for individuals without ready access to these technologies.<sup>54</sup> A World Bank Group Report on 'Digital Dividends' echoes the sentiment of exclusionary access to the market, l that "online job search remains concentrated among youth and the best educated and grows with income"<sup>55</sup>. It further notes that the use of online job search in smaller Asian economies like Viet Nam can be less than 5%. This unequal access indicates the limited efficacy of online searches may have in improving labour market inefficiency in developing countries by plugging the large informational gaps that exist.

In a slightly different vein, managerial challenges in regard to building organisational capacity vis-a-vis hiring external expertise are expected to emerge. A Mckinsey Report on Industry 4.0 in the ASEAN region finds that firms are largely resorting to external hires to fill new roles created by Industry 4.0. However, it notes that hiring for new roles needs to strike a balance, external hires can "disrupt the corporate culture and dampen employee

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<sup>53</sup> Id.

<sup>54</sup> Greene, Laura, Mamic, Ivanka. 2015. The future of work: Increasing reach through mobile technology. ILO DWT for East and South-East Asia and the Pacific. Bangkok: ILO. Retrieved from [http://ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-bangkok/documents/publication/wcms\\_342162.pdf](http://ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-bangkok/documents/publication/wcms_342162.pdf).

<sup>55</sup> 2016. World Development Report. World Bank. Retrieved from <http://www.worldbank.org/en/publication/wdr2016>.

motivation” while relying on internal hires solely may “prolong the transformation (to industry 4.0), giving competitors a chance to jump ahead.”<sup>56</sup>

## Forms of employment and employment relationships

The use of new technologies, and the new forms of employment will affect how jobs are structured and the forms that employment takes. The Standard Employment Relationship (SER) model of labour relationships is likely to be supplanted.<sup>57</sup> The forms this will take has been variously categorised as the ‘gigs’, ‘tasks’ etc. within the broader categorisation of ‘flexible’ or ‘remote’ work. A review of certain forms of new contracts finds that piece-rating and putting-out (sub-contracting) contracts are being more commonly adopted.<sup>58</sup>

The ILO categorises three non-standard forms of employment which are gaining prominence in ASEAN nations - intra-regional labour migration, freelance workers and remote workers.<sup>59</sup> A common factor in these is the shift from standard employment contracts to flexible or casual employment, particularly through freelancing and contract-based work instead of employment-based work. The ILO notes that from a managerial perspective, this allows for multiple and diverse workers to be managed, while also granting greater work-life balance to workers.<sup>60</sup> On the other hand, the Asia Monitoring Resource Centre finds that the new forms of employment contracts can have a negative effect on job quality and labour rights, particularly since employers are shifting hiring and negotiations to sub-contracting agencies which impose new terms and conditions without negotiating with unions.<sup>61</sup>

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<sup>56</sup> Industry 4.0: Reinvigorating ASEAN Manufacturing for the Future. McKinsey & Co. Retrieved from <https://www.mckinsey.com/~media/mckinsey/business%20functions/operations/our%20insights/industry%20%20%20reinvigorating%20asean%20manufacturing%20for%20the%20future/industry-4-0-reinvigorating-asean-manufacturing-for-the-future.ashx>.

<sup>57</sup> 2016. A challenging future for the employment relationship: Time for affirmation or alternatives? International Labour Office. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms\\_534115.pdf](https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_534115.pdf)

<sup>58</sup> 2016. Building an inclusive future with decent work: Towards sustainable development in Asia and the Pacific 16th Asia and the Pacific Regional Meeting Bali, Indonesia 6–9 December 2016. Report of the Director-General. Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_norm/---relconf/documents/meetingdocument/wcms\\_531409.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_531409.pdf)

<sup>59</sup> 2016. Non-standard employment around the world: Understanding challenges, shaping prospects. International Labour Office. Retrieved from [https://www.ilo.org/global/publications/books/WCMS\\_534326/lang--en/index.htm](https://www.ilo.org/global/publications/books/WCMS_534326/lang--en/index.htm)

<sup>60</sup> 2016. ASEAN in transformation : perspectives of enterprises and students on future work / International Labour Office. Bureau for Employers’ Activities (ACT/EMP). Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579556.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579556.pdf)

<sup>61</sup> 2013. Labour rights in high tech electronics: Case studies

## Employee working conditions and social protections

There is a gap in existing literature specific to South and South-East Asia on the health and safety impacts of these new forms of employment. The limited studies on this subject indicate that the use of automation is expected to change the interaction of workers with their immediate working environment. An ILO study on the automotive industry among the ASEAN nations notes that safer work conditions are one of the foremost reasons for adoption of greater automation.<sup>62</sup> The use of digital platforms for online work has also been positively linked to women's safety in Bangladesh, as the option of working from home is considered safer.<sup>63</sup>

A common feature of new forms of contracting are the lack of traditional social protection systems such as employee benefits, protections, insurance and PF schemes, etc.<sup>64</sup> Moreover, new forms of contracts and employment are legally ambiguous and do not clearly fall within existing labour regulations. For example, a contemporary challenge being faced by economies across the globe, including Asian nations, is the categorisation of for-hire transport workers within existing labour laws and institutions. While platforms like Uber, or GoJek (Indonesia) or Grab (Singapore and Malaysia) would categorise their drivers as self-employed, while radio taxi operators would be classified as wage earners for the same service.<sup>65</sup> There is therefore a clear need to update policies and labour institutions to ensure that labour rights are protected under the new forms of work as well.<sup>66</sup>

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of workers' struggles in Samsung Electronics and its Asian suppliers (Hong Kong). Asia Monitor Resource Centre (AMRC). Retrieved

<https://www.amrc.org/hk/content/workers%E2%80%99-struggle-samsung-electronics-indonesia>

<sup>62</sup> Jae-Hee Chang, Gary Rynhart and Phu Huynh. 2016. ASEAN in transformation: How technology is changing jobs and enterprises. International Labour Office, Bureau for Employers' Activities (ACT/EMP). Retrieved from [https://www.itcilo.org/en/the-centre/programmes/employers-activities/hidden-folder/pdf/asean-in-transformation\\_ilo-actemp](https://www.itcilo.org/en/the-centre/programmes/employers-activities/hidden-folder/pdf/asean-in-transformation_ilo-actemp)

<sup>63</sup> October 2017. Employment Law Alliance, The Future of Work in the Asia Pacific. Retrieved <https://www.employmentlawalliance.com/Templates/media/files/Law%20Firm%20Articles/CORRS-ELA-2017-Paper-201710.pdf>

<sup>64</sup> Christina Behrendt and Quynh Anh Nguyen. 2018. Innovative approaches for ensuring universal social protection for the future of work. International Labour Organisation. Retrieved from [https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms\\_629864.pdf](https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_629864.pdf)

<sup>65</sup> 2016. Building an inclusive future with decent work: Towards sustainable development in Asia and the Pacific 16th Asia and the Pacific Regional Meeting Bali, Indonesia 6–9 December 2016. Report of the Director-General. Retrieved from

[http://www.ilo.org/wcmsp5/groups/public/---ed\\_norm/---relconf/documents/meetingdocument/wcms\\_531409.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_531409.pdf)

<sup>66</sup> Id.

## Labour organisation and collective bargaining

Literature on the effects of Industry 4.0 and collective bargaining focuses largely on online work and the 'gig economy' than its implications for collectivisation strategies in traditional sectors such as manufacturing industries. The forms of collective bargaining are clearly linked to changing forms of employment and employment relations, particularly the introduction of intermediaries such as online labour platforms, as well as the disaggregation of work among multiple 'clients'. The lack of organisation affiliation and delocalisation is likely to be felt in labour organisation and collective bargaining. An Oxford Internet Institute study notes that, in the platform economy, while demand is relatively geographically concentrated (Western Europe and the USA), the supply is more diffuse – leading to competition between workers in very different contexts (high income countries and low income countries), and differential bargaining power exerted by these workers.<sup>67</sup> ICT technologies are simultaneously said to be also playing providing avenues to “reconnect workers, counter organizational dispersal, and build ‘virtual places’ or online substitutes to the missing geographic nexus”, which may, inter alia, include means of collective bargaining, though these may not be as effective as traditional means of collective bargaining.<sup>68</sup>

The efficacy of trade unions - as traditionally conceived - in collective bargaining among workers appears to be declining. The platform economy is urging an exploration of alternative collectivisation tools. A study of three large online labour platforms indicated that in some cases, the platform itself encouraged worker communication through the platform itself, or encouraged worker organisation through other means like forming online groups or conventional get-togethers. Lehdonvirta notes that “to the extent that the self-organised formations also allowed participants to discover and express their shared interests against unfair employers, it could be said that they also allowed workers to enact class identities.”<sup>69</sup> A study of drivers using the online platform GoJek in Indonesia similarly finds that these drivers consider themselves as employees working for a traditional employer and make demands on the platform, and formed effective associations to push back against

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<sup>67</sup> Graham, Mark. January 30 2018. Microwork and Virtual Production Networks in Sub-Saharan Africa and Southeast Asia. Oxford Internet Institute. Retrieved

<https://www.oii.ox.ac.uk/research/projects/microwork-and-virtual-production-networks/>

<sup>68</sup> Vili Lehdonvirta. 2016. Algorithms That Divide and Unite: Delocalization, Identity, and Collective Action in 'Microwork' in Space, place and global digital work. London: Palgrave-Macmillan (Fletcher J. ed.) Retrieved <http://vili.lehdonvirta.com/files/Lehdonvirta%202016%20Delocalization%20identity%20collective%20action%20in%20microwork.pdf>

<sup>69</sup> Id.

power asymmetries vis-à-vis the platform.<sup>70</sup> Labour organisation on such platforms is achieved through non-traditional mechanisms like WhatsApp groups.<sup>71</sup> Another study finds that freelancers did not consider trade unions as important for collective organisation, which could stem from the perception of being ‘independent’ workers, and that unionisation could lead to greater taxation or risks of job loss.<sup>72</sup>

## Skilling and Education

As noted in the previous sections, the future of work is likely to produce a paradigm shift in the kind of jobs that are done, as well as how they are performed. For economies across South and Southeast Asia, preparing for the advent of ‘Industry 4.0’ and the new technological revolution will require workers as well as firms and governments to reorient professional and scholastic education for being more compatible with new forms of work and new technologies. This section provides an overview of the literature on skilling and education in the context of the future of work in South and Southeast Asia.

The availability of skills that will be compatible with technological development is a significant factor for developing Asian economies in combating unemployment. The ILO and ADB both indicate that a potential ‘skills gap’ may play out, with the ILO citing that in 2020, the global labour market could potentially have a surplus of 95 million low-skilled workers and a potential shortage of 38 to 40 million high-skilled workers.<sup>73</sup> Providing impetus to TVET (Technical Vocational Education and Training) as a way to make up for this deficit is said to be a significant priority for policymakers.<sup>74</sup> However, few countries have prioritized readiness for new technologies (ICT and automation) in the context of Industry 4.0, within the larger TVET framework.<sup>75</sup>

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<sup>70</sup> Victoria Faggidae, Muto P. Sagala & Dwi Rahayu Ningrum, *Perkumpulan Prakarsa*. 2018. on-demand Transport Workers in Indonesia. Retrieved

<https://www.justjobsnetwork.org/wp-content/uploads/2018/03/toward-understanding-sharing-economy.pdf>

<sup>71</sup> Graham, M., 2017. Could online Gig Work drive development in lower-income countries? In *The Future of Work in the Global South* (pp. 8–12). (Galperin, Hernan and Alarcon, andrea, Ed.), IDRC/CDRI.

<https://ora.ox.ac.uk/objects/uuid:f623f897-3c57-4de3-9ef0-e3777bccab3f>

<sup>72</sup> Id.

<sup>73</sup> 2016. ASEAN in transformation : perspectives of enterprises and students on future work / International Labour Office. Bureau for Employers’ Activities (ACT/EMP). Retrieved

[http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579556.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579556.pdf);

Asian Development Bank. (April 2018). Asian Development Outlook 2018: How technology affects jobs. Retrieved

<https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>

<sup>74</sup> 2018. Draft National Industry 4.0 Policy, Ministry of International Trade and Industry, Singapore.

[http://grp.miti.gov.my/miti-grp/resources/Public%20Consultation/Industry4.0FrameworkLayout\\_PublicReview\(9Feb\)V3.pdf](http://grp.miti.gov.my/miti-grp/resources/Public%20Consultation/Industry4.0FrameworkLayout_PublicReview(9Feb)V3.pdf); Paryono. 2017. The importance of TVET and its contribution to sustainable development. AIP

Conference Proceedings 1887. Retrieved <https://aip.scitation.org/doi/pdf/10.1063/1.5003559>

<sup>75</sup> Id.



There is a lack of sources studying specific skill compositions that will be required in South and Southeast Asian economies. This kind of skill mapping is a feature of labour market data in countries like the UK, US and Australia, to name a few, as has been pointed out by the World Bank.<sup>76</sup> An ILO study of ASEAN countries indicates that technical education is the most valued skill, along with teamwork and communication skills. In this context, university qualifications were higher valued than TVET. The study also reports that certain skills were unavailable among the working population, namely strategic thinking and problem solving, as well as foreign language skills, technical knowledge and soft skills (which includes creativity and innovation).<sup>77</sup> Apart from general skills like cognitive or behavioral skills, job-specific skills are also a relevant area of research. ILO's study of industry sectors being affected by new technologies indicates that the electronics and equipment sectors in ASEAN will need to accommodate higher-value production and higher skilled assembly work. In the Textiles, Clothing and Footwear sector, operating new software like CAD and new machines like 3D printing instruments will be required skills. In the retail sector, the ILO reports that employees who can conduct data and web analysis will be increasingly sought after, as well as workers with increased knowledge of the product being sold.<sup>78</sup> A World Bank study of the future of work in Bangladesh notes a crucial deficit of higher-order cognitive skills and soft skills like critical thinking and problem solving; practical technical skills and knowledge for job, particularly in STEM fields; Information Technology skills; as well as foundational skills (basic mathematics and logic) and skills for operating in a new job market (for example, by using newer search tools for finding employment).<sup>79</sup> A similar skills gap is seen in countries with higher development indices, such as Viet Nam.<sup>80</sup>

Policy makers are recognising the need to reorient skills development and education programmes to equip employees and employers with the tools to compete in the future workplace. Among South East Asian countries, Singapore is perhaps the most forward looking, having established 'SkillsFuture', a statutory body under the Ministry of Education which aims to facilitate continuous education and training, upgrading skills in line with

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<sup>76</sup> APRIL 2018. THAILAND ECONOMIC MONITOR: BEYOND THE INNOVATION PARADOX. World Bank Group. Retrieved <http://pubdocs.worldbank.org/en/147711523275364465/pdf/TEM-Innovation-9-April-2018WEB3.pdf>

<sup>77</sup> 2016. ASEAN in transformation : perspectives of enterprises and students on future work / International Labour Office. Bureau for Employers' Activities (ACT/EMP). Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579556.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579556.pdf);

<sup>78</sup> Id.

<sup>79</sup> 2018. Bangladesh Skills for Tomorrow's Jobs: Preparing Youths for a Fast-changing Economy. World Bank. Retrieved <http://documents.worldbank.org/curated/en/684441522921114827/AUS0000069-revised-PUBLIC.pdf>

<sup>80</sup> Bodewig, Christian; Badiani-Magnusson, Reena; Macdonald, Kevin; Newhouse, David; Rutkowski. Jan. 2014. Skilling up Vietnam : preparing the workforce for a modern market economy (English). Directions in development ; human development. Washington, DC ; World Bank Group. Retrieved <http://documents.worldbank.org/curated/en/283651468321297015/Skilling-up-Vietnam-preparing-the-workforce-for-a-modern-market-economy>

technological advancements and increasing competition.<sup>81</sup> The department partners with institutes of higher learning to deliver more than 400 courses, and provides eligible citizens with monetary credit to avail through the courses for upgrading skills or learning new skills.<sup>82</sup>

The Malaysian Government's National Industry 4.0 Policy Framework includes a long-term and short-term policy for skilling in the context of Industry 4.0. Short term outcomes include re-skilling and upskilling of the existing workforce, inter alia, by creating an Industry 4.0 Talent Competency & Technology Mentoring Program, developing new courses and establishing an expert certification program. The long term policy focuses on technical vocational education & training (TVET) and STEM (science, technology, engineering, mathematics) in order to ensure that future graduates and workers are equipped to enter the new job market.<sup>83</sup> Thailand's "4.0" initiative has recognised the need to develop "new skills that better support Non-Routine/Non-Repetitive/Task specific/Project-based jobs", and has a stated policy goal of integrating education, training, and occupation development including TVET programmes to meet the demands of the industrial sector.<sup>84</sup> A study from Pakistan notes the ineffectiveness of its current skills development programme and proposes a shift from curriculum to a competency based training system which requires the students to acquire the knowledge and skills according to the requirements and standards set by the industries.<sup>85</sup> Industry collaboration is an important factor in both the development of these skilling programmes as well as in ensuring their efficacy as drivers of job-growth. In Thailand and Malaysia, for example, Mercedes Benz has tied up with government agencies to offer technical apprenticeships.<sup>86</sup>

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<sup>81</sup> Graham, M., 2017. Could online Gig Work drive development in lower-income countries? In *The Future of Work in the Global South* (pp. 8–12). (Galperin, Hernan and Alarcon, andrea, Ed.), IDRC/CDRI.

<https://ora.ox.ac.uk/objects/uuid:f623f897-3c57-4de3-9ef0-e3777bccab3f>

<sup>82</sup> *Id.*

<sup>83</sup> Ministry of International Trade and Industry, Singapore. Draft National Industry 4.0 Policy Framework'. Retrieved [http://grp.miti.gov.my/miti-grp/resources/Public%20Consultation/Industry4.0FrameworkLayout\\_PublicReview\(9Feb\)V3\\_.pdf](http://grp.miti.gov.my/miti-grp/resources/Public%20Consultation/Industry4.0FrameworkLayout_PublicReview(9Feb)V3_.pdf)

<sup>84</sup> Agenda 1: Prepare Thais 4.0 for Thailand becoming a first world nation

Royal Thai Embassy, Washington D.C. Retrieved

<http://thaiembdc.org/agenda-1-prepare-thais-4-0-for-thailand-becoming-a-first-world-nation/>

<sup>85</sup> Sumaira Chamadia & Muhammad Shahid, 'Skilling for the Future', available

<http://penerbit.uthm.edu.my/ojs/index.php/ITET/article/view/2319>

<sup>86</sup> Chomchuen W., Wall Street Journal (November 27 2014) In Thailand, Firms Add Apprentice Programs. Retrieved

<https://www.wsj.com/articles/in-thailand-firms-add-apprentice-programs-1417109906>

# Automotive Sector

## Overview of the region

As of 2015, the ASEAN region was the seventh largest producer of vehicles globally with a compound annual growth rate of 10 per cent since 2009.<sup>87</sup> Due to the abundance of low-cost, trained workers and an up-and-coming consumer market both from within and outside the region, along with the expansion of foreign Original Equipment Manufacturers (OEMs) and automotive producers, the region has witnessed consistent growth in the automotive industry. The ASEAN automotive industry has become a dominant market for both OEMs and auto parts suppliers, and is also a major assembly hub<sup>88</sup>.

Actively adopting automotive technologies, coupled with advances in the use of Artificial Intelligence (AI) through software, hardware, and robotics, has the potential to transform business capabilities<sup>89</sup>. ASEAN has a young workforce (half the 630 million inhabitants are aged under 30), and with its internationally competitive market, they are poised to take advantage of technological advancement in the sector. **The impact of such technological upgradation will be negotiated by the approximately 800,000 workers employed in the ASEAN region.**<sup>90</sup>

Congruent to the trend called out in the previous section, according to a 2016 ILO study on the automotive sector in ASEAN, **robotics automation is having the greatest impact in the ASEAN region by replacing lower skilled jobs.**<sup>91</sup> Robots are becoming better at assembly, they

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<sup>87</sup> Chang, J., Rynhart, G., & Huyuh, P. July 2016. ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>88</sup> Chang, J., Rynhart, G., & Huyuh, P. (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>89</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>

<sup>90</sup> Chang, J., Rynhart, G., & Huyuh, P. (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation; Thailand Automotive Institute. (December 2012). Master Plan for Automotive Industry 2012-2016. Retrieved [http://www.thaiauto.or.th/2012/backoffice/file\\_upload/research/11125561430391.pdf](http://www.thaiauto.or.th/2012/backoffice/file_upload/research/11125561430391.pdf).

<sup>91</sup> Chang, J., Rynhart, G., & Huyuh, P. (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

are cheaper and are progressively becoming better at collaborating with and complementing the human workforce. In addition to increasing productivity, robots potentially improve the health and safety at the workplace as hazardous tasks are being automated. **Amongst the key drivers of robotics automation is the contractual demand by suppliers to either reduce the overall price of an auto part or increase productivity without increasing the resources expended.**<sup>92</sup> In countries where the government has been raising the minimum wages, such as Thailand, Viet Nam and Myanmar amongst others,<sup>93</sup> automation can then prove to be an alternative for lowering costs.

As per a study by the International Labour Organisation (ILO), 60 percent of tier I suppliers in ASEAN have already seen significant increase in automation.<sup>94</sup> The advent of Industry 4.0 technology in production is predicted to have a two-fold effect on the labor force: low-skill workers will find themselves displaced in favour of automation, with over 60 per cent and over 70 percent of workers in Indonesia and Thailand facing high automation risk respectively, and manufacturers will increasingly seek higher skilled talent with R&D competencies, ranging from analytical experts to autonomous driving engineers and sustainability integration experts.<sup>95</sup>

A third effect on the labour force could be that the use of technology will create employment. It is argued that the adoption of technology makes production cost efficient, thus resulting in lower prices for goods and services and increased spending power (also known as the income effect). **By increasing productivity gains and boosting real income from the use of newer technology, it is argued that new demands for workers will be generated, creating 4.9 million new jobs in the manufacturing sector as a result.**<sup>96</sup>

The advent of Industry 4.0 in manufacturing may not merely eliminate or create jobs, but could also alter employment structures, moving workers into non-repetitive task functions.

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<sup>92</sup> Chang, J., Rynhart, G., & Huyuh, P. (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>93</sup> Rastogi, V. (30 August 2018). Minimum Wage Levels Across ASEAN. ASEAN Briefing. Retrieved <https://www.aseanbriefing.com/news/2018/08/30/minimum-wage-levels-across-asean.html>.

<sup>94</sup> Chang, J., Rynhart, G., & Huyuh, P., (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>95</sup> Chang, J., Rynhart, G., & Huyuh, P., (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>96</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>, Fig 12.

## **This would pose a considerable reskilling challenge for both the state and industry in ASEAN.**

Existing research indicates a very large gap in the skills constitution of the workforce, given predicted levels of technological adoption. 41 percent of the 6.6 million cohort studied by the study conducted by Oxford Economics and Cisco are “acutely lacking” the IT skills that new jobs will be demanding, almost 30 percent lack the “interactive skills” that will be demanded by future vacancies — such as negotiation, persuasion, and customer service skills; and just over 25 percent also lack “foundational skills” — such as active learning, reading, and writing skills that are required to a much greater extent in ASEAN’s future labour market in the mid to long term.<sup>97</sup>

## **Granulating at the level of countries**

### **Thailand**

Thailand is a regional leader in the production of automobiles – in 2018 it manufactured 2,167,694 motor vehicles<sup>98</sup> and it employed about a tenth of Thai workers in manufacturing, thus accounting for roughly 10 percent of the country’s gross domestic product (GDP) as far back as 2016<sup>99</sup>.

The Thai automobile and auto parts industry employs more than 500,000 people and accounts for nearly 12 percent of Thailand’s economic growth<sup>100</sup>. The country has an established presence of a range of multinational corporations, including Toyota, Isuzu, Honda, Mitsubishi, Nissan, and BMW, which together account for a lion’s share of the total number of vehicles produced in the country each year<sup>101</sup>. At present there are over 1,800 manufacturers in the Thai auto parts sector: tier I manufacturers that produce parts used in the vehicle assembly process in the Original Equipment Manufacturer (OEM) or Replacement

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<sup>97</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>.

<sup>98</sup> International Organization of Motor Vehicles Manufacturers. Country Statistics. Retrieved <http://www.oica.net/category/production-statistics/2018-statistics/>.

<sup>99</sup> Chang, J., Rynhart, G., & Huyuh, P., (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation; Thailand Automotive Institute. (December 2012). Master Plan for Automotive Industry 2012-2016; Reuters Singapore. (July 7, 2016). Automation can get you fired, and those in South-East Asia are most at risk. Retrieved <https://www.khaleejtimes.com/business/companies/automation-can-get-you-fired-and-those-southeast-asia-are-most-at-risk?X-IgnoreUserAgent=1>

<sup>100</sup> Rastogi, V. (10 May 2018). Thailand’s Automotive Industry: Opportunities and Incentives. ASEAN Briefing. Retrieved <https://www.aseanbriefing.com/news/2018/05/10/thailands-automotive-industry-opportunities-incentives.html>

<sup>101</sup> Rastogi, V. (10 May 2018). Thailand’s Automotive Industry: Opportunities and Incentives. ASEAN Briefing. Retrieved <https://www.aseanbriefing.com/news/2018/05/10/thailands-automotive-industry-opportunities-incentives.html>.

Equipment Manufacturer (REM) market, and tier II and tier III manufacturers that are largely Thai-owned small manufacturing enterprises supplying raw materials and producing specific parts for tier 1 operators and/or manufacturers of parts for REM market<sup>102</sup>.

The automotive industry has been experiencing ongoing expansion, allowing it to maintain its status as one of the top manufacturers from ASEAN. **Among the key factors behind the growth of the industry is that the labor force is highly skilled in comparison with neighbouring countries**<sup>103</sup>. By 2020, Thailand aims to manufacture over 35,00,000 units of vehicles to become one of the top performers in the global automotive market<sup>104</sup>. However, as the period of growth prolongs, Thailand will face an increasingly serious problem of labour shortage as the population structure shifts towards an aging society, as indicated by data from the Office of National Economic and Social Development Board<sup>105</sup>.

**Thailand's domestic use and production of autoparts has been promoted by state-led measures** such as increased import duties on completely built up (CBU) vehicles, and on 'completely knocked down' parts (CKD) in order to stimulate investment in their local auto parts production<sup>106</sup>. Apart from measures to promote foreign investment in auto part manufacturing facilities in Thailand, the government also issues 'local content requirements' which specifies the proportion of locally produced parts that must be included in assembled vehicles<sup>107</sup>. The auto part manufacturing sector has resultantly seen continuous investment, including from large international manufacturers, and the sector is now completely capable of meeting domestic demand for auto parts for both OEMs and REMs<sup>108</sup>.

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<sup>102</sup> Thailand Industry Outlook 2017-2019. (October 2017). Auto parts Industry. Retrieved [https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO\\_Auto\\_Parts\\_2017\\_EN.aspx](https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO_Auto_Parts_2017_EN.aspx)

<sup>103</sup> Thailand Automotive Institute. (December 2012). Master Plan for Automotive Industry 2012-2016. Retrieved [http://www.thaiauto.or.th/2012/backoffice/file\\_upload/research/11125561430391.pdf](http://www.thaiauto.or.th/2012/backoffice/file_upload/research/11125561430391.pdf), Para 4.4.

<sup>104</sup> Rastogi, V. (10 May 2018). Thailand's Automotive Industry: Opportunities and Incentives. ASEAN Briefing. Retrieved <https://www.aseanbriefing.com/news/2018/05/10/thailands-automotive-industry-opportunities-incentives.html>.

<sup>105</sup> Thailand Automotive Institute. (December 2012). Master Plan for Automotive Industry 2012-2016. Retrieved [http://www.thaiauto.or.th/2012/backoffice/file\\_upload/research/11125561430391.pdf](http://www.thaiauto.or.th/2012/backoffice/file_upload/research/11125561430391.pdf), Para 4.4.

<sup>106</sup> Thailand Industry Outlook 2017-2019. (October 2017). Auto parts Industry. Retrieved [https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO\\_Auto\\_Parts\\_2017\\_EN.aspx](https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO_Auto_Parts_2017_EN.aspx)

<sup>107</sup> Thailand Industry Outlook 2017-2019. (October 2017). Auto parts Industry. Retrieved [https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO\\_Auto\\_Parts\\_2017\\_EN.aspx](https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO_Auto_Parts_2017_EN.aspx)

<sup>108</sup> Thailand Industry Outlook 2017-2019. (October 2017). Auto parts Industry. Retrieved [https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO\\_Auto\\_Parts\\_2017\\_EN.aspx](https://www.krungsri.com/bank/getmedia/a9819388-356d-464d-9533-b54e904b3e57/IO_Auto_Parts_2017_EN.aspx)

**Thailand has embarked on an ambitious programme known as Thailand 4.0 to accelerate the Kingdom's development to a more technologically advanced economy.**<sup>109</sup> The programme is designed to promote and support innovation, creativity, research and development, adoption of higher technologies and green technologies<sup>110</sup>. The initial emphasis of the program is on upgrading five existing business clusters: the next generation of automobiles, smart electronics, medical and wellness tourism, agriculture and biotechnology, and agriculture. Thailand, in particular, is becoming a global hub for robotics in industry, ranking eighth in the world for annual consumption of industrial robots.<sup>111</sup> **Ultimately, these upgraded clusters are expected to evolve into five new industries: robotics, aviation and logistics, biofuel and biochemical, digital technology, and medical technology**<sup>112</sup>.

Upgrading workforce skills is a significant portion of the policy, in support of Thailand 4.0. It is divided into three areas:

1. enhancing the quality of secondary education;
2. promoting the study of science, technology, engineering, and mathematics in higher education institutions; and
3. forging stronger collaboration between educational institutions and the private sector.

The skills challenge in Thailand is smaller than most other economies in the region (with the exception of Indonesia), due to expectations of a more limited environment for automation and digitalisation<sup>113</sup>. **Further, new job opportunities are skewed further towards manufacturing, heavy industry, and transport, making the skills transition less severe than for other labour markets that are shifting more predominantly into service sectors**<sup>114</sup>.

Nevertheless, there is an urgent need for upskilling in the current workforce, even given current levels of technology. Test results from the Programme for International Student Assessment, 2015 showed **more than 50% of Thailand's 15-year-old students do not have**

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<sup>109</sup> Royal Thai Embassy in D.C. National Strategy Thailand 4.0 officially launched. Retrieved <http://thaiembdc.org/2018/10/22/national-strategy-thailand-4-0-officially-launched/>

<sup>110</sup> Royal Thai Embassy in D.C. National Strategy Thailand 4.0 officially launched, available <http://thaiembdc.org/2018/10/22/national-strategy-thailand-4-0-officially-launched/>

<sup>111</sup> Chang, J., Rynhart, G., & Huyuh, P., (July 2016). *ASEAN in Transformation: Automotive and auto parts: Shifting Gears*. International Labour Organisation. Retrieved [http://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf)

<sup>112</sup> Asian Development Bank. (April 2018). *Asian Development Outlook 2018: How technology affects jobs*. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>.

<sup>113</sup> Oxford Economics & Cisco. (Sept 2018). *Technology and the future of ASEAN Jobs*. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>.

<sup>114</sup> Oxford Economics & Cisco. (Sept 2018). *Technology and the future of ASEAN Jobs*. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 5.2.

**basic reading skills or proficiency in mathematics, and 47% lack basic scientific knowledge.**<sup>115</sup>

Enhancing the quality of secondary education is crucial to ensure that students possess the basic skills necessary to succeed in tertiary education. Further, universities are not producing enough graduates in science, technology, engineering, and mathematics. Less than 20% of tertiary students are enrolled in science or engineering<sup>116</sup>.

Steps taken by the Thai government to enhance their education and skilling ecosystem includes **increased cooperation between local educational institutions and foreign universities by setting up the Eastern Economic Corridor (EEC) to foreign educational institutions.** Carnegie Mellon University, for example, is collaborating with King Mongkut's Institute of Technology Ladkrabang to expand research and education in new digital technologies<sup>117</sup>. The Thai government has also offered tax incentives to foreign executives and specialists in companies situated in the EEC and provided incentives to skilled non-resident Thai workers to join their workforce to fill existing skills gaps<sup>118</sup>.

## Indonesia

Indonesia is the second largest manufacturing of motor vehicles after Thailand in the ASEAN region, manufacturing 1,216,615 vehicles in 2017<sup>119</sup>. The percentage of increase in the units of motor vehicles manufactured for Indonesia was 3.30% in 2017 while it was 2.28% for Thailand<sup>120</sup>.

The success of the automotive industry in the country has been a consequence of a range of factors, including low interest rates, relatively easy access to credit, and abundant assembly of low-cost models locally<sup>121</sup>. As of 2017, Indonesia's production capacity stands at 2.2 million

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<sup>115</sup> Asian Development Bank. (April 2018). Asian Development Outlook 2018: How technology affects jobs. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>. Fig 3.30.10

<sup>116</sup> Asian Development Bank. (April 2018). Asian Development Outlook 2018: How technology affects jobs. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>. Fig 3.30.11

<sup>117</sup> Carnegie Mellon University news. (28 November 2017). CMU and KMITL announce research and education collaboration. Retrieved <https://www.cmu.edu/news/stories/archives/2017/november/thailand-collaboration.html>

<sup>118</sup> Asian Development Bank. (April 2018). Asian Development Outlook 2018: How technology affects jobs. Retrieved <https://www.adb.org/sites/default/files/publication/411666/ado2018.pdf>.

<sup>119</sup> International Organization of Motor Vehicles Manufacturers. Country Statistics. Retrieved <http://www.oica.net/category/production-statistics/2018-statistics/>.

<sup>120</sup> International Organization of Motor Vehicles Manufacturers. Country Statistics. Retrieved <http://www.oica.net/category/production-statistics/2018-statistics/>.

<sup>121</sup> Nag. B., Banerjee. S., Chaterjee. R. (July 2007). Changing Features of the Automobile Industry in Asia: Comparison of Production, Trade and Market Structure in Selected Countries. Retrieved <https://www.unescap.org/sites/default/files/AWP%20No.%2037.pdf>.



units a year, driven primarily by foreign investment from Japanese manufacturers<sup>122</sup>. While other investors have also entered the market due to low cost labour and an expanding domestic market, it remains dominated by Japanese companies. **The automobile sector is a key pillar of the economy, with investments of more than US\$7 billion, and employment for over 300,000 workers**<sup>123</sup>. The industry is expected to receive a boost from the expansion of a domestic market as vehicle ownership per capita remains low<sup>124</sup> despite a growing population and rising middle class, indicating a strong consumer base for the industry<sup>125</sup>.

The manufacturing sector is a key employer with over 25 million workers, and a key contributor to the country's GDP at 20 percent in 2017, leading the government to create strategies to boost its growth, including a roadmap for the transition to Industry 4.0<sup>126</sup>. The roadmap aims to ease production for small and medium enterprises, increase foreign investment, strengthen the quality of human resources, as well as the national digital infrastructure<sup>127</sup>.

**Major drivers for Industry 4.0 implementation in Indonesia have been identified as: a growing domestic market, state-led investment in national infrastructure, and an increasing demand for electric vehicles.**<sup>128</sup> Conversely, low productivity in the sector compared to other economies in the region, high costs of logistics and production time, and high dependence on import due to inadequate domestic production of value-adding components have been identified as major challenges to Industry 4.0<sup>129</sup>.

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<sup>122</sup> Indonesia Investments. (2 April 2018). Automotive Manufacturing Industry Indonesia. Retrieved <https://www.indonesia-investments.com/business/industries-sectors/automotive-industry/item6047>.

<sup>123</sup> Nag. B., Banerjee. S., Chaterjee. R. (July 2007). Changing Features of the Automobile Industry in Asia: Comparison of Production, Trade and Market Structure in Selected Countries. Retrieved <https://www.unescap.org/sites/default/files/AWP%20No.%2037.pdf>.

<sup>124</sup> Indonesia Investments. (2 April 2018). Automotive Manufacturing Industry Indonesia. Retrieved <https://www.indonesia-investments.com/business/industries-sectors/automotive-industry/item6047>.

<sup>125</sup> Indonesia Investments. (2 April 2018). Automotive Manufacturing Industry Indonesia. Retrieved <https://www.indonesia-investments.com/business/industries-sectors/automotive-industry/item6047>.

<sup>126</sup> Business Sweden. Industry 4.0 in Indonesia. Retrieved <https://www.business-sweden.se/globalassets/indonesia-industry-4.0.pdf>.

<sup>127</sup> Business Sweden. Industry 4.0 in Indonesia. Retrieved <https://www.business-sweden.se/globalassets/indonesia-industry-4.0.pdf>.

<sup>128</sup> Business Sweden. Industry 4.0 in Indonesia. Retrieved <https://www.business-sweden.se/globalassets/indonesia-industry-4.0.pdf>.

<sup>129</sup> Business Sweden. Industry 4.0 in Indonesia. Retrieved <https://www.business-sweden.se/globalassets/indonesia-industry-4.0.pdf>.

Technological upgradation is expected to create over 5 million jobs<sup>130</sup> in the country, while displacing 9.5 million workers between 2018 and 2028<sup>131</sup>. The McKinsey Global Institute projects that skill demand in technical tasks will increase by 55 percent by 2030<sup>132</sup>. However, the skill gap is expected to be narrower than other countries in the region, with lower job growth in highly-skilled IT and professional roles than other countries and greater growth in manufacturing and heavy industry - as is the case with Thailand<sup>133</sup>. Accordingly, the impact on job displacement in Indonesia is expected to be small as a share of the total workforce, although the absolute number displaced is expected to be very high<sup>134</sup>.

Infrastructural impediments to digitalisation and automation are also expected to contribute to a narrower skills gap in the short term. **The infrastructural challenge is compounded by the size and geographical complexity of the country.** For instance, international bandwidth, which is an important consideration for planning Indonesia's digital future, is crucially determined by geographical variation and the urban-rural divide. **Connectivity in the country is limited, with most lines going through Singapore, and 40 percent of the landing points located in just three cities i.e. Batam, Dumai and Jakarta**<sup>135</sup>. Other impediments include high barriers to entry, and uncertainty and inconsistency among consumers and service providers regarding regulations. Finally, the abundance of cheap labour is also a major factor in cost efficiency of technological upgradation<sup>136</sup>.

## Malaysia

Malaysia's approach to automobile manufacturing has been protectionist and inward-looking, to the extent of being labelled "Malaysian automobile nationalism"<sup>137</sup>. It has thus been recommended that Malaysia moves towards the penetration of less competitive

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<sup>130</sup> Kuikka. S. (11 October 2018). Preparing the workforce for industry 4.0. Retrieved <https://www.thejakartapost.com/academia/2018/10/11/preparing-the-workforce-for-industry-4-0.html>.

<sup>131</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Fig 4.

<sup>132</sup> Kuikka. S. (11 October 2018). Preparing the workforce for industry 4.0. Retrieved <https://www.thejakartapost.com/academia/2018/10/11/preparing-the-workforce-for-industry-4-0.html>.

<sup>133</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 5.2.

<sup>134</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 2.1.

<sup>135</sup> McKinsey & Co.(October 2016). Unlocking Indonesia's digital opportunity. Retrieved [https://www.mckinsey.com/-/media/McKinsey/Locations/Asia/Indonesia/Our%20Insights/Unlocking%20Indonesias%20digital%20opportunity/Unlocking\\_Indonesias\\_digital\\_opportunity.ashx](https://www.mckinsey.com/-/media/McKinsey/Locations/Asia/Indonesia/Our%20Insights/Unlocking%20Indonesias%20digital%20opportunity/Unlocking_Indonesias_digital_opportunity.ashx).

<sup>136</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 2.1.

<sup>137</sup> Wad. P. (2009) The automobile industry of Southeast Asia: Malaysia and Thailand. *Journal of Asia Pacific Economy* 14(2), p.172-193.

markets or the re-linking of the industry with multinational companies.<sup>138</sup> Therefore, while traditionally the Malaysian automotive industry comprised of local manufacturers like Proton and Perodua, global companies like Toyota, Nissan, Honda, Mercedes-Benz, BMW have been operating and expanding their businesses over the recent past.<sup>139</sup> As of 2017, the total production of motor vehicles was 460,140 units, which was 15.62 percent less than the previous years<sup>140</sup>, and employed 736,632 workers<sup>141</sup>. The automotive sector made a 4% contribution to the Malaysian GDP in 2017<sup>142</sup>.

The Malaysian Government identifies nine technologies driving the next industrial revolution - Autonomous Robots, Big Data Analytics, Cloud Computing, Internet of Things (IoT), Additive Manufacturing (3D Printing), System Integration, Cybersecurity and Augmented Reality Simulation.<sup>143</sup> **Recognising a need to enhance productivity to improve regional and global competency and generate employment, the government launched the National Policy on Industry 4.0, known as Industry4WRD in 2018<sup>144</sup>.** The policy aims to transform the manufacturing sector and related services with an emphasis on smart manufacturing and giving a push to high-technology industries<sup>145</sup>. The Malaysian Prime Minister, Dr. Mahathir Mohamad, has earlier asserted that the policy will work to buttress ongoing structural reforms in the economy, enhancing equitability, sustainability, and inclusivity<sup>146</sup>. **The policy focuses on SMEs, which comprise approximately 98.5 percent of enterprises in the manufacturing sector, providing 42 percent of employment,<sup>147</sup> and are estimated to contribute 41% to the GDP by 2020<sup>148</sup>.** Steps to support SMEs include increased funding

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<sup>138</sup> Wad. P. (2009) The automobile industry of Southeast Asia: Malaysia and Thailand. Journal of Asia Pacific Economy 14(2), p. 172-193.

<sup>139</sup> Gotfredsen. S. (15 March 2018). Bringing Cobots to the automotive sector. Retrieved <http://www.theedgemarkets.com/article/my-say-bringing-cobots-automotive-sector>.

<sup>140</sup> International Organization of Motor Vehicles Manufacturers. Country Statistics. Retrieved <http://www.oica.net/category/production-statistics/2018-statistics/>.

<sup>141</sup> Malaysian automotive robotics and IoT Institute. The contribution of the automotive industry. Retrieved <http://mai.org.my/the-automotive-industry/>.

<sup>142</sup> International Organization of Motor Vehicles Manufacturers. Country Statistics. Retrieved <http://www.oica.net/category/production-statistics/2018-statistics/>.

<sup>143</sup> Ministry of International Trade and Industry. Industry 4.0. Retrieved [www.miti.gov.my/index.php/pages/view/industry4.0?mid=559](http://www.miti.gov.my/index.php/pages/view/industry4.0?mid=559).

<sup>144</sup> Wad. P. (2009) The automobile industry of Southeast Asia: Malaysia and Thailand. Journal of Asia Pacific Economy 14(2), p.172-193.

<sup>145</sup> Gnanasagran. A. (1 November 2018). Malaysia Launches Industry 4.0 Policy. Retrieved <https://theaseanpost.com/article/malaysia-launches-industry-40-policy>.

<sup>146</sup> Gnanasagran. A. (1 November 2018). Malaysia Launches Industry 4.0 Policy. Retrieved <https://theaseanpost.com/article/malaysia-launches-industry-40-policy>.

<sup>147</sup> Gnanasagran. A. (1 November 2018). Malaysia Launches Industry 4.0 Policy. Retrieved <https://theaseanpost.com/article/malaysia-launches-industry-40-policy>.

<sup>148</sup> Malaysia Budget. (2018). Retrieved <http://www.treasury.gov.my/pdf/budget/speech/bs18.pdf>.

support, creation of infrastructure for digital uptake, supportive regulatory frameworks, and skilling initiatives in the labour force<sup>149</sup>.

Companies such as Universal Robots are strengthening their presence in Malaysia due to a rising industrial demand for robotics backed by governmental support.<sup>150</sup>

**Malaysia is predicted to experience the displacement of 1.2 million workers between 2018 and 2028 stemming from low skill levels in a digitising economy, which is high in absolute numbers although not a large share of the labour force<sup>151</sup>.** 250,000 existing roles will disappear, pushing workers into industries and occupations with increasing employment, such as the wholesale & retail sector<sup>152</sup>. These will be largely managerial and decision-making roles with non-repetitive tasks with a requirement of complex “softer” skill sets such as customer services and negotiation<sup>153</sup>. The inadequacy of such skills in the workforce is expected to lead to a mismatch in demand and supply. It is then expected that the Malaysian government will have to respond by investing in skill development, especially at advanced levels. This has historically been a challenge in the skill development initiatives taken by the government, which have included the introduction of a skill certification system, increasing technical schools, and providing tax incentives to companies for undertaking skill development<sup>154</sup>.

## Singapore

**Singapore has an exceptionally enabling environment for innovation and digital transformation, supported by factors such as adequate infrastructure and a concerted sovereign approach, giving it a significant advantage over other countries in the region in its potential to transition to Industry 4.0.<sup>155</sup>** A number of multinational firms have equipped their facilities in Singapore with new technological capabilities due to its pool of engineering skills and expertise in high-tech manufacturing. Initiatives in manufacturing include: gathering and analysing data for predictive maintenance, and/or ensuring cheaper and more

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<sup>149</sup> Gnanasagran. A. (1 November 2018). Malaysia Launches Industry 4.0 Policy. Retrieved <https://theaseanpost.com/article/malaysia-launches-industry-40-policy>.

<sup>150</sup> Universal Robots strengthens its partner network in Malaysia. Retrieved <https://www.universal-robots.com/about-universal-robots/news-centre/universal-robots-strengthens-its-partner-network-in-malaysia/>.

<sup>151</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Fig 4.

<sup>152</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>.

<sup>153</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 5.2.

<sup>154</sup> Sadoi. Y. (1998). Skill Formation in Malaysia: The Case of Auto Parts Industry. *Southeast Asian Studies*, 36(3).

<sup>155</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 2.1.

environment-friendly products<sup>156</sup>, electric car plants<sup>157</sup>, and conversion of manufacturing units into smart factories<sup>158</sup>. Another increasingly relevant stakeholder is consultancies such as Siemens ZerOne.Design™, which designs digital factories for companies by assessing the current state of their facilities and developing a strategy for digitising their factories<sup>159</sup>.

The government has been playing a key role in supporting this transformation. International Enterprise Singapore is the statutory board under the Ministry of Trade and Industry of the Singapore Government which helps manufacturers work towards the gradual adoption of Industry 4.0 in their global expansion process. They assist companies in identifying demand for production domestically and overseas, as well as manufacturers of technology that could be potential co-partners for overseas operations<sup>160</sup>. **The government has also been investing in R&D projects, developing industry transformation maps and strengthening the workforce's skill sets to enable a more seamless transition to Industry 4.0.**<sup>161</sup>

**Launched in 2017, the Singapore Smart Industry Readiness Index is one of the first Industry 4.0 tools, developed by the Singapore Economic Development Board (EDB) to categorise and support the transition of the economy to Industry 4.0.** Companies across industries and sizes will be mapped, and the state of infrastructure in each evaluated, to contextualise Industry 4.0 in the economy and offer a roadmap to enhance productivity cost efficiency through transformation<sup>162</sup>. The Index derives from the Reference Architectural Model for Industry 4.0 framework, and has been evaluated by an advisory panel of academic and industry experts.<sup>163</sup>

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<sup>156</sup> Industry 4.0 and Singapore manufacturing. Retrieved <https://www.gov.sg/microsites/future-economy/press-room/news/content/industry-4-0-and-singapore-manufacturing>.

<sup>157</sup> Financial Times. (October 2018). Singapore beats UK for Dyson's lurch from vacuum to vehicles. Retrieved <https://www.ft.com/content/086bc9a2-d6d7-11e8-a854-33d6f82e62f8>.

<sup>158</sup> EDB Singapore. (18 Jan 2019). Factory forward: Advances manufacturing takes root in Singapore. Retrieved <https://www.edb.gov.sg/en/news-and-resources/insights/manufacturing/factory-forward-advanced-manufacturing-takes-root-in-singapore.html>

<sup>159</sup> EDB Singapore. (10 July 2017). Singapore's advanced manufacturing avatar "Industry 4.0". Retrieved <https://www.edb.gov.sg/en/news-and-resources/insights/manufacturing/singapores-advanced-manufacturing-avatar--industry-4-0.html>.

<sup>160</sup> Enterprise Singapore, <https://ie.enterprisesg.gov.sg/Venture-Overseas/Browse-By-Sector/Technology-Business/Manufacturing/Industry-4-0/Support-from-IE-Singapore>.

<sup>161</sup> EDB Singapore. (10 July 2017). Singapore's advanced manufacturing avatar "Industry 4.0". Retrieved <https://www.edb.gov.sg/en/news-and-resources/insights/manufacturing/singapores-advanced-manufacturing-avatar--industry-4-0.html>.

<sup>162</sup> EDB Singapore (22 March 2018). The Singapore Smart Industry Readiness Index. Retrieved <https://www.edb.gov.sg/en/news-and-resources/news/advanced-manufacturing-release.html>.

<sup>163</sup> EDB Singapore. (13 Nov 2017). Launch of the Singapore Smart Industry Index. Retrieved <https://www.edb.gov.sg/en/news-and-events/news/launch-of-singapore-smart-industry-readiness-index.html>.

The labour market in Singapore is predicted to experience the implications of technological disruption at a large scale within the next ten years<sup>164</sup>. This is due to the rapid pace of digital transformation, including IoT and automotive robotics investment, leading to a higher percentage of displacement of production workers and labourers in Singapore than other parts of the region over the next decade.<sup>165</sup> It will experience the displacement of 0.5 million workers between 2018 and 2028, which is smaller in absolute numbers but is the largest percentage wise in the region, with almost 21 percent of its full time equivalent workers affected<sup>166</sup>. 22.1 percent of the workforce is predicted to be displaced in the manufacturing sector itself, while new jobs will be created for 28.2 percent of the overall workforce - implying the biggest skills challenge in Singapore as compared with others in the region<sup>167</sup>. This is expected to create a larger supply-demand gap in skills in the workforce in Singapore than in other economies due to growth in highly skilled roles.<sup>168</sup>

## Concluding Remarks

### Skilling challenges will be endemically navigated

It can be seen that the automotive sector is a key driver of growth and employment in countries within the ASEAN region at varying levels of income. Governments and corporations alike, across the region, are then forced to respond to changes in technology globally to remain competitive, while also responding to the need to produce employment for a workforce at different levels of skill. The levels of infrastructural and skill development will be crucial factors in determining the impact of Industry 4.0 in each country. Thus while countries such as Thailand and Indonesia are in need of reskilling to meet existing demands within the sector even at lower rates of technological adoption, a large skill challenge in Singapore is expected to be caused by more rapid technological disruption in the immediate future.

Accordingly, each of the policy frameworks around Industry 4.0 proposed by ASEAN countries has a significant component of skill development. Thailand in particular, has proposed a

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<sup>164</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>.

<sup>165</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 5.2.

<sup>166</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Fig 4.

<sup>167</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>.

<sup>168</sup> Oxford Economics & Cisco. (Sept 2018). Technology and the future of ASEAN Jobs. Retrieved <https://www.oxfordeconomics.com/recent-releases/dd577680-7297-4677-aa8f-450da197e132>. Para 5.2.

complete overhaul of their education system. The efficacy of these initiatives in preparing the workforce for Industry 4.0 would then need to be assessed through future research, as well as their applicability to other contexts facing similar skill challenges. Apart from supporting research to assess and support ongoing skilling initiatives in countries facing immediate skilling challenges such as Singapore, this could also preempt responses of countries that are expected to face a skilling challenge in the mid to long term.

### **The relative costs of technology and labour remain key**

Drivers of and challenges to adoption of technology are also found to be similar yet contextual to each country. Improving productivity and cost competitiveness are primary factors propelling adoption of Industry 4.0, but could be tempered by the abundance of low cost labour - as is the case with Indonesia and India. At the same time, these countries face an equal impetus to increase productivity, especially in higher value products, as other investors become less reliant on low labour costs. Growth in the ASEAN region is also being driven by a growing domestic market for automobiles, which could then give a boost to the industry and lead to a faster transition to Industry 4.0.

Even so, the supply chain of the automotive industry across most countries under consideration remains dominated by smaller manufacturing units, which are unable to afford the heavy initial costs required by automotive or other Industry 4.0 technologies. This has generated policy responses focusing on enhancing productivity through increased investment public infrastructure and access to financing for SMEs, such as in Indonesia.

### **Policy responses need to be custom fitted**

Policy responses will then need to respond to the approach taken by the industry to increase cost competitiveness. As per our findings, this could include strategies such as adopting Industry 4.0 technology, outsourcing tasks to companies further down the supply chain with lower labour costs, and increasing work intensity while keeping labour costs constant. Policy responses would thus need to respond to infrastructural and financial needs of the industry as well as protect workers and ensure decent conditions of work.

## **IT/IT-eS Sector**

### **Regional overview**

The ASEAN region represents a portion of the global population of digital users significant enough to take it to levels comparable to other leading global markets (US, EU, China). This growth has primarily been enabled through the expansion of technological infrastructures that support Internet and mobile connections in the region.<sup>169</sup> Connected to the development of ICT, and Industry 4.0, Southeast Asia appears to be the world's fastest growing internet region, with an existing internet user base of 260 million, projected to grow to 480 million users by 2020. The region's internet economy is predicted to grow to \$200B by 2025 driven mostly by the growth of online travel, e-commerce, and online media.<sup>170</sup>

Southeast Asia's internet economy has also consistently exceeded expectations. Google's reports for the region during 2016 and 2017 estimated a \$200 billion internet economy in the region by 2025. However, the 2018 report had to revise this estimate to reflect the region's accelerating growth surpassing this estimate prematurely. With about six years left to go, ASEAN is already more than a third of the way to the target and technology companies in the region have already raised half of the \$40-\$50 billion in funds they were expected to attract. The latest report by Google and Temasek now projects a \$240 billion Southeast Asian internet economy by 2025.<sup>171</sup>

**Nearly 37% of ASEAN companies are firming up their AI strategies with adoption plans in place over the next five years.** Top use cases in the region include algorithmic market forecasting (17%), and automated asset and infrastructure management (11%). Improved business insight has become the most important driver behind the use of the technology, according to more than half (52%) of companies. Other key drivers include enhanced process automation (51%) and improved productivity (42 percent). Indonesia is in the vanguard of ASEAN AI strategy, says IDC, with 24.6% of organisations adopting the technology, followed by Thailand (17.1%), Singapore (9.9%), and Malaysia (8.1%). However, while Indonesia has the highest adoption rates, it also has the highest percentage of organisations with no plans to deploy AI over the next five years (59 percent). Overall, lack of skills and knowledge (23 percent) and the high cost of solutions (23 percent) are among the biggest barriers to adoption in the region.<sup>172</sup>

In the ASEAN region, IoT spending was expected to reach US\$1.68 billion in 2015, and present estimates for 2020 have seen a 35% growth in value to reach US\$7.53 billion. Due to lower initial IoT spending, the rate of uptake in the ASEAN countries is expected to be among the

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<sup>169</sup> ASEAN UP (2018). Retrieved <<https://aseanup.com>>

<sup>170</sup> Anandan R., and ors., (December 2017). e-Conomy Southeast Asia Spotlight. Retrieved <<https://www.thinkwithgoogle.com/intl/en-apac/tools-resources/research-studies/e-conomy-sea-spotlight-2017-unprecedented-growth-southeast-asia-50-billion-internet-economy/>>

<sup>171</sup> Anandan R., Sipahimalani R., (19 November 2018). Southeast Asia's accelerating internet economy. Retrieved <<https://www.blog.google/around-the-globe/google-asia/economysea-2018/>>

<sup>172</sup> Millman R., (July 16 2018). Adoption of AI booming in SE Asia, says IDC. Retrieved <<https://internetofbusiness.com/adoption-of-ai-booming-in-se-asia-says-idc/>>



highest in the Southeast Asian region (contrastingly, the largest markets are predicted to be the more mature IT markets in countries like Japan, China, India and the Republic of Korea).<sup>173</sup>

Research by HfS Research, in what it terms the “HfS Future Workforce Impact Model”, categorised the workforce in the IT and BPO sector on the basis of skill levels - low skilled, medium skilled and high skilled - to then ascertain the impact on automation on jobs.<sup>174</sup> They categorise “*low skilled workers as conducting simple entry level, process driven tasks that require little abstract thinking or autonomy and higher skilled workers as undertaking complicated tasks that require experience, expertise, abstract thinking and autonomy.*”<sup>175</sup> Their findings indicate that 640,000 low-skilled service jobs in the IT sector are at risk of automation while only 160,000 mid to high-skilled positions will be created in the Indian IT and BPO service sector. Out of all the main countries offering IT services (i.e. the Philippines, the US, the UK, and India) India is expected to suffer the greatest negative impact with a 14 per cent decline in the workforce by 2021.<sup>176</sup>

## Granulating at the level of countries

### Singapore

The maturing of demand for Industry 4.0 technologies

The potential of the Internet of Things, and enabled technologies was recognised and explored in the region from as early as 2016. While some have only begun with the technology and testing, other countries such as Singapore have taken a leading position, setting up dedicated innovation labs and rolling out pilot projects.

IoT and enabled technologies play a very important role for Singapore, to realise its vision of a Smart Nation. In this regard, Singapore chose the US IoT Networking Solutions company, Silver Spring Networks as partner.<sup>177</sup> The partnership involves deployment of IoT platforms for Smart Utility and Smart Nation Applications, to implement a “country-wide smart grid

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<sup>173</sup> Millman R., (July 16 2018). Adoption of AI booming in SE Asia, says IDC. Retrieved <<https://internetofbusiness.com/adoption-of-ai-booming-in-se-asia-says-idc/>>

<sup>174</sup> Fersht P., and ors., (July 4 2016). Automation Will Trim 1.4 Million Global Services Jobs By 2021. Retrieved <<https://www.hfsresearch.com/pointsofview/automation-will-trim-14-million-global-services-jobs-2021>>

<sup>175</sup> Fersht P., and ors., (July 4 2016). Automation Will Trim 1.4 Million Global Services Jobs By 2021. Retrieved <<https://www.hfsresearch.com/pointsofview/automation-will-trim-14-million-global-services-jobs-2021>>

<sup>176</sup> Fersht P., and ors., (July 4 2016). Automation Will Trim 1.4 Million Global Services Jobs By 2021. Retrieved <<https://www.hfsresearch.com/pointsofview/automation-will-trim-14-million-global-services-jobs-2021>>

<sup>177</sup> Connected World Press Release, (November 3 2016). Retrieved <<https://connectedworld.com/silver-spring-networks-extends-collaboration-with-singapore-power-to-deploy-iiot-platform-for-additional-smart-utility-and-smart-nation-applications/>>

platform, enabling SP to deliver greater value to Singapore consumers – with more choice and the ability to better manage their energy usage,” according to Lawrence Lee, head of operations and projects at Singapore Power Services.<sup>178</sup> Additionally, GovTech, a government agency created to lead the digital transformation of Singapore’s public sector, is developing technical expertise and engineering specialists in a center focusing on sensors and the IoT.<sup>179</sup>

This center intends to examine the design and deployment of government-wide IoT infrastructure across the nation. The new infrastructure will enable connectivity by smart objects such as wearables, sensors and mobile devices, and facilitate high-speed transmission of data from the sensors. The center will also build up the government’s capabilities in new, emerging IoT technology and collaborate with commercial organizations, research institutes and public agencies for pilot projects and experimentations.<sup>180</sup>

In what tantamounts to the recognition AI’s capacity to influence both business and social settings, countries in the ASEAN region have seen the publication of a diverse range of AI-related research papers and patents in recent years. Subject matters include not just computer algorithms, but also semiconductors, robotics, medicine, and biochemistry, thus highlighting the versatility of AI and its potential applications to impact everyday lives. Studies indicate an overall increase in the number of AI-specific patents published in Southeast Asia during the past 20 years, with consistent growth since 2013. By country, Singapore remains at the lead in the region, accounting for 77% of Southeast Asia’s total patent publications. Established brands, Johnson & Johnson, Applied Materials and So bank Robotics are at the forefront of the sector, dominating published patents in the country.<sup>181</sup>

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<sup>178</sup> Connected World Press Release, (November 3 2016). Retrieved

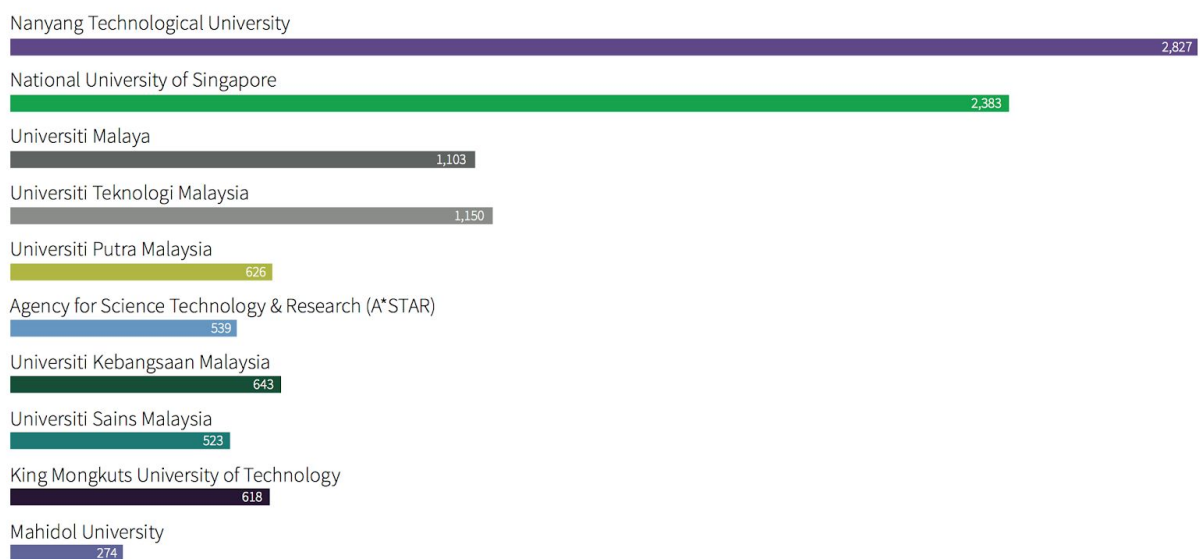
<<https://connectedworld.com/silver-spring-networks-extends-collaboration-with-singapore-power-to-deploy-iot-platform-for-additional-smart-utility-and-smart-nation-applications/>>

<sup>179</sup> Tan J., Computer Weekly (December 7 2016) Internet of things gains momentum in Southeast Asia. Retrieved <<https://www.computerweekly.com/news/450404190/Internet-of-things-gains-momentum-in-Southeast-Asia>>

<sup>180</sup> Fintechnews Singapore, (May 31 2017) How Southeast Asian Governments Are Pushing IoT Development. Retrieved <<http://fintechnews.sg/9677/iot/southeast-asian-governments-pushing-iot-development/>>

<sup>181</sup> Mattei F. and ors., (August 7 2019) Patenting Artificial Intelligence In China And South-East Asia. Retrieved <<https://www.rouse.com/magazine/news/patenting-artificial-intelligence-in-china-and-south-east-asia/>>

### AI-related Research Papers Published by Top 10 Southeast Asian Universities



Number of AI-related papers published by top 10 Southeast Asian universities from 2007 to 2016. The universities are sorted according to the number of citations they received in this period.

Source: *InCites Benchmarking & Analytics* by *Clarivate Analytics*

Image 1: AI-related Research Papers Published by Top 10 Southeast Asian Universities

### Implications for the IT services sector

The IT sector in Singapore is one of the key growth drivers of the Singapore economy, contributing over 20% to Singapore's GDP.<sup>182</sup> The IT sector within the country is understood very broadly, with several sub-sectors incorporating the range of IT based offerings from hardware manufacturing to services.<sup>183</sup> As a result, the incorporation of technologies associated with Industry 4.0 have been at the forefront of thinking across several domains including the public and private sectors as well as academia. This is how the demand for these technologies is being fostered and this stands to have implications for those engaged in the IT services sector in Singapore. This demand is sought to be met internally and is reflected in the distinct narrative around the future of work when compared to other countries within the ASEAN region.

<sup>182</sup> Occasional Paper On Economic Statistics The Information And Communication Technology Sector In The Singapore Economy. Retrieved <<https://www.singstat.gov.sg/-/media/files/publications/economy/op-e11.pdf>>

<sup>183</sup> Occasional Paper On Economic Statistics The Information And Communication Technology Sector In The Singapore Economy. Retrieved <<https://www.singstat.gov.sg/-/media/files/publications/economy/op-e11.pdf>>

The Industry 4.0 narrative vis-a-vis the IT services sector in Singapore is premised around the newer job roles that will be generated in the sector.<sup>184</sup> For instance, a 2018 workforce survey conducted by Infocomm Media Development Authority (IMDA), a Singapore government agency, indicated has encouraging findings:

*“The number of infocomm professionals employed grew by 5.2% from 180,000 in 2016 to reach 189,400 in 2017. Together with 13,200 infocomm job vacancies, total demand of infocomm professionals increased by 2.2% to reach 202,600 in 2017. Enterprises have projected the demand for infocomm professionals to grow by another 28,500 in the next three years (2018 – 2020).”<sup>185</sup>*

The findings of the survey further focus on the categories of IT professions for who demand is anticipated to be felt. A key category is that of critical emerging tech specialists. These include the following: Data analysts/Data scientists, Machine Learning/Artificial Intelligence Engineer, IT Security specialists, IT Security Operations Analysts/Engineers, Infocomm R&D, Internet of Things (IoT) Engineer, Embedded Systems/Firmware Developers, IoT Solution Architect. The demand for these roles is visualised through the chart below:

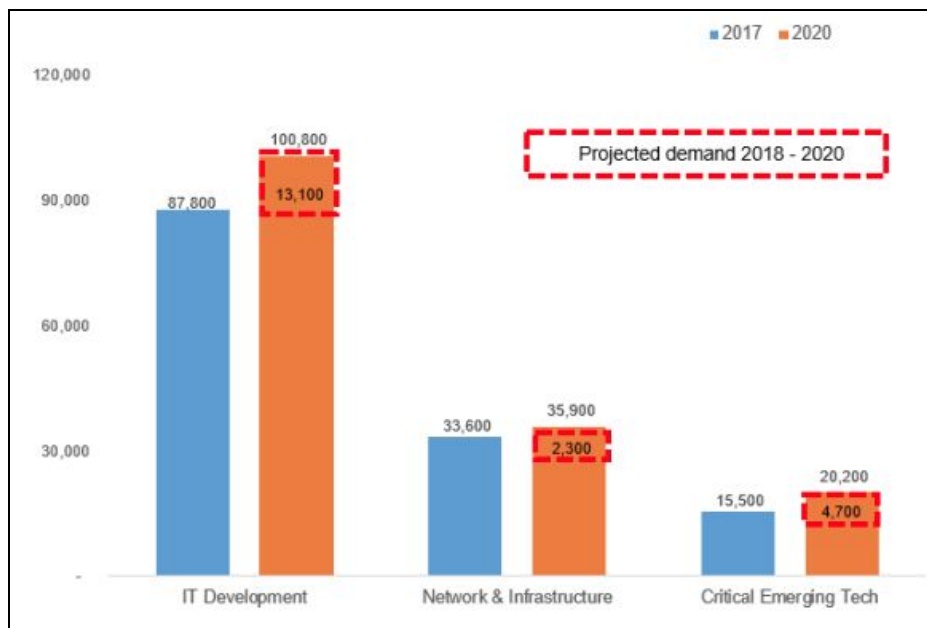


Image 2: Projected demand for IT professionals

<sup>184</sup> Chan T.J., South China Morning Post, (April 26 2018), What Industry 4.0 means to Singapore and why its workers must upskill and lose their sense of entitlement. Retrieved <<https://www.scmp.com/lifestyle/article/2143239/what-industry-40-means-singapore-and-why-its-workers-must-upskill-and-lose>>

<sup>185</sup> Infocomm Media Development Authority, (2018), Annual Survey On Infocomm Media Manpower 2018. Retrieved <<https://www2.imda.gov.sg/-/media/Imda/Files/Industry-Development/Fact-and-Figures/Infocomm-Survey-Reports/20190208-Infocomm-Media-Manpower-Survey-2018-Public-Report.pdf>>

Source: Infocomm Media Development Authority (IMDA) Survey, 2018

At the same time, concerted effort is being made to devise skilling mechanisms for the training and retraining of the IT workforce. There is an explicit acceptance of the crucial role IT professionals have played in the diffusion of IT based solutions across various industries in the country.<sup>186</sup> To continue leveraging the gains of ICT diffusion, a comprehensive skilling framework has been devised by government agencies jointly with industry associations, education institutions, training providers, organisations and unions.<sup>187</sup> The framework is designed to help individuals both in-service and potential entrants into IT roles, employers and training providers.<sup>188</sup> Within the 119 job roles that have been identified, the framework specifically identifies relevant skills in the emerging areas of artificial intelligence and data science, cybersecurity and the Internet of Things.<sup>189</sup> An array of incentives and subsidies are offered for the utilisation of this framework for each of the intended beneficiary categories (individuals, employers, training providers). These range from fellowships, monetary credit, placement programmes etc.<sup>190</sup>

## Viet Nam

Viet Nam has recorded numerous pledges and proposed initiatives to increase the level of preparedness to Industry 4.0. The Viet Nameese Prime Minister acknowledged the need for Viet Nam to adapt to Industry 4.0 by introducing a set of directives on May 5th, 2017.<sup>191</sup> The Ministry of Labour, Invalids and Social Affairs works on upskilling through training and education of workers, whereas the Ministry of Finance encourages investment into the telecommunications sector. Viet Nam's adoption of cloud computing has been analysed by

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<sup>186</sup> National Trade Union Congress, (2018), Insight Report Future Jobs, Skills & Training In Infocomm Technology Industry. Retrieved  
<<https://www.ntuc.org.sg/wps/wcm/connect/f1c0c037-814e-44a7-81a5-4ee45fab8794/FJST+Report+Future+Jobs%2C+Skills+%26+Training+in+the+Infocomm+Technology+Industry.pdf?MOD=AJPERES&CACHEID=f1c0c037-814e-44a7-81a5-4ee45fab8794>>

<sup>187</sup> Skillsfuture, Skills Framework For Infocomm Technology: What Is It? Retrieved  
<<https://www.skillsfuture.sg/skills-framework/ict#whatisit>>

<sup>188</sup> Infocomm Media Development Authority, Skills Framework for Infocomm Technology (ICT). Retrieved  
<<https://www.imda.gov.sg/imtalent/programmes/skills-framework-for-ict>>

<sup>189</sup> Skillsfuture, (November 15 2017), Skills Framework For Infocomm Technology: A Guide to Occupations and Skills. Retrieved  
[https://www.skillsfuture.sg/-/media/SkillsFuture/Initiatives/Files/SF-for-Infocomm-Technology/FINALFA\\_ICT\\_lo\\_wres.pdf?la=en](https://www.skillsfuture.sg/-/media/SkillsFuture/Initiatives/Files/SF-for-Infocomm-Technology/FINALFA_ICT_lo_wres.pdf?la=en)

<sup>190</sup> Skillsfuture, (November 15 2017), Skills Framework For Infocomm Technology: A Guide to Occupations and Skills. Retrieved  
[https://www.skillsfuture.sg/-/media/SkillsFuture/Initiatives/Files/SF-for-Infocomm-Technology/FINALFA\\_ICT\\_lo\\_wres.pdf?la=en](https://www.skillsfuture.sg/-/media/SkillsFuture/Initiatives/Files/SF-for-Infocomm-Technology/FINALFA_ICT_lo_wres.pdf?la=en)

<sup>191</sup> And D., (May 8 2017), Vietnam sets out plans for Industry 4.0. Retrieved  
<<http://vneconomictimes.com/article/vietnam-today/vietnam-sets-out-plans-for-industry-4-0>>

the Lee Kwan Yew School of Public Policy which states that 55% of state agencies have adopted cloud computing, while in the private sector 57% of private enterprises with less than 50 employees have.<sup>192</sup>

A recent survey found that Viet Nameese businesses believe the country should focus on business fields in which it has strong advantages in the 4.0 industrial revolution – IT (89.9 percent), tourism (45.7 percent), agriculture (44.9 percent), finance & banking (47 percent) and logistics (28.3 percent).<sup>193</sup>

In Viet Nam, the ‘4.0 industrial revolution’ is understood as automation at the highest possible level in production.<sup>194</sup> Estimates suggest that around 300 out of every 1,600 workers have lost jobs; the uptake of automation technologies is anticipated to be most in large firms and that’s where these job losses are being felt.<sup>195</sup> While smaller enterprises may not have the financial wherewithal for the implementation of disruptive emerging technology, they also do not have high worker demand.<sup>196</sup> However, this appears to be the case mostly in the legacy manufacturing sectors in Viet Nam and even then, the adoption of Industry 4.0 technologies is very low as per the most comprehensive study done across enterprises in Viet Nam by the UNDP.<sup>197</sup> Within the technologies seeing uptake, only cloud computing was seen to adopted by more than 10% of these enterprises.<sup>198</sup>

Viet Nam is an emerging powerhouse in the global IT and BPO outsourcing industry, and this may be why the impact of Industry 4.0 will be experienced differently. The latest data available on the workforce engaged in the industry indicates that there has been an increase in both the number of personnel engaged as well as the average salary:

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<sup>192</sup> VN Economic Times, (June 22 2017), Vietnam leads ASEAN in cloud computing spending growth. Retrieved <<https://english.vietnamnet.vn/fms/science-it/180758/vietnam-leads-asean-in-cloud-computing-spending-growth.html>>

<sup>193</sup> VN Economic Times, (September 29 2017), Vietnam feels impact of 4.0 industrial revolution. Retrieved <<https://english.vietnamnet.vn/fms/business/187132/vietnam-feels-impact-of-4-0-industrial-revolution.html>>

<sup>194</sup> VN Economic Times, (September 29 2017), Vietnam feels impact of 4.0 industrial revolution. Retrieved <<https://english.vietnamnet.vn/fms/business/187132/vietnam-feels-impact-of-4-0-industrial-revolution.html>>

<sup>195</sup> VN Economic Times, (September 29 2017), Vietnam feels impact of 4.0 industrial revolution. Retrieved <<https://english.vietnamnet.vn/fms/business/187132/vietnam-feels-impact-of-4-0-industrial-revolution.html>>

<sup>196</sup> VN Economic Times, (September 29 2017), Vietnam feels impact of 4.0 industrial revolution. Retrieved <<https://english.vietnamnet.vn/fms/business/187132/vietnam-feels-impact-of-4-0-industrial-revolution.html>>

<sup>197</sup> UNDP, (February 28 2019), Industry 4.0 Readiness of Industry Enterprises in Viet Nam. Retrieved <<http://www.vn.undp.org/content/vietnam/en/home/library/l40.html>>

<sup>198</sup> UNDP, (February 28 2019), Industry 4.0 Readiness of Industry Enterprises in Viet Nam. Retrieved <<http://www.vn.undp.org/content/vietnam/en/home/library/l40.html>>

Unit: Person

No.	Indicator	2015	2016 (Estimated)
4.1.1	Total number of employees	721,584	780,926
4.1.2	Number of employees in hardware, electronic industry	533,003	568,288
4.1.3	Number of employees in software industry	81,373	97,387
4.1.4	Number of employees in digital content industry	44,320	46,647
4.1.4	Number of employees in IT services (not including trade and distribution)	62,888	68,605

Image 3: Total number of employees in Viet Nam's IT industry  
Source: Viet Nam Information and Communication White Book, 2017<sup>199</sup>

Unit: USD/person/year

No.	Indicator	2015	2016 (Estimate)
4.2.1	Average of salary per employee in hardware, electronic industry	2,859	3,866
4.2.2	Average of salary per employee in software industry	6,215	6,849
4.2.3	Average of salary per employee in digital content industry	6,120	6,189
4.2.3	Average of salary per employee in IT services (not including trade and distribution)	5,376	5,609

Image 4: Average salary per employee in Viet Nam's IT industry  
Source: Viet Nam Information and Communication White Book, 2017<sup>200</sup>

Specifically, Viet Nam's BPO sector is also emerging at a time when existing "low-cost countries are losing jobs due to increased automation in the sector and that new, more highly skilled jobs are being created in certain countries to manage the demands from automation."<sup>201</sup> posing threats to countries like India.<sup>202</sup> This is being facilitated by rising education levels, an increased focus on English proficiency and deeply contextual factors

<sup>199</sup> Ministry of Information and Communication, White Book of Viet Nam Information and Communication Technology 2017. Retrieved

<<https://english.mic.gov.vn/Upload/ENGLISH/Statistics/ICT-WHITEBOOK2017-Final.pdf>>

<sup>200</sup> Ministry of Information and Communication, White Book of Viet Nam Information and Communication Technology 2017. Retrieved

<<https://english.mic.gov.vn/Upload/ENGLISH/Statistics/ICT-WHITEBOOK2017-Final.pdf>>

<sup>201</sup> Sethi A. and ors., AT Kearney, (2019) Digital Resonance: The New Factor Impacting Location Attractiveness. Retrieved <<https://www.atkearney.com/digital-transformation/gsl/2019-full-report>>

<sup>202</sup> Frazzetto A., Forbes (May 29 2018) IT Outsourcing Hotspot: Vietnam, A Small But Mighty Powerhouse. Retrieved <<https://www.forbes.com/sites/forbestechcouncil/2018/05/29/it-outsourcing-hotspot-vietnam-a-small-but-mighty-powerhouse/#1c69f2754fc7>>

such as loyalty amongst the workforce.<sup>203</sup> At the same time, there has been a concerted attempt by policy makers to enable an environment where investment into the IT sector is being made appealing. For example, under Resolution 41/NQ-CP, a reduced corporate income tax rate for a period of 15 years is granted to IT greenfield IT services projects employing more than 1,000 employees; these include service of BPO or knowledge process outsourcing for export.<sup>204</sup> The “Developing target programme in information technology industry to 2020, vision to 2025” (Prime Minister’s Decision No. 392 / QD-TTg dated 27/03/2015) set a guideline to give priority to *inter alia* the development of software industry and to provide information technology services in which Viet Nam has competitive advantage and export potential.<sup>205</sup>

Viet Nameese businesses seem to be cognisant of the impact that the Industry 4.0 will have, and have been looking at IT services companies to stay competitive. This is being enabled by the rise of firms offering exclusively applied AI based services which also incorporate elements of Big Data analytics and the Internet of Things.<sup>206</sup> This is also being seen with the adoption, albeit nascent, of business models such as software-as-a--service (SaaS).<sup>207</sup> Viet Nam’s largest IT service company, FPT has committed to working with large technology conglomerates such as Amazon Web Services, Siemens, General Electric, and Microsoft, with the goal of achieving deployment of technology solutions and services, which are based on the digital revolution’s core technology platform for Viet Nameese businesses, and other foreign markets.<sup>208</sup> For instance, companies like Shopee acknowledge the role of data in e-commerce, and have committed to utilising in-depth analysis systems to evaluate the market based on Big Data. The CEO of Shopee, Tran Tuan Anh also spoke about plans to apply Big Data and Machine Learning to controlling fraud and prevent counterfeiting of goods.

## Malaysia

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<sup>203</sup> Frazzetto A., Forbes (May 29 2018) IT Outsourcing Hotspot: Vietnam, A Small But Mighty Powerhouse. Retrieved <<https://www.forbes.com/sites/forbestechcouncil/2018/05/29/it-outsourcing-hotspot-vietnam-a-small-but-mighty-powerhouse/#1c69f2754fc7>>

<sup>204</sup> PWC, (October 2017) Spotlight on Viet Nam: The leading emerging market. Retrieved <<https://www.pwc.com/vn/en/publications/2017/spotlight-on-vietnam.pdf>>

<sup>205</sup> UNESCO, (2016) Developing target programme in information technology industry to 2020, vision to 2025. Retrieved <<https://en.unesco.org/creativity/policy-monitoring-platform/developing-target-programme>>

<sup>206</sup> Voice of Vietnam, (April 21 2019), Top 7 trends for Vietnam’s IT sector in 2019. Retrieved <<https://english.vov.vn/society/top-7-trends-for-vietnams-it-sector-in-2019-395518.vov>>

<sup>207</sup> Voice of Vietnam, (April 21 2019), Top 7 trends for Vietnam’s IT sector in 2019. Retrieved <<https://english.vov.vn/society/top-7-trends-for-vietnams-it-sector-in-2019-395518.vov>>

<sup>208</sup> VN Economic Times, (September 25 2017), Businesses hurriedly preparing for 4.0 revolution. Retrieved <<https://english.vietnamnet.vn/fms/science-it/186861/businesses-hurriedly-preparing-for-4-0-revolution.html>>



The IT sector (domestically referred to as the ICT sector) in Malaysia has been receiving governmental support for nearly a decade and a half. In 1995, the Malaysian government had set-up “MSC Malaysia” (formerly the Malaysian Multimedia Support Corridor), a special economic zone which was formed by the Malaysian Digital Economy Corporation. While the initial focus was on the manufacture and export of IT products, this is increasingly being shifted to focus on higher value manufacture and export of IT services.<sup>209</sup> It is anticipated that this will enable the continued rise of the IT industry's share in the Malaysian GDP; under the 11th Malaysia Plan (2016 – 2020) the government is attempting to increase the ICT contribution to GDP to 17 percent from 13.1 percent during the 10th Malaysia Plan (2011-2015).<sup>210</sup> The sub-sector wise break up is telling and the increasing contribution of IT services vis-a-vis IT manufacturing is very evident:

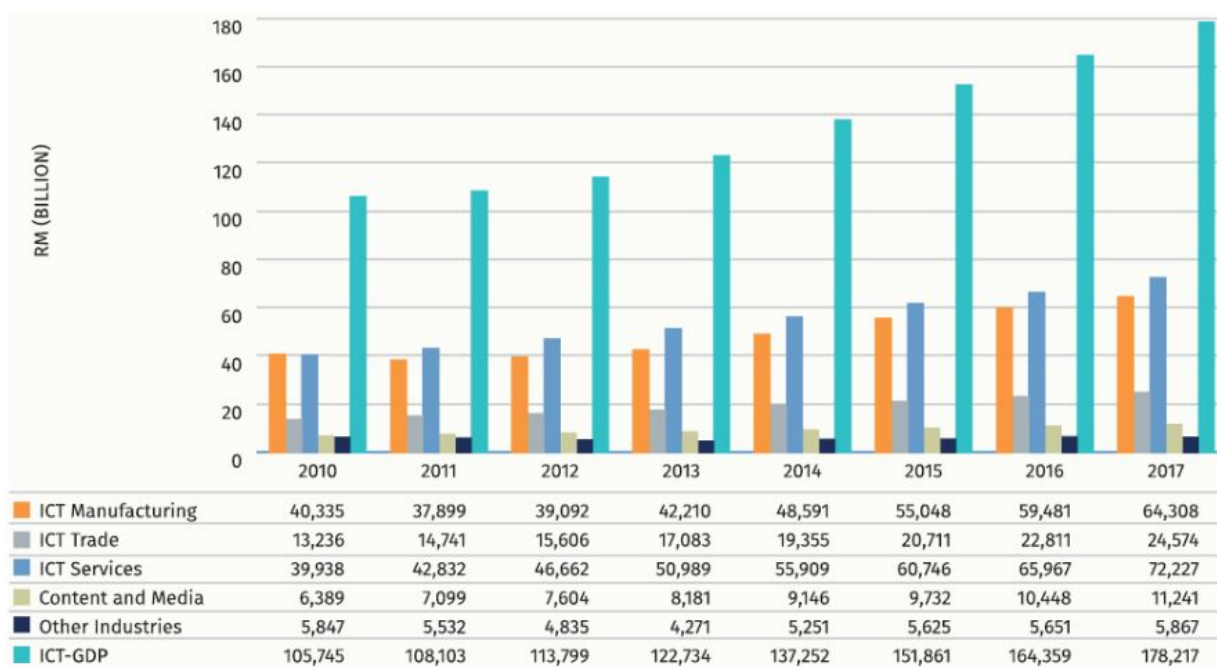


Image 5: ICT-GDP in Malaysia by industry sub-sector

Data source: Ministry of Statistics, Malaysia

Image source: Persatuan Industri Komputer dan Multimedia Malaysia (PIKOM)<sup>211</sup>

<sup>209</sup> British Malaysian Chamber of Commerce (BMCC), ICT Sector Report 2017/2018. Retrieved <<http://www.bmcc.org.my/vault/publications/ict-sector-report-2017-2018/>>

<sup>210</sup> Export.gov (July 19 2018) Malaysia - Information & Communications Technology. Retrieved <<https://www.export.gov/article?id=Malaysia-Information-Communications-Technology>>

<sup>211</sup> PIKOM, (2019) ICT Industry Outlook in Malaysia 2019. Retrieved <<http://www.pikom.org.my/ict-industry-outlook-malaysia-2019/>>

During the 2015-2016 period, the key drivers for the growth of the IT sector, as identified by the Malaysian government were: Big Data, the Internet of Things (IoT) and cloud computing. For 2017-2018, this had transitioned into the Fourth Industrial Revolution (4IR), and Industry 4.0, Fintech and Block Chain.<sup>212</sup> Moving forward, the key areas identified by IDC Malaysia, a leading IT services consulting firm in the ASEAN region, as best prospects are: Big Data in the Cloud, Enterprise Mobility and Device Deployment, IoT, Cognitive Cybersecurity, Datacenter Vision and Fintech.<sup>213</sup>

On the jobs front, the Malaysian IT services sector had plateaued for a few years, but saw a significant increase of nearly 4% in 2017.

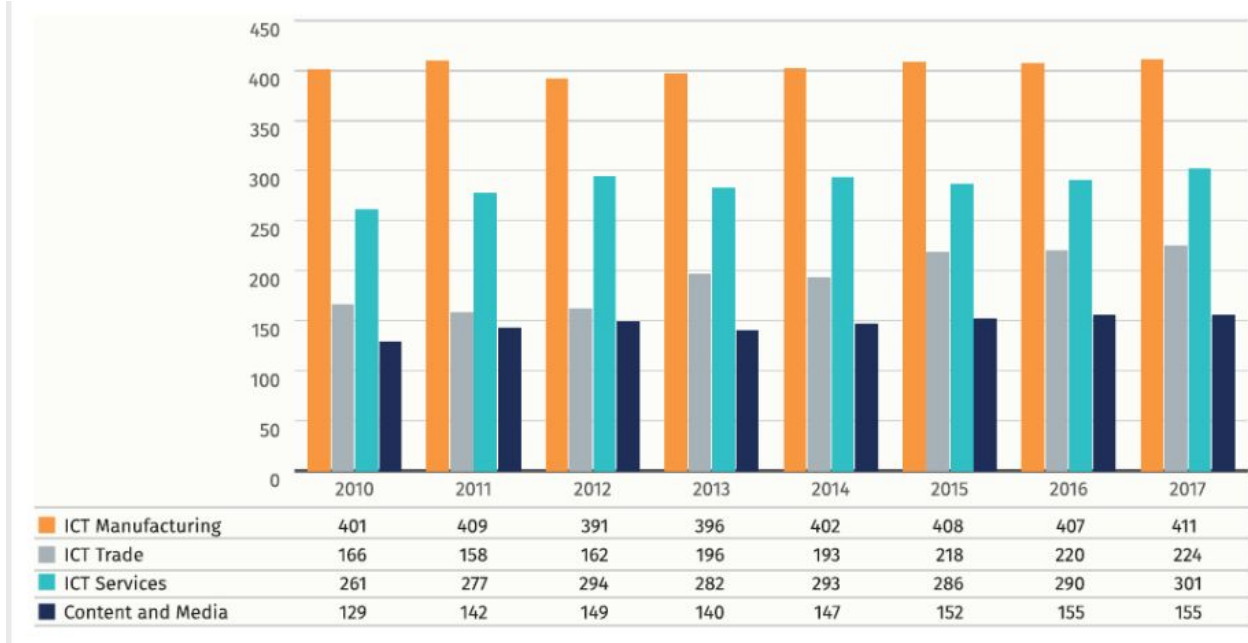


Image 6: ICT employment (as hundred thousand people) in Malaysia by industry sub-sector  
Data source: Ministry of Statistics, Malaysia

Image source: Persatuan Industri Komputer dan Multimedia Malaysia (PIKOM)<sup>214</sup>

In Malaysia too, the narrative around the uptake of Industry 4.0 is that of optimism. It is anticipated that most demand for the adoption of these technologies will be generated domestically. Resultantly, the Malaysian government has provided a lot of impetus for the adoption of Industry 4.0 in the large manufacturing sector in the country. The supply for

<sup>212</sup> Export.gov (July 19 2018) Malaysia - Information & Communications Technology. Retrieved <<https://www.export.gov/article?id=Malaysia-Information-Communications-Technology>>

<sup>213</sup> Export.gov (July 19 2018) Malaysia - Information & Communications Technology. Retrieved <<https://www.export.gov/article?id=Malaysia-Information-Communications-Technology>>

<sup>214</sup> PIKOM, (2019) ICT Industry Outlook in Malaysia 2019. Retrieved <<http://www.pikom.org.my/ict-industry-outlook-malaysia-2019/>>

these technologies is, then, hoped to be generated by the IT sector in the country. This is evidenced by the clear policy formulations already in place.

In 2019, the Malaysian government allocated RM210 million in its budget as funds to be invested in enabling the adoption of Industry 4.0 by 500 SMEs from 2019-21.<sup>215</sup> The government continues to follow the National IoT Strategic Roadmap,<sup>216</sup> with objectives that include making the country a premier hub for regional IoT development, in addition to enabling domestic use and industrialization of IoT as a new source of economic growth. The National Industry 4.0 Policy framework in Malaysia introduces a national regulatory sandbox initiative which covers diverse areas such as finance, healthcare, transportation, smart cities, green technology and waste management.<sup>217</sup> The Industry4WRD policy initiated by the Ministry of International Trade and Industry also involves five other industries. Additionally, the government also has policies towards smart villages.<sup>218</sup> The Malaysian Investment Development Authority has also introduced the Automation Capital Allowance (ACA) and Accelerated Capital Allowance to incentivise automation and industry 4.0<sup>219</sup>

## Philippines

The Philippine IT industry, due to increased consumer spending, low PC penetration, and small and medium enterprise (SME) modernization is expected to continue with its upward trajectory. This sector includes the financial, telecommunications, Business Process Management (BPM), and health IT sectors. Business Monitor International (BMI) expects its annual growth rate to increase to 10.6 percent and reach US\$6.6 billion in total spending by 2020.<sup>220</sup>

ILO's analysis of technological change in the developing ASEAN economies anticipates, using the Frey-Osborne methodology, estimates that 89% of the wage workers in Philippines' BPO

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<sup>215</sup> ADilla F., (November 2 2018) 2019 Budget a testament to gov't ambition in accelerating Industry 4.0 adoption. Retrieved <<https://www.nst.com.my/business/2018/11/427724/2019-budget-testament-govt-ambition-accelerating-industry-40-adoption>>

<sup>216</sup> Ministry of Science Technology and Innovation, (2015), National Internet of Things (IoT) Strategic Roadmap: A Summary. Retrieved <[http://www.mimos.my/iot/National\\_IoT\\_Strategic\\_Roadmap\\_Summary.pdf](http://www.mimos.my/iot/National_IoT_Strategic_Roadmap_Summary.pdf)>

<sup>217</sup> Lim J., (October 18 2018), Malaysia to introduce the National Industry 4.0 Policy Framework. Retrieved <<http://www.theedgemarkets.com/article/malaysia-introduce-national-industry-40-policy-framework>>

<sup>218</sup> Malaysian Industry-Government Group For High Technology, (September 17 2014), Malaysia's 'Smart Villages' and 9 other proven ideas for sustainable development. Retrieved <[https://www.eurekalert.org/pub\\_releases/2014-09/tca-mv091414.php](https://www.eurekalert.org/pub_releases/2014-09/tca-mv091414.php)>

<sup>219</sup> Yun T.Z., The Edge Malaysia, (July 13 2018) Industry 4.0: The journey towards automation. Retrieved <<http://www.theedgemarkets.com/article/industry-40-journey-towards-automation>>

<sup>220</sup> Export.gov, (July 18 2019) Philippines - Information and Communications Technology. Retrieved <<https://www.export.gov/article?id=Philippines-Information-and-Communications-Technology>>

sector are at a high risk of automation. This is largely pegged to the anticipated redundancy of basic language skills and literacy<sup>221</sup> which form the bedrock for Philippines' BPO sector.<sup>222</sup> However, in the short to medium term, it is anticipated that the Philippines BPO sector will be subject to lesser automation than India, for instance, due to high levels of customer service work in the former as opposed to high concentration of repetitive BPO work in the latter.<sup>223</sup>

The Asian Development Bank's analysis of labor force surveys using a task-based approach, finds evidence that is backed theoretically that in developing economies of Asia, the share of jobs intensive in nonroutine tasks is on the rise, while the share of jobs intensive in routine tasks has been declining. Using a historical perspective, they also find that in developing Asian economies, both employment and wages have grown in high-skilled jobs that require higher levels of social interaction and cognitive use and intensive usage of ICT. **Thus, process driven jobs requiring little abstract thinking, such as jobs found in the Philippines BPO sector are expected to dramatically be impacted.<sup>224</sup> Commensurately, it is also predicted by various industry players that "call-centre workers will still be needed, not for repetitive tasks, but to coax customers into buying other products and services."<sup>225</sup>**

As per an ATKearney analysis, Philippines has a mature digital strategy which focuses on internet connectivity, e-government, ICT industries, and developing an ICT enabled workforce which ranks with Thailand and Cambodia. The country's National Broadband Plan (NBP) emphasises the national strategy to focus on ICT infrastructure as the department responsible sees this as an opportunity to improve the citizen's access to the internet.<sup>226</sup>

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<sup>221</sup> A.T. Kearney: On the eve of disruption: A new business model threatens established concepts of offshoring and expands the market (2016).

<sup>222</sup> The Economist, (February 6 2016) The End of the Line. Retrieved <<https://www.economist.com/international/2016/02/06/the-end-of-the-line>>

<sup>223</sup> Sethi A. and ors., ATKearney, (2019) Digital Resonance: The New Factor Impacting Location Attractiveness. Retrieved <<https://www.atkearney.com/digital-transformation/gsli/2019-full-report>>

<sup>224</sup> Chang, J., Rynhart, G., & Huyuh, P. (July 2016). ASEAN in Transformation: Automotive and auto parts: Shifting Gears. International Labour Organisation. Retrieved [https://www.ilo.org/wcmsp5/groups/public/---ed\\_dialogue/---act\\_emp/documents/publication/wcms\\_579557.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579557.pdf).

<sup>225</sup> The Economist, (February 6 2016) The End of the Line. Retrieved <<https://www.economist.com/international/2016/02/06/the-end-of-the-line>>

<sup>226</sup> Department of Information and Communication Technology, Republic of Philippines, (2017) National Broadband Plan. Retrieved <<http://www.dict.gov.ph/wp-content/uploads/2017/06/National-Broadband-Plan.pdf>>

## Concluding remarks

### Focus on technological and quantitative aspects

In the region, the future of work has captured the imagination of the state with most countries having formulated plans that imagine technologies associated with the future of work to play a key economic as well as governance role. For instance, there are initiatives in the offing such as the creation of smart cities, e-government as well as a dedicated focus on e-commerce. However, a common theme that appears to also emerge is that the future of work in the IT sector will be determined by corporations operating in the sector. The IT sector is seen as playing a big role in furthering the economic agendas of the countries in the region, however there appears no focussed attention on how work in the sector itself may be reorganised. The focus is restricted to the quantitative aspects of how Industry 4.0 will shape out to be. As a result the terminology used is those of rate of returns, economic growth indicators and gains in job numbers; also relatedly, skilling challenges get mention. Crucially, what gets left out is qualitative ways in which work may be impacted and what that would entail for workers currently in the workforce and those entering it. This would entail looking at how human resource functions are changing, how the tasks being performed will change not just in content but also in intensity and size, the nature of the workplace itself etc.

### The demand is articulated domestically with the domestic IT sector being the supply side

For countries in the region, the size and emphasis of the IT sector within the domestic economy will play a crucial role in determining the timelines for the future of work in the sector. More mature IT sectors such as that of Singapore and the BPO sector in the Philippines has resulted in relatively more fastidious digital agenda devised by their respective governments. On the other hand, the incorporation of Industry 4.0 in policy-making is a more recent development in countries such as Malaysia and Viet Nam with emerging IT sectors. The demand for Industry 4.0 is articulated mostly in the context of the manufacturing sector, and also for the development of public infrastructure such as 'smart cities' with the domestic IT sector expected to be providing the supply. Then, the desire and readiness of firms in the manufacturing sector for the adoption of Industry 4.0 technologies also become a key determinant. In Malaysia, for instance, the reason being put forth to encourage the adoption of Industry 4.0 is to reduce the reliance on manual labour in the manufacturing sector<sup>227</sup>; it is the manufacturing sector that is seen as the key adopted of

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<sup>227</sup> Export.gov (July 19 2018) Malaysia - Information & Communications Technology. Retrieved <<https://www.export.gov/article?id=Malaysia-Information-Communications-Technology>>

Industry 4.0.<sup>228</sup> This also precludes a focus on how the production of Industry 4.0 technologies may themselves be adopted by the IT sector the impact it will have on work in the sector.

### **The size of IT sub-sectors will determine the impact of Industry 4.0**

The task composition on job with the various IT sub-sectors vary. It is self-evident that the tasks being performed by workers in the BPO sub-sector will vary from those required in the IT services sub-sector as well as in electronics manufacturing. Borrowing from the earlier discussion on methodologies and specifically the task-based approach to understanding technological unemployment, it is jobs which have a high content of cognitive, routine tasks that stand to be impacted the most. The BPO sector is understood to comprise a greater amount of such job roles, than the IT services sector. Thus, Viet Nam with greater focus on its BPO sector will need a very different and more urgent strategy to navigate the uptake of Industry than Singapore, which has a greater contribution of IT services within its IT sector. Even within the BPO sector, not all jobs will be impacted equally. Utilising the learning from the task based approach again, jobs that are process driven will be impacted before those that require communication skills. This may soften the impact on jobs in the BPO sub-sector in Viet Nam it is a key destination for the outsourcing of conversational customer service work.<sup>229</sup>

### **Technological adoption is determined by existing economic hierarchies**

The literature in the area focuses largely on the adoption of technologies by ASEAN nations, although some literature has also studied economies in South Asia, such as Sri Lanka and Pakistan. Certain technologies have seen wide application across sectors – such as 3D printing in the electronics or automotive industry, even as specific technologies being employed are potentially disrupting entire sectors – for example, the use of AI and cloud computing for the BPO sector. Most studies are optimistic about the scale and scope of adoption of new technologies, particularly among ASEAN countries. However, this narrative is also challenged in certain instances. A study of G20 countries, focusing on Asian economies particularly, finds that, although there is cause for some optimism due to decreasing time between invention and adoption of technologies as well as reduced cross-country divergence in technological adoption, a closer look at developing economies indicates that the gap

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<sup>228</sup> Ministry of International Trade and Industry, (2018) Industry 4WD: National Policy on Industry 4.0. Retrieved <[https://www.miti.gov.my/miti/resources/National%20Policy%20on%20Industry%204.0/Industry4WRD\\_Final.pdf](https://www.miti.gov.my/miti/resources/National%20Policy%20on%20Industry%204.0/Industry4WRD_Final.pdf)>

<sup>229</sup> Sethi A. and Gott J., ATKearney, (2017) 2017 A.T. Kearney Global Services Location Index: The Widening Impact of Automation. Retrieved <<https://www.atkearney.com/digital-transformation/article?/a/the-widening-impact-of-automation-article>>

between technological leaders and technological followers has widened.<sup>230</sup> This poses some difficult challenges in the anticipation of the outcomes of technological adoption on global inequality. On one hand, this entails that the developmental gaps may be exacerbated as has been the case in previous technological ‘revolutions’. On the other hand, the diagnosis for the future of work will be mitigated by the specific structural factors, skill development measures and rates of technological adoption unique to each country. The data for these, may, however, be lacking in many low and middle income countries.

## Data gaps and future research agenda

An objective behind conducting this literature review was to identify factors that are precluding a comprehensive diagnosis of the future of work in the ASEAN region. Accordingly, the following data points were identified. The commonality among these data points is the lack of their availability in low and middle income contexts. Also identified were broader research areas that would allow for a more robust understanding of the changes underway in the labour market that are anticipated to only amplify going forward.

- **Occupational data:** It has been hypothesized that some factors, such as hiking minimum wages and shortages in high-skilled workers, will augment the growth of Industry 4.0 technologies in the ASEAN region. It is also expected that these trends will cause a further mismatch in skills supply and demand, which will have to be addressed by governments through comprehensive skill development frameworks. While some studies have speculated about the expected skill gap based on current figures of employment, these will have to be substantiated periodically with data on actual skill gaps, with evidence of the kinds of jobs being created. Comparative research using country level occupational data can be used to call out similarities, differences, and trends in the region.
- **Enterprise-level data:** Research at the sectoral and company level can be undertaken to understand how companies are responding to industry 4.0 and the subsequent impact it is having on work. This could include comparing skilling initiatives, business and revenue models, HR functions, hiring patterns, product trends, changes to business processes, tasks, and allocation of financial resources to technology and R&D.

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<sup>230</sup> Uhlig A. and ors., G20 Insights, (June 19 2018), Technological Innovation and the Future of Work: A View From the South. Retrieved <<http://www.g20-insights.org/wp-content/uploads/2018/06/technological-innovation-and-the-future-of-work-a-view-from-the-south-1529419607.pdf>>

- **Bringing in stakeholders on the margins:** Collectivisation and other strategies employed by labour unions in informal and formal settings need to be contextualised against recent trends of technological upgradation, in order to support their presence as stakeholders in the discussion on transitioning to Industry 4.0. In addition, we recognised SMEs as an important stakeholder, with specific needs to successfully transition to Industry 4.0. Research is then required to assess the state of preparedness among SMEs, with regards to factors such as technological adoption, skills requirements, and access to credit and infrastructure.
- **Gender:** Currently, women are underrepresented in the labour market in South Asia (28 per cent).<sup>231</sup> Yet, few studies estimate if women labour participation rates will increase or decrease in the future world of work. One study that does look at the impact of automation on female participation in labour in ASEAN countries finds that women represent the majority in occupations that are likely to be automated, thus being more vulnerable to unemployment than men.<sup>232</sup> Such research is required to formulate strategies to create employment opportunities with decent work conditions for women across levels of skill and education.
- **Agriculture:** Outside of manufacturing industries and services, several of the countries surveyed still have a significant workforce occupied in farming and agricultural activities. In regard to the future of job creation and destruction, projections on the impact of Industry 4.0 on agriculture would be essential for the analysis, particularly for agrarian low and middle income countries.
- **Wage growth:** There has been no study on anticipated wage growth in the region over the horizon of the next few decades. This has made it near impossible to anticipate wage trends, and the differential impact that the future of work will have of differing income groups.
- **The ‘gig’ economy:** Few studies on online labour or freelancing in the online economy have focused specifically on Asia or the Global South. One of the most comprehensive studies of online labour, by the iLabour Project at Oxford University,<sup>233</sup> indicates that South and Southeast Asia account for the greatest share of online labour across the world. A further study by Graham, Hjorth and Ledonvirtha concludes that while most of the demand for work done on digital platforms comes from western nations, most

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<sup>231</sup> Gallup.; International Labour Organisation (ILO). 2017. Towards a Better Future for Women and Work: Voices of Women and Men, (Geneva, ILO).

<sup>232</sup> ILO 2016. ASEAN in Transformation: How Technology Is Changing Jobs and Enterprises, (Geneva).

<sup>233</sup> Lehdonvirta V., The iLabour Project, Oxford Internet Institute, (July 11 2017) Where are online workers located? The international division of digital gig work. Retrieved <<http://ilabour.oii.ox.ac.uk/where-are-online-workers-located-the-international-division-of-digital-gig-work/>>



of the workers come from India, Philippines, Viet Nam or Malaysia.<sup>234</sup> Common platform technologies are used across countries, including those which have worldwide adoption, like Amazon's Mechanical Turk (Mturk), as demonstrated by LIRNESIA's study of microwork in Sri Lanka.<sup>235</sup>

In a study on online work in South East Asia, researchers from the Oxford Internet Institute found that there are five characteristics of online work contracts - bridging, disintermediation, reintermediation, local lengthening, and horizontal collaboration. **This characterisation implies that there are instances of direct communication and contracting between an online contractor and client, while in other cases, new forms of hierarchies in the form of intermediaries or subcontractors develop.**<sup>236</sup> While the new platform economy introduces greater flexibility for workers, it is accompanied by job insecurity, as work is disaggregated and based on specific tasks.<sup>237</sup> Another effect of the gig economy on workers, as suggested by Vili Lehdonvirta, is the lack of organisational affiliation, caused due to de-localisation of work and the lack of "physical colocation, offices, employment contracts, working hours, titles, recognizable supervisors and coworkers, and even work clothes."<sup>238</sup> The nature and impact of the gig economy is crucial to develop policy responses to protect workers and support decent employment.

- **Skill gaps:** It is anticipated that skilling gaps will be a critical issue across high, middle, and low income economies. In the World Economic Forum's Global Competitiveness Report (September 2017), for instance, Singapore slipped in its rankings on innovation and sophistication, both major drivers of economic success in an Industry 4.0 landscape. One factor in its falling competitiveness could be a shortage in STEM training amongst a large proportion of the existing workforce,

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<sup>234</sup> Graham, M., Hjorth, I., & Lehdonvirta, V. (2017). Digital labour and development: impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, 23(2), 135–162. <https://doi.org/10.1177/1024258916687250>

<sup>235</sup> Galpaya, H., Perampalam, S., & Senanayake, L. (2018). Investigating the potential for micro-work and online-freelancing in Sri Lanka. In *Digitized Labor* (pp. 229-250). Palgrave Macmillan, Cham. Retrieved <[https://lirnesia.net/wp-content/uploads/2015/05/2\\_Updated-book-chapter\\_Paper-13\\_Galpaya\\_v3.pdf](https://lirnesia.net/wp-content/uploads/2015/05/2_Updated-book-chapter_Paper-13_Galpaya_v3.pdf)>

<sup>236</sup> Lehdonvirta, V., Hjorth, I., Graham, M., & Barnard, H. (2015, August). Online labour markets and the persistence of personal networks: evidence from workers in Southeast Asia. In *American Sociological Association Annual Meeting* (Vol. 8, pp. 23-45). Retrieved <<http://vili.lehdonvirta.com/files/Online%20labour%20markets%20and%20personal%20networks%20ASA%202015.pdf>>

<sup>237</sup> Graham, M., Lehdonvirta, V., Wood, A., Barnard, H., Hjorth, I., & D Simon, P. (2017). The risks and rewards of online gig work at the global margins. Retrieved <<https://www.oii.ox.ac.uk/publications/gigwork.pdf>>

<sup>238</sup> Lehdonvirta, V. (2016). Algorithms that divide and unite: delocalisation, identity and collective action in 'Microwork'. In *Space, place and global digital work* (pp. 53-80). Palgrave Macmillan, London. Retrieved <<http://vili.lehdonvirta.com/files/Lehdonvirta%202016%20Delocalization%20identity%20collective%20action%20n%20microwork.pdf>>

believed to be critical to prepare an economy for Industry 4.0.<sup>239</sup> An example of a policy response to deal with job loss and skills gaps can be found in the Malaysian context. The government of Malaysia has responded by increasing wages to attract local talent to develop the Industrialised Building System (IBS)<sup>240</sup>, and continuing to encourage the implementation of the IBS to reduce low-skilled foreign workers.

The existing skill gaps in countries, presenting an opportunity for collaboration and mutual learnings across the Asia Pacific region. An example could be for countries to collaborate to develop skilling programmes and enable the flow of skilled IT workers across the region. Mutual Recognition Agreements (MRA) have traditionally facilitated the flow of skilled workers (and not unskilled) across borders by ensuring the recognition of qualifications in other ASEAN countries. ASEAN currently has MRA's in engineering, nursing, architectural, dental, medical, tourism, and accountancy.<sup>241</sup> MRA's alone do not enable access to access to labour markets across countries and trade agreements and immigration regulations play an important role.<sup>242</sup> This ecosystem will have to be assessed to enhance flows of workers across skill categories.

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<sup>239</sup> Chan T.J., South China Morning Post, (April 26 2018), What Industry 4.0 means to Singapore and why its workers must upskill and lose their sense of entitlement. Retrieved <<https://www.scmp.com/lifestyle/article/2143239/what-industry-40-means-singapore-and-why-its-workers-must-upskill-and-lose>>

<sup>240</sup> Volume 3 (2016) Heights. Retrieved <<http://www.cidb.gov.my/images/content/pdf/Korporat/Heights3-compressed.pdf>>

<sup>241</sup> Mendoza, D. R., Desiderio, M. V., Sugiyarto, G., & Salant, B. (2016). Open Windows, Closed Doors: Mutual Recognition Arrangements on Professional Services in the ASEAN Region. Asian Development Bank. Retrieved <<https://www.migrationpolicy.org/research/open-windows-closed-doors-mutual-recognition-arrangements-professional-services-asean>>

<sup>242</sup> Papademetriou, D. G., Sugiyarto, G., Mendoza, D. R., & Salant, B. (2016). Achieving Skill Mobility in the ASEAN Economic Community: Challenges, Opportunities, and Policy Implications. Asian Development Bank. Retrieved <<https://www.adb.org/sites/default/files/publication/178816/skill-mobility-asean.pdf>>