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# TECHNOLOGICAL *CHANGE IS COMING:* THE FOURTH INDUSTRIAL REVOLUTION

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## LABOR MARKET INTELLIGENCE REPORT



Technical Education and Skills Development Authority

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## I. Introduction

Intensely pervasive has technology become that it has its manifestations in the people's day-to-day activities. It has altered the way people eat, sleep, shop, socialize, study, play, and most importantly, in this context, the way people work. While these developments have been functional, technological change and its potential to bring about inimical effects to employment remains an issue that need be pondered upon. The fear of job destruction due to possible labor substitution in effect of technological change has always been present in periods typified by radical technological changes i.e. the First, Second and Third Industrial Revolution.

Industrial Revolution, essentially, is a period in which machines bring significant changes to the people's way of life especially in the area of manufacturing. As history provides, the First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production and the **Fourth** is building on the digital revolution that has been occurring since the middle of the last century. It is said to be characterized by a **fusion of technologies** that is obscuring the barriers between the physical, digital, and biological spheres.

At the World Economic Forum in January 2015, German Chancellor Angela Merkel, discussed **Industry 4.0** to describe the **computerization of manufacturing** regarded as the fourth industrial revolution. She claims that the phenomenon will change the way we deal with the **fusion of the online world and the world of industrial production** where smart technology and real-time data will be used to increase productivity and reduce costs.

**Table 1: Navigating the next industrial revolution**

Revolution	Year	Information
 1	1784	Steam, water, mechanical production equipment
 2	1870	Division of labor, electricity, mass production
 3	1969	Electronics, IT, automated production
 4	?	Cyber-physical systems

Source: World Economic Forum, 2016

Though both digital in nature, experts identify velocity, scope and systems impact as the reasons why the Fourth Industrial Revolution is not merely a continuation of the Third. Moreover, what sets it apart is, when placed vis-à-vis the earlier industrial revolution, the Fourth is evolving at an **exponential** rather than a linear pace. It also projected to obstruct every industry in every country. These critical changes, according to Schwab (2016), will be amplified by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.

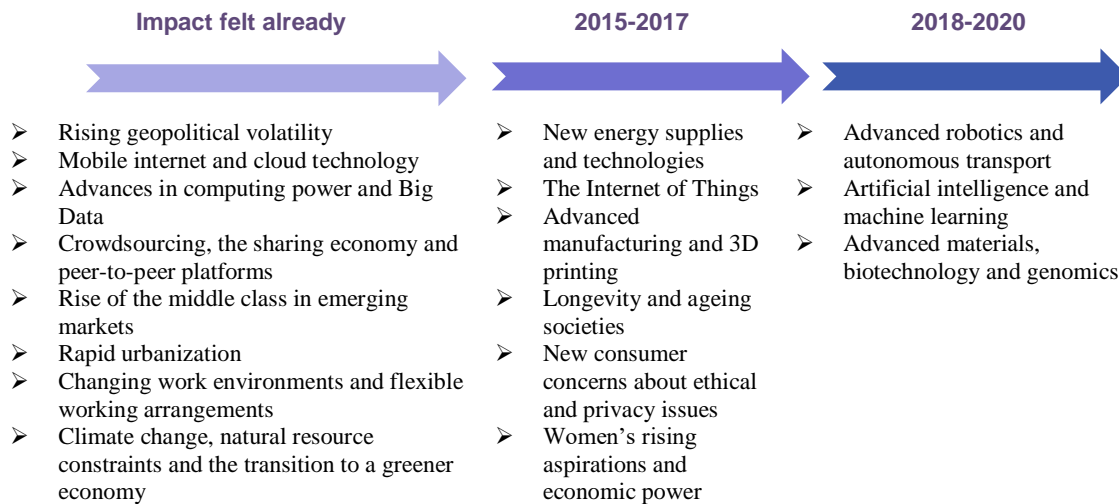
## II. Human Capital in the Future

### A. Employment Trends

Similar to the earlier industrial revolutions, Schwab (2016) maintains that the Fourth has the potential to effect positive changes in terms of **job creation** and/or result to **greater inequality**, especially with its capability to **disrupt labor markets**. The anticipation of job creation is rooted in the fact that, most in-demand occupations today did not exist ten or even five years ago, and the momentum of this change is yet to accelerate. In one estimate provided in *The Fourth Industrial Revolution: what it means, how to respond* (2016), 65% of children entering primary school today will end up working in completely

new jobs that are not existing yet. The businesses covered in *The Future of Jobs (2016)* estimate that the substantial part of the change will occur within the next 5 years. Below is a more comprehensive timeframe regarding the matter:

**Table 2: Timeframe to impact industries, business models**



Source: World Economic Forum, 2016

Job families and functions will also experience shifts among them. Across the countries covered by *The Future of Jobs (2016)*, it is projected that net employment impact could lead to more than 5.1 million jobs lost to disruptive labor market changes over the period 2015–2020, with a total loss of 7.1 million jobs—two thirds of which are concentrated in routine white collar office functions, such as Office and Administrative roles—and a total gain of 2 million jobs in Computer and Mathematical and Architecture and Engineering related fields. On the other hand, jobs under manufacturing and production are expected to experience a further downturn but are at the same time expected to have relatively good potential for upskilling, redeployment and productivity enhancement through technology rather than pure substitution.

The same study identifies new and emerging job categories and functions that they expect to become critically important to their industry by 2020. The top mentioned job categories are **data analysts** and **specialized sales representatives**. Companies expect



data analysts to help them make sense and derive insights from the data generated by technological disruptions. Specialized sales representative, on the other hand, are expected to help them explain their offerings, either due to the innovative technical nature of the products themselves or due to new client targets with which the company is not yet familiar, or both. Aside from this, there also emerges a need for a new type of senior manager who will successfully steer companies, especially in the areas of Energy and Media, Entertainment and Information, through the upcoming change and disruption.

**Table 3: Employment effect of drivers of change, by job family Compound growth rate, 2015-2020, %**

<b>Job family</b>	<b>Employment outlook</b>
Computer and Mathematical	3.21%
Architecture and Engineering	2.71%
Management	0.97%
Business and Financial Operations	0.70%
Sales and Related	0.46%
Installation and Maintenance	-0.15%
Construction and Extraction	-0.93%
Arts, Design, Entertainment, Sports and Media	-1.03%
Manufacturing and Production	-1.63%
Office and Administrative	-4.91%

Source: World Economic Forum, 2016

In terms of employment outlook, the following are forecasted: **strong growth** in the **Architecture and Engineering** and **Computer and Mathematical** job families; a **moderate decline** in **Manufacturing and Production** roles and a **significant decline** in **Office and Administrative** roles; and an almost **flat outlook** for the **Management, Business and Financial Operations, Sales and Related** and **Construction and Extraction**.

The forecasted global decline in the employment outlook of Manufacturing and Production comes as a result of labor-substituting technologies such as additive manufacturing and 3D printing. However, the Forum claims that the picture is not entirely gloomy as there is an increase in the manufacturing demand for materials which

can be a manifestation of **labor-complementing productivity enhancement** rather than pure job replacement.

It is also reported that **Installation and Maintenance** jobs will experience **growth** in **green jobs** such as the **installation, retrofitting, repair and maintenance of smart meters and renewable energy technologies in residential and office buildings**. Office and Administrative roles expected decline is due to technological innovations which have the potential to make certain roles redundant.

With regard workers in the **Office and Administrative and Manufacturing and Production** job families, according to *The Future of Jobs* (2016), they may find themselves in a vicious cycle where **low skills stability means facing redundancy especially without re-upskilling**. This possible downturn may be aggravated since disruptive change may erode employers' incentives and business case for investing in such reskilling.

With all these projections- both **job creation and destruction**- the usual alarm that as automation permeates the global economy, the displacement of workers will increase, still holds true today- even after all the past Revolutions. For Schwab (2016), at this point, determining which of these two scenarios will overpower the other is still unpredictable but history suggests that it is likely to be a **combination** of the two.

## **B. Skills Stability**

Evidently, **radical change** in **technology** results to **skills set disruption**. For the Forum, such disruption can happen almost simultaneously with the Revolution or with only a minimal time lag. In fact, some of their respondents report that disruptions on skills set of existing employees' skills can already be felt today, as seen in Table 2. Not complying with the skills need of the changing and demanding time shortens the shelf-life of the workers' skill sets.

**Table 4: Skills Stability, 2015-2020, industries overall**

Industry Group	Unstable	Stable
Industries Overall	35%	65%
Media, Entertainment and Information	27%	73%
Consumer	30%	71%
Healthcare	29%	71%
Energy	30%	70%
Professional Services	33%	67%
Information and Communications Technology	35%	65%
Mobility	39%	61%
Basic and Infrastructure	42%	58%
Financial Services & Investors	43%	57%

Source: World Economic Forum, 2016

In terms of skills stability, jobs in the Financial Services & Investors are the most unstable and the Media, Entertainment and Information group hold the least unstable jobs. Instability across the industries range from 27% to 43%, with 35% as the average.

*The Future of Jobs* (2016) holds that, by 2020, more than a third of the **desired core skills** sets of most occupations will be comprised of skills that are not yet considered crucial to the job today. **Social skills- such as persuasion, emotional intelligence and teaching others-** will be more in demand than specific technical skills- such as programming or equipment operation and control. Essentially, technical skills have to be coupled by **strong social and collaboration skills**. Table 4 below specifies the skills requirements in effect of the technological change.

**Table 4: Core work-related skills**

ABILITIES	BASIC SKILLS	CROSS-FUNCTIONAL SKILLS	
<p><i>Cognitive Abilities</i></p> <ul style="list-style-type: none"> <li>• Cognitive Flexibility</li> <li>• Creativity</li> <li>• Logical Reasoning</li> <li>• Problem Sensitivity</li> <li>• Mathematical Reasoning</li> <li>• Visualization</li> </ul>	<p><i>Content Skills</i></p> <ul style="list-style-type: none"> <li>• Active Learning</li> <li>• Oral Expression</li> <li>• Reading Comprehension</li> <li>• Written Expression</li> <li>• ICT Literacy</li> </ul>	<p><i>Social Skills</i></p> <ul style="list-style-type: none"> <li>• Coordinating with Others</li> <li>• Emotional Intelligence</li> <li>• Negotiation</li> <li>• Persuasion</li> <li>• Service Orientation</li> <li>• Training and Teaching Others</li> </ul>	<p><i>Resource Management Skills</i></p> <ul style="list-style-type: none"> <li>• Management of Financial Resources</li> <li>• Management of Material Resources</li> <li>• People Management</li> <li>• Time Management</li> </ul>

		<p><i>Systems Skills</i></p> <ul style="list-style-type: none"> <li>• Judgement and Decision-making</li> <li>• Systems Analysis</li> </ul>	<p><i>Technical Skills</i></p> <ul style="list-style-type: none"> <li>• Equipment Maintenance and Repair</li> <li>• Equipment Operation and Control</li> <li>• Programming</li> <li>• Quality Control</li> <li>• Technology User Experience Design</li> <li>• Troubleshooting</li> </ul>
<p><i>Physical Abilities</i></p> <ul style="list-style-type: none"> <li>• Physical Strength</li> <li>• Manual Dexterity and Precision</li> </ul>	<p><i>Process Skills</i></p> <ul style="list-style-type: none"> <li>• Active Listening</li> <li>• Critical Thinking</li> <li>• Monitoring Self and Others</li> </ul>	<p><i>Complex Problem Solving Skills</i></p> <ul style="list-style-type: none"> <li>• Complex Problem Solving</li> </ul>	

Source: World Economic Forum, 2016

An important component of the new skills requirements is the ability to **work with data** and make **data-based decision**. This skill will become vital in many job families as employers struggle to create a workforce rich in data analysis and presentation skills; given the influx of digital information.

The need for such skills is also advocated for by the British Council. The organization believes that employers want to recruit people who know how to learn, who can work well with others, who can communicate and solve problems. More alarmingly, the Council maintains that there are powerful reasons to believe that **what education system worked spectacularly between 1960 and 2010 will not work between 2010 and 2060**. In line with this conjecture, the British Council released the required skills set they call *Deep Learning Skills* composed of: Global Citizenship, Collaboration, Character, Communication, Creativity and imagination, Real World Problem Solving, Critical Thinking, and Use of ICT for Learning. Table 5 below gives a description:

**Table 5: Deep Learning Skills**

<b>Global Citizenship</b>	Global knowledge, sensitivity to and respect for other cultures, active involvement in addressing issues of human and environmental sustainability
<b>Collaboration</b>	Work in teams, learn from and contribute to the learning of others, social networking skills, empathy in working with diverse others
<b>Character</b>	Honesty, self-regulation and responsibility, hard work, perseverance, empathy for

	contributing to the safety and benefit of others, self-confidence, personal health and wellbeing, career and life skills
<b>Communication</b>	Communicate effectively orally, in writing and with a variety of digital tools; listening skills
<b>Creativity and imagination</b>	Economic and social entrepreneurialism, considering and pursuing novel ideas and leadership for action
<b>Real World Problem Solving</b>	Give students real experiences in creating and using new knowledge in the world beyond the classroom
<b>Critical Thinking</b>	Think critically to design and manage projects, solve problems, make effective decisions using a variety of digital tools and resources
<b>Use of ICT for Learning</b>	Technology allows us discover and master content knowledge and to enable the deep learning goals of creating and using new knowledge in the world

Source: British Council, 2014

In a similar note, aside from social and creative skills, the *Human Capital Outlook: ASEAN* (2016) emphasizes that the Fourth Industrial Revolution also requires **strong vocational skills**- which is often regarded as poor alternatives in relation to traditional academic routes.

### III. Human Capital Today

Given the profound effects of the Fourth Industrial Revolution on the labor market, the world must manage its transition today by making human capital development at the core of national and international strategies to be able to harness the optimal outcomes in the future. Our actions today will determine our participation in the unfolding of the Revolution. To be able to have grounded initiatives, it is but proper to discuss human capital as it is today.

The discussion of the status of human capital today is referenced to the Human Capital Report of the World Economic Forum. The Forum's *Report* ranks 130 countries on how well they are developing and deploying their talent. The index takes a life-course approach to human capital, evaluating the levels of education, skills and employment available to people in five distinct age groups, starting from under 15 years to over 65 years. The aim is to assess the outcome of past and present investments in human capital



and offer insight into what a country's talent base looks like today and how it is likely to evolve into the future.

## A. Global

This year's report presents no new entrants or dropouts from its top 10 list last year. Smaller European countries continue to dominate the Index. These are the Nordics and Benelux states, two countries from the East Asia and the Pacific region and one country from the North America. Evidently, the leaders of the Index are high-income economies that put premium in developing high educational attainment and consequently, put a large share of their workforce in high-skilled occupations.

**Table 6: Human Capital Index 2016, detailed rankings**

Country	Overall Index		0-14 Age Group		15-24 Age Group		25-54 Age Group		55-64 Age Group		65 and over Age Group	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Finland	85.86	1	98.17	1	85.35	1	81.24	1	83.90	7	72.95	9
Norway	84.64	2	94.69	11	84.72	2	80.11	4	85.34	3	74.53	2
Switzerland	84.61	3	95.76	7	83.34	4	80.51	2	83.54	8	73.28	7
Japan	83.44	4	95.78	6	77.26	19	79.13	5	85.72	1	75.61	1
Sweden	83.29	5	93.25	14	81.03	9	80.17	3	84.58	4	70.43	16
New Zealand	82.79	6	95.20	9	82.25	7	76.25	17	85.70	2	74.07	3
Denmark	82.47	7	91.77	22	81.89	8	78.17	8	83.99	6	74.04	4
Netherlands	82.18	8	92.81	17	83.70	3	77.58	10	81.06	13	69.59	18
Canada	81.95	9	93.46	13	77.74	16	77.61	9	84.22	5	73.05	8
Belgium	81.59	10	95.29	8	78.25	13	77.55	11	78.33	27	68.32	23
Germany	81.55	11	89.56	38	79.78	10	78.39	7	83.31	9	73.54	6
Austria	81.52	12	92.29	20	82.41	6	76.75	15	79.06	23	72.00	12
Singapore	80.94	13	95.81	5	76.12	25	78.70	6	75.17	39	60.59	52
Ireland	80.79	14	95.87	4	75.84	29	76.32	16	78.16	28	67.77	26
Estonia	80.63	15	95.09	10	77.35	18	74.02	24	82.98	10	71.77	13
Slovenia	80.33	16	92.90	16	79.13	12	75.30	20	77.04	32	71.39	14
France	80.32	17	93.07	15	76.00	26	77.32	12	77.59	30	66.32	31
Australia	80.08	18	91.36	24	82.56	5	74.33	22	80.85	15	67.27	27
United Kingdom	80.04	19	91.91	21	76.64	22	76.78	14	79.07	22	66.43	30
Iceland	79.74	20	93.85	12	79.63	11	75.78	18	74.62	40	60.30	54
Lithuania	79.34	21	92.38	19	75.87	28	74.25	23	81.24	12	68.30	24
Luxembourg	79.28	22	91.33	26	73.46	36	77.24	13	75.74	36	66.45	29
Israel	78.99	23	89.56	37	76.75	21	75.39	19	79.78	20	67.05	28

	Overall Index	0-14 Age Group	15-24 Age Group	25-54 Age Group	55-64 Age Group	65 and over Age Group
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											Group	
Country	Score	Rank	Score	Rank	Score	Rank	Country	Score	Rank	Score	Rank	Score
United States	78.86	24	88.97	39	75.99	27	74.91	21	80.62	16	70.32	17
Czech Republic	78.45	25	89.66	36	77.49	17	73.72	25	78.43	25	68.38	22
Ukraine	78.42	26	90.73	28	78.04	15	71.83	32	79.14	21	72.21	10
Latvia	78.13	27	88.79	41	76.24	24	72.79	27	80.58	17	72.10	11
Russian Federation	77.86	28	86.95	53	78.21	14	72.74	28	80.46	18	71.14	15
Kazakhstan	77.57	29	91.01	27	75.45	30	70.91	36	80.95	14	68.78	21
Poland	77.34	30	90.66	29	74.67	34	72.53	29	76.12	34	65.61	32
Cyprus	76.97	31	91.33	25	71.05	52	73.36	26	74.23	45	63.98	36
Korea, Rep.	76.89	32	90.34	31	75.39	32	71.68	34	78.42	26	61.64	45
Hungary	76.36	33	87.56	45	73.00	41	71.72	33	78.11	29	68.83	20
Italy	75.85	34	92.77	18	71.82	49	69.25	39	75.95	35	62.95	41
Malta	75.66	35	87.49	47	73.31	37	72.09	31	73.22	50	63.13	39
Cuba	75.55	36	96.87	2	75.00	33	67.80	47	72.49	54	50.94	81
Armenia	75.39	37	87.49	48	69.96	56	68.76	43	81.84	11	74.01	5
Romania	74.99	38	87.30	51	72.42	42	69.01	42	77.47	31	68.18	25
Croatia	74.99	39	90.64	30	72.06	46	69.17	40	72.54	53	62.68	42
Slovak Republic	74.94	40	85.01	60	72.36	43	71.13	35	76.58	33	65.36	33
Portugal	74.39	41	88.91	40	72.16	45	70.46	37	68.10	70	58.98	58
Malaysia	74.26	42	87.51	46	76.78	20	72.13	30	70.03	65	42.36	106
Bulgaria	73.66	43	78.49	83	73.26	40	70.21	38	80.27	19	69.43	19
Greece	73.64	44	88.43	42	71.18	51	68.33	45	71.42	56	60.37	53
Spain	72.79	45	87.31	50	69.07	60	68.35	44	71.06	59	58.02	63
Bahrain	72.69	46	90.11	33	66.47	70	69.08	41	69.33	68	51.35	79
Kyrgyz Republic	72.35	47	83.64	67	74.44	35	65.13	52	75.58	37	65.01	35
Thailand	71.86	48	81.71	74	73.31	39	67.91	46	70.71	62	58.65	60
<b>Philippines</b>	<b>71.75</b>	<b>49</b>	<b>81.41</b>	<b>75</b>	<b>71.01</b>	<b>54</b>	<b>66.62</b>	<b>49</b>	<b>74.46</b>	<b>42</b>	<b>65.34</b>	<b>34</b>
Sri Lanka	71.69	50	91.44	23	67.12	65	62.34	66	72.91	51	63.47	37
Chile	71.45	51	83.17	70	73.31	38	64.60	54	74.55	41	61.50	47
Panama	71.18	52	79.64	80	72.02	47	66.16	50	75.27	38	63.44	38
Ecuador	70.84	53	85.57	58	76.25	23	60.58	76	73.49	48	61.75	43
Azerbaijan	70.72	54	83.18	68	61.65	87	66.66	48	78.85	24	60.93	50
Mongolia	70.71	55	87.42	49	66.84	67	63.19	63	73.64	46	59.81	56
Argentina	70.70	56	83.65	66	69.74	57	64.21	59	72.82	52	61.59	46
Serbia	70.54	57	88.22	43	65.17	75	64.67	53	70.00	66	54.91	69
Tajikistan	70.53	58	87.17	52	63.06	81	65.42	51	74.40	43	53.96	71
Macedonia, FYR	70.01	59	86.60	54	67.03	66	62.17	67	71.09	58	61.21	49
Uruguay	69.96	60	78.74	81	71.03	53	64.42	57	74.32	44	63.06	40
Barbados	69.78	61	95.92	3	55.62	108	63.96	60	63.30	82	50.71	83
Costa Rica	69.72	62	79.72	78	71.92	48	64.54	55	70.89	61	58.26	61
Moldova	69.67	63	82.97	71	68.83	62	62.95	65	73.51	47	58.69	59
Colombia	69.58	64	78.42	85	71.43	50	64.26	58	72.40	55	61.40	48
Mexico	69.25	65	82.03	73	68.60	63	63.60	62	69.35	67	58.06	62
	Overall Index		0-14 Age Group		15-24 Age Group		25-54 Age Group		55-64 Age Group		65 and over Age Group	

Country	Score	Rank	Score	Rank	Score	Rank	Country	Score	Rank	Score	Rank	Score
<b>Qatar</b>	68.64	66	90.31	32	65.95	72	59.55	82	67.93	71	51.30	80
<b>Jamaica</b>	68.62	67	84.92	61	61.52	88	64.54	56	64.27	78	55.89	67
<b>Vietnam</b>	68.39	68	77.21	89	75.43	31	61.19	70	70.92	60	59.64	57
<b>United Arab Emirates</b>	68.25	69	89.84	35	60.84	90	61.75	68	67.29	73	47.90	89
<b>Albania</b>	68.23	70	90.03	34	62.03	85	59.46	83	67.45	72	55.83	68
<b>China</b>	67.81	71	82.80	72	69.55	58	63.79	61	61.61	87	43.38	100
<b>Indonesia</b>	67.61	72	84.08	63	68.51	64	60.83	73	63.66	80	51.57	77
<b>Turkey</b>	67.57	73	85.09	59	72.34	44	58.21	86	63.30	81	53.66	74
<b>Trinidad and Tobago</b>	67.04	74	86.42	55	60.80	91	61.72	69	62.90	84	48.83	86
<b>Guyana</b>	66.67	75	83.17	69	60.62	93	60.52	77	67.20	74	56.39	66
<b>Mauritius</b>	66.53	76	85.89	57	64.04	79	58.98	85	63.94	79	50.45	84
<b>Bolivia</b>	66.47	77	78.46	84	64.19	78	60.87	72	70.22	64	56.93	65
<b>El Salvador</b>	66.31	78	77.00	90	70.85	55	60.13	81	66.72	75	53.88	72
<b>Peru</b>	66.31	79	74.79	94	66.14	71	60.73	75	73.25	49	60.29	55
<b>Dominican Republic</b>	65.88	80	74.31	96	64.74	76	60.89	71	71.34	57	60.62	51
<b>Jordan</b>	64.70	81	86.26	56	65.27	74	55.91	94	56.65	101	47.41	91
<b>Paraguay</b>	64.62	82	70.50	102	64.63	77	60.23	80	70.44	63	61.72	44
<b>Brazil</b>	64.51	83	71.51	100	69.28	59	60.31	78	65.79	76	52.42	76
<b>Ghana</b>	64.26	84	75.28	93	60.65	92	60.77	74	65.64	77	52.42	75
<b>Iran, Islamic Rep.</b>	64.16	85	87.86	44	66.65	69	53.60	106	56.57	102	44.67	96
<b>Egypt</b>	63.72	86	80.25	77	62.41	83	58.09	87	62.62	85	43.17	101
<b>Saudi Arabia</b>	63.69	87	78.24	86	66.77	68	57.49	89	61.23	91	44.95	95
<b>South Africa</b>	62.97	88	73.89	97	59.47	95	63.08	64	62.42	86	35.43	117
<b>Venezuela</b>	62.94	89	77.00	91	65.45	73	56.80	90	60.87	94	46.22	94
<b>Zambia</b>	62.06	90	68.06	108	61.94	86	60.29	79	63.17	83	50.93	82
<b>Bhutan</b>	61.83	91	81.09	76	57.46	102	56.52	91	53.50	109	44.63	97
<b>Cameroon</b>	61.64	92	70.28	104	60.95	89	59.30	84	61.10	92	47.81	90
<b>Honduras</b>	61.60	93	75.96	92	63.28	80	54.18	101	61.53	89	49.87	85
<b>Guatemala</b>	61.07	94	68.57	107	68.96	61	54.56	99	61.46	90	53.73	73
<b>Nicaragua</b>	60.60	95	69.10	106	55.25	110	56.07	93	69.28	69	57.74	64
<b>Botswana</b>	60.50	96	78.69	82	57.23	103	55.29	97	54.08	108	42.06	107
<b>Kuwait</b>	60.27	97	83.82	65	51.79	115	52.83	108	57.19	99	42.68	105
<b>Morocco</b>	59.65	98	77.36	88	57.10	104	51.88	113	58.60	97	48.38	88
<b>Uganda</b>	59.28	99	65.06	119	62.78	82	57.97	88	60.27	95	39.54	111
<b>Cambodia</b>	58.88	100	69.44	105	55.60	109	55.38	96	59.81	96	48.41	87
<b>Tunisia</b>	58.24	101	83.89	64	58.21	98	48.55	115	48.19	118	35.82	116
<b>Kenya</b>	57.90	102	67.94	109	54.64	113	56.47	92	56.75	100	40.94	108
<b>Namibia</b>	57.90	103	71.04	101	47.03	125	53.80	104	61.58	88	54.37	70
<b>Bangladesh</b>	57.84	104	77.88	87	58.16	99	47.21	122	57.58	98	46.92	92
<b>India</b>	57.73	105	84.91	62	56.46	106	48.11	119	46.48	120	33.74	119
<b>Lao PDR</b>	57.66	106	73.81	98	58.92	96	53.74	105	49.05	116	32.62	122
<b>Gabon</b>	57.48	107	72.79	99	50.67	119	52.61	109	61.05	93	42.92	103
<b>Nepal</b>	57.35	108	74.56	95	62.11	84	52.51	110	44.53	124	30.86	123
<b>Myanmar</b>	56.52	109	67.80	110	56.27	107	53.18	107	54.70	107	39.77	110
	Overall Index		0-14 Age Group		15-24 Age Group		25-54 Age Group		55-64 Age Group		65 and over Age	

Country	Score		Rank		Score		Rank		Score		Rank		Group	
	Score	Rank	Score	Rank	Score	Rank	Country	Score	Rank	Score	Rank	Score	Rank	Score
Rwanda	56.27	110	66.93	113	58.47	97	55.06	98	46.84	119	34.02	118		
Haiti	56.24	111	65.54	116	57.91	100	53.83	103	51.32	111	40.59	109		
Madagascar	56.17	112	63.98	120	55.19	111	54.04	102	56.16	104	43.98	98		
Benin	55.38	113	66.34	114	51.39	116	55.53	95	52.69	110	30.68	124		
Malawi	54.64	114	57.50	127	51.36	117	54.52	100	55.81	106	51.38	78		
Mozambique	53.64	115	61.72	123	52.93	114	51.36	114	51.07	112	43.47	99		
Tanzania	53.56	116	53.03	129	59.87	94	52.29	111	55.99	105	46.59	93		
Algeria	53.22	117	79.67	79	55.04	112	44.36	126	43.65	125	19.94	129		
Pakistan	53.10	118	67.16	112	51.29	118	48.15	118	50.85	113	39.13	112		
Ethiopia	53.02	119	65.25	118	57.75	101	46.38	124	48.52	117	42.74	104		
Burkina Faso	52.11	120	62.28	122	46.82	126	51.91	112	46.25	121	37.51	114		
Lesotho	51.62	121	67.56	111	49.95	120	47.88	120	41.33	127	33.73	120		
Senegal	51.49	122	63.90	121	44.22	129	48.45	116	50.36	114	42.97	102		
Côte d'Ivoire	50.34	123	65.30	117	49.04	122	47.62	121	41.34	126	28.49	125		
Burundi	50.17	124	65.57	115	48.81	123	44.23	127	56.25	103	27.40	127		
Guinea	50.17	125	58.16	126	47.82	124	48.43	117	50.12	115	38.17	113		
Mali	49.37	126	61.66	124	49.89	121	44.83	125	44.98	123	36.57	115		
Nigeria	48.86	127	53.19	128	56.58	105	46.96	123	45.71	122	32.62	121		
Chad	44.23	128	52.03	130	44.38	128	43.96	128	37.28	128	27.87	126		
Yemen	42.98	129	70.40	103	45.36	127	33.25	130	25.82	130	17.79	130		
Mauritania	42.33	130	59.57	125	38.85	130	38.02	129	34.54	129	24.21	128		

Noticeably, the Index shows that all countries covered can always exert their best effort in developing and utilizing their human capital. Across the scope of the Index, only 19 nations have tapped 80% of their human capital potential or more; 40 countries score between 70% and 80%; 38 countries score between 60% and 70%; 28 countries score between 50% and 60% and five countries remain below 50%. The Philippines ranks 49 and is among the 40 countries with overall HDI between 70% and 80%.

Across the globe, per region, only North America passes the 80% threshold. Western Europe, Eastern Europe and Central Asia scores play around 70% to 80% range and East Asia and the Pacific, Latin America and the Caribbean, and the Middle East and North Africa register at 60% to 70% range. Not crossing the 60% average threshold are South Asia and Sub-Saharan Africa.

## B. ASEAN

This year's development and deployment of ASEAN's human capital ranges from 56.52% (Myanmar) to 80.94% (Singapore). For unknown reasons, there was no mention of Brunei in the report. The region's average score is 68% which is over Latin America and the Caribbean (66.95%), Middle East and North Africa (61.54%), South Asia (59.92%), and Sub-Saharan Africa (55.44%); and significantly under Eastern Europe and Central Asia (74.02%), North America (80.41%), and Western Europe (79.86%).

From the table below, it can be deduced that ASEAN features a cluster of solid performers-Singapore, Malaysia, Philippines and Thailand- and a few countries which are underperforming their potential-Myanmar, Lao PDR and Cambodia. While there are shuffles in the top ranking, Singapore has maintained its top position in the region.

**Table 7: Human Capital Index, ASEAN, 2015-2016**

Country	Global Rank (GR) and Score (S)		Ranking within ASEAN	
	2015	2016	2015	2016
Cambodia	GR: 97 S: 59	GR: 100 S: 58.88	7	7
Indonesia	GR:69 S:67	GR:72 S:67.61	6	6
Lao PDR	GR:105 S:56	GR:106 S:57.66	8	8
Malaysia	GR:52 S:70	GR:42 S:74.26	3	2
Myanmar	GR:112 S:53	GR:109 S:56.52	9	9
<b>Philippines</b>	<b>GR:46 S:71</b>	<b>GR:49 S:71.85</b>	<b>2</b>	<b>4</b>
Singapore	GR:24 S:78	GR:13 S:80.94	1	1
Thailand	GR:57 S:69	GR:48 S:71.86	4	3
Vietnam	GR:59 S:68	GR:68 S:68.39	5	5

Source: Human Capital Outlook- ASEAN, 2016



With the region’s growing globally competitive population, notable member states fare successfully with international standards in terms of human capital. When evaluated on the ease of finding skilled employees, Malaysia, Singapore, Philippines, and Indonesia receive strong scores. The average monthly wage in ASEAN is US \$ 664.25 and ranges from US \$ 121 (Cambodia) to US \$ 3547 (Singapore). This does not cover Myanmar due to lack of supporting data. When it comes to workers in vulnerable employment, Singapore registers the least with only 9%; on the other extreme is Myanmar with 89%. Child labor is the highest in Cambodia (18.3%), Indonesia and Vietnam tie as the lowest country with the incidence of child labor.

**Table 8: Labor market conditions in ASEAN**

Country	Ease of finding skilled employees (7=easiest, 1=hardest)	Average monthly wage (US\$)	Workers in vulnerable employment (%)	Incidence of child labor (%)
Cambodia	3.4	121	64	18.3
Indonesia	4.3	174	36	6.9
Lao PDR	3.1	119	83	10.1
Malaysia	5.3	609	22	--
Myanmar	2.4	--	89	--
<b>Philippines</b>	<b>4.4</b>	<b>206</b>	<b>42</b>	<b>11.1</b>
Singapore	4.8	3547	9	--
Thailand	3.8	357	56	8.3
Vietnam	3.4	181	63	6.9

Note: “Workers in vulnerable employment\* refers to the number of unpaid family workers and informal sector \*own account workers\* as a share of total employment.

Source: World Economic Forum, 2016

The strong performance of the region, however, conceals the differing level of development within them. Such is the case in the perceived quality of skilling and training programs which varies widely within countries. In Cambodia, Lao PDR and Thailand, OJT training is rated higher than the rest of the member states’ education systems. Human Capital Outlook-ASEAN (2016) acknowledges that this is due to the effort of local companies undertaking their own measures to secure their supply of talent.

**Figure 1: Resulting disruptions to jobs projected by ASEAN business leaders**

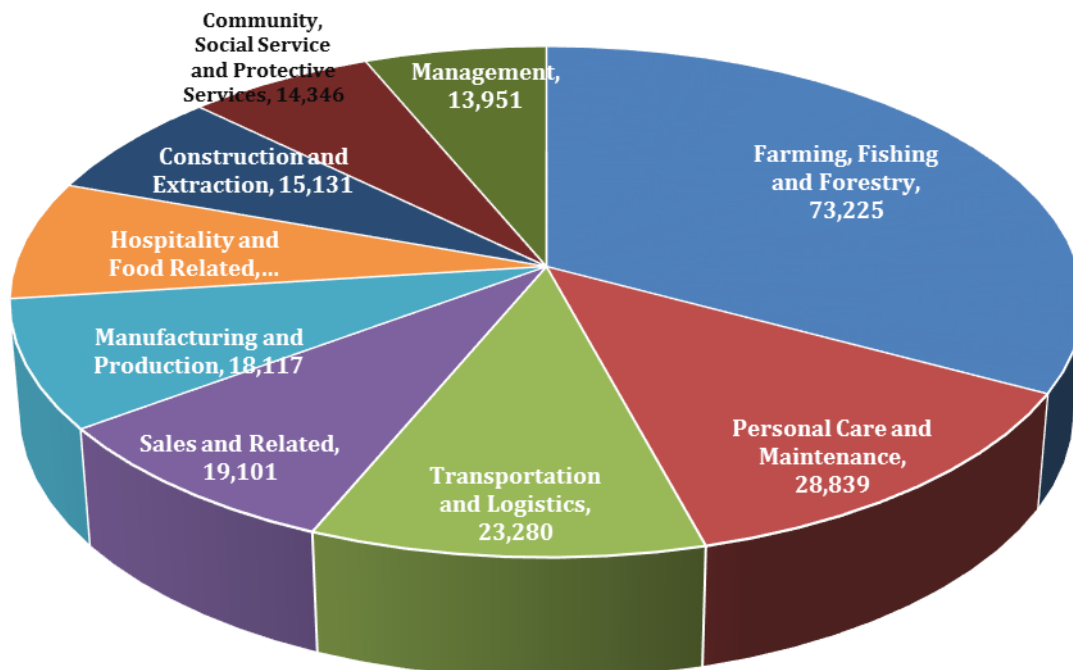


Source: Human Capital Outlook- ASEAN, 2016

Overall, for ASEAN business leaders, resulting disruptions to jobs are projected to be at 4:1- the former for job creation and the latter for displacement. The following job families in Figure 1 identifies sectors with expanding employment in ASEAN. This includes Transportation and Logistics, Sales and related, Management and Business, Legal and Financial sectors.

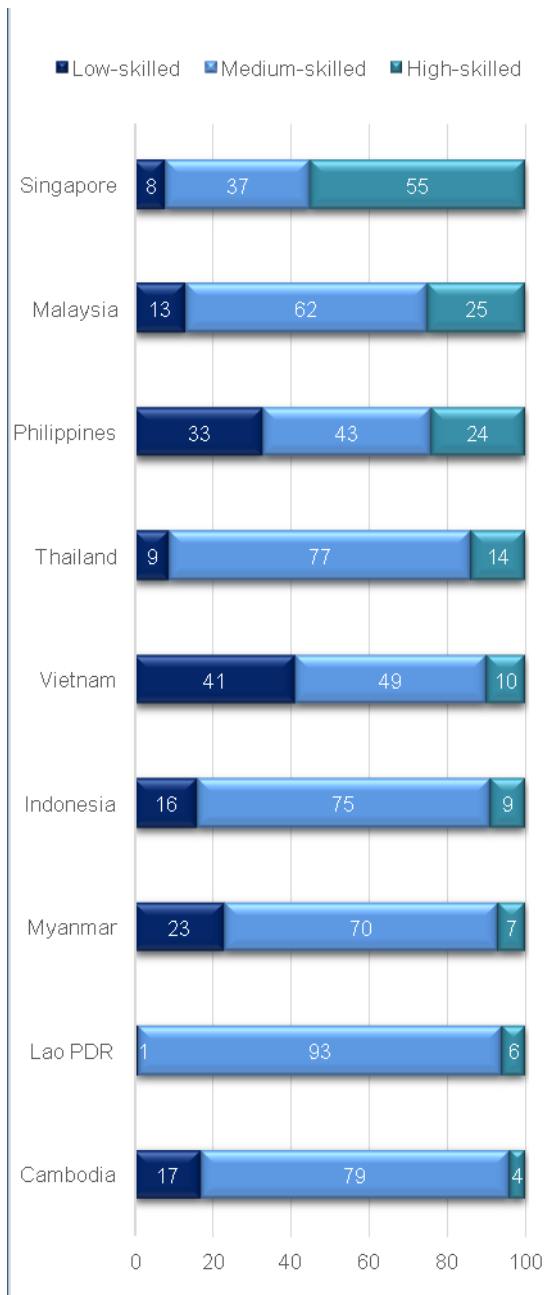
Agriculture is one of the key drivers of the Region’s economic growth. Because of its dynamic geography, ASEAN has a wide range of food and agriculture outputs with a number of ASEAN countries ranking as worldwide top exporters in certain agricultural products. As seen in Figure 2, this makes Farming, Fishing and Forestry as the prime job family where the workforce belongs to. Services follow but are disaggregated into their specific families.

**Figure 2: Size of job families, ASEAN**



Source: Human Capital Outlook-ASEAN, 2016

**Figure 3: Employment Share, ASEAN**



Source: Human Capital Outlook-ASEAN, 2016

In terms of employment share, Singapore once again takes the lead in having high-skilled workers with 55% (See Figure 3). It is followed by Malaysia and the Philippines which have a close number of high-skilled persons, with 25% and 24%, respectively. The gap of the two countries' high-skilled workers with that of Singapore, however, is wide. Thailand (14%) and Vietnam (10%) are average performers, relative to its neighbors. Indonesia (9%), Myanmar (7%), Lao PDR (6%) and Cambodia (6%) lag behind with scores less than 10%. These countries abound in medium-skilled workers.

The Philippines is rich in medium-skilled workers (43%); followed by low-skilled workers (33%), and then high-skilled workers (24%).

#### **IV. Country Initiatives**

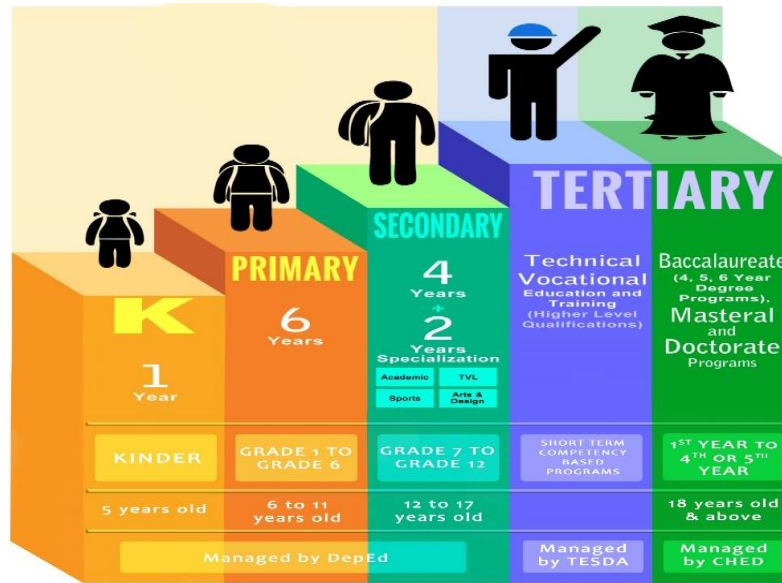
*“The realities of the modern world require a different Filipino.”*

Education should always be at the core of national development. In this changing time, the Philippines has undertaken critical educational reforms to address the growing demands of the labor market. Two of the major relevant reforms include the passage of the K to 12 Law and the development of the Philippine Qualifications Framework.

##### *A. Enhanced Basic Education Act (K to 12)*

RA 10533 or the Enhanced Basic Education Act/ K to 12 Law was passed on May 15, 2013. With its passage, basic education is now composed of Kindergarten and 12 years of basic education- six years of primary education, four years of Junior High School, and two years of Senior High School [SHS]). Before this law, basic education in the Philippines was only ten (10) years- six years of primary education and four years of secondary education. The salient component of the Act is the introduction of the SHS which began its implementation this year. It gives the students the opportunity to choose from the following tracks: 1) Academic; 2) Technical-Vocational and Livelihood; 3) Sports, and 4) Arts and Design. Specifically, the Academic Track includes three strands: Accountancy, Business and Management (ABM); Humanities, Education, Social Sciences (HESS); and Science, Technology, Engineering, Mathematics (STEM). The Technical-Vocational and Livelihood track has the following specialization in Agri-fishery Arts; Information and Communication Technology; Industrial Arts; and Home Economics.

Figure 4: The New Philippine Education System



Source: DepEd and TESDA, 2016

K to 12 is aimed at providing sufficient time for **mastery of concepts and skills**, **development of lifelong learners**, and **preparation of graduates for tertiary education**. At the same time, it is aimed at developing **middle-level skills for immediate employment and entrepreneurship**.

### B. Philippine Qualifications Framework

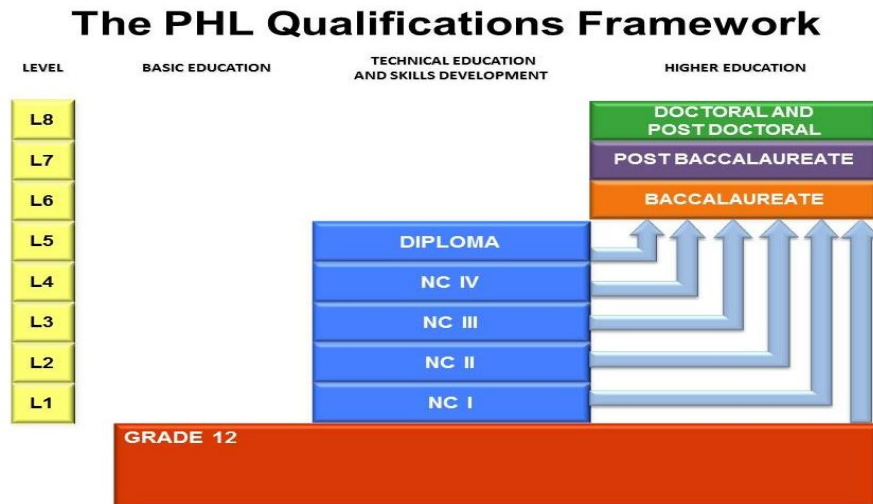
Another notable development in the Philippine educational system is the institutionalization of the Philippine Qualifications Framework as contained in the Executive Order 83 s. 2012. It describes the levels of educational qualifications and sets the standards for qualifications outcomes. It is a quality-assured national system for the development, recognition and award of qualifications based on standards of knowledge, skills and values acquired in different ways and methods by learners and workers of a certain country.

The PQF has 8 levels of qualifications. Levels 1-5 pertains to TVET qualifications and graduates of TVET programs are can earn (national certificate) NC I, NC II,



NCIII NCIV or Diploma for Level 5. Acquiring the NC assure that the person possesses and can demonstrate the competencies required to perform a particular job.

Figure 5: Philippine Qualifications Framework



Source: TESDA, 2012

One of the PQF's objective is its **alignment with international qualifications framework** to support the **national and international mobility** of Filipino workers through increased recognition of the value and comparability of Philippine qualifications.

## V. Philippine TVET in the Changing Time

TVET in the Philippines has been facing innovation issues head on. It has an adamant commitment in providing quality technical vocational education and is resilient in molding this commitment in accordance to the needs of the labor market. The demanding requirements of the Fourth Industrial Revolution is a challenge for the whole education sector but more so for TVET because of its technology-based nature. Though the revolution seems looming, TESDA has already laid the groundwork in its recognition to develop the changing skills needs, as indicated in the National Technical Education and Skills Development Plan 2011-2016, and its efforts to strengthen its linkages with the industry- the two most crucial strategies in coping with the Revolution.

## A. *Skills Development*

### 1. Technology-biased skills

Advances in technology have brought about changes in skills structures demanded by industries. These new technologies such as the use of industrial robots for higher levels of productivity have had major impacts on the structure of employment and significant implications for human resource in terms of the nature, level, and quality of skills required.

Progress towards a more knowledge-based, service-directed and information oriented markets call for a new type of skills training with a technology-bias to enable individuals and firms to participate in a workplace that has gone wired.

### 2. HOT (High Order Thinking) skills

With modernization and deregulation, particularly in the information technology industry, there will be a profound shift from low-level to high-level type of skills. These technological and organizational changes have a significant impact on the skills profile of workers in the production sector. Skills shall be one of the functions of the new economic order such that enterprises utilizing advanced technology and new organizational methods would require a different mix of skills.

Changes in skill composition are gearing towards the mental or problem solving type of skills rather than physical. Likewise, new competencies in industry as well as personal ones (such as teamwork and communication skills) will require a series of interventions over a period of time even after initial training.

Critical to the 21st century is not only technical competence but also creativity and innovation and adaptability to new technologies and

opportunities. This necessitates the development of technical, cognitive and behavioral skills conducive to high productivity and flexibility in the work environment.

HOT Skills will be needed in preparing the 21st century Filipino skilled workforce. These skills include problem solving, critical thinking, and innovation, being technological savvy, including communication and learning other people's languages. These have to be incorporated in the TVET curriculum, learning systems and approaches.

### *B. Industry involvement*

The TVET System under TESDA is competency-based, assessment driven and occupation-focused. As such, it starts with the industry definition of competency standards and ends with the industry utilizing TVET system outputs that are able to demonstrate the competence desired in the workplace. TESDA calls technical experts from the industry in the whole process of developing the competency standards. This is in belief that the industry, being the end users of human capital, should be in the prime position in developing the training regulations which will be the basis in equipping the trainees with relevant skills.

Aside from the industry's strong involvement at the policy level, they are also engaged in the implementation given that 90% of TVET providers are private TVET institutions.

Since the Fourth Industrial Revolution necessitates businesses to participate in the formation of knowledge and skills of the students; and thus, veer away from their usual practice of simply utilizing ready-made human resource; TESDA's Dual Training System can be maximized as a tool to deepen the involvement of businesses in education, and

consequently, employment. With trainees undergoing training conducted by businesses as part of the curriculum, assurance of quality and relevant skills would be greater. Exposure to the actual work goes beyond training people on their duties and responsibilities but teaching them work ethics- something the Revolution asks for.

From this, it can be clearly observed that TESDA finds it imperative to engage its partners to actively participate in the formulation and implementation of policies and programs that address TVET issues.

## VI. Way Forward

*“The ability to anticipate and prepare for future skills requirements, job content and aggregate effect on employment is increasingly critical for businesses, governments and individuals in order to fully seize the opportunities presented by these trends- and to mitigate undesirable outcomes.”*  
– *The World Economic Forum, 2016*

The World Economic Forum (2016) maintains that technology, and its possible inimical effects, is not of exogenous source and thus under the control of the people. Since humans are responsible for technological development, humans are also responsible to exert every effort in shaping the Fourth Industrial Revolution and directing it toward a future that reflects the universal good.

Now that the Fourth Industrial is unfolding, its impact has been felt and it will continue to alter the employment landscape and skills requirements. This drastic change is said to result to transformations in recruiting, training and managing talent. Apparently, not being able to prepare for such drastic change will take its toll on the society as a whole.

Coping with any Industrial Revolution requires the creation of training systems which are capable of developing new skills. The past revolutions tell us that building these training systems takes decades. Given the projected pace and scale of the Fourth Industrial Revolution, the Forum asserts that the usual coping pace may not work. Further, the Forum encourages stakeholders to take action now to avoid fast-growing unemployment and inequality (for governments), and shrinking consumer base (for businesses).

To be able to capitalize on the fruits of the Revolution, the Forum advocates for what they call *talent revolution*. For a talent revolution to take place, governments and businesses will have to change the way they handle education, skills and employment, as well as the way they work with each other. Ideally, businesses have to take an active role in developing human resource.

*“Firms can no longer be passive consumers of ready-made human capital. Governments, on the other hand, will need to re-consider the education models of today. As the issue becomes more urgent, governments will need to show bolder leadership in putting through the curricula and labor market regulation changes that are already decades overdue in some economies.”*

*-World Economic Forum, 2016*

As to TVET, now more than ever, its role in the economy has become remarkably significant. As the Forum expresses, the Fourth Industrial Revolution will need strong vocational skills along with social and creative skills.

TESDA, for its part, envisions a more globally competitive Filipino workforce by instilling technical competence, innovation and creativeness, higher order thinking skills, foundational life skills, and desirable work attitudes and behavior. These skills will facilitate greater mobility across occupations and locations. The development of these critical skills is aimed at meeting the present and future



skills requirements. It essentially involves making our workforce more employable, productive and flexible to the changing requirements of industry and the labor markets, locally and overseas.

To achieve this, in light of the challenges of the Fourth Industrial Revolution, TESDA must look into the following:

1. Ensure that the training regulations remain congruent to the needs of the labor market. First, it is fitting to implement a mandatory review of TRs especially those unassessed for more than 3 years. Second, a review of the core skills is suggested; given the influx of the changing core skills requirements. Innovation, creativeness, and higher order thinking skills, have to be visibly taught to students/trainees.
2. Along with the development of higher competencies and TRs, TESDA must seriously continue and improve the incorporation of the 21<sup>st</sup> century skills in all TRs. TESDA's initial step- the review the basic competencies- must be heavily pursued with the goal of aligning it with the 21<sup>st</sup> century skills framework. Moreover, TESDA has to find ways to develop assessment arrangements to align the requirements of the Philippine Qualifications Framework Level 1 to Level V (Diploma).
3. TESDA could also develop a system that would provide value to low level skilled workers who can be given opportunities to pursue higher level qualifications thru life-long learning initiatives.
4. To ensure that all TVET stakeholders are grounded, TESDA must initiate discussions with the industry and other government agencies of the implications of the Fourth Industrial Revolution to human resource development. Along with this, TESDA may opt to revive its industry skills studies complementing the Industry Roadmaps of the Department of Trade

and Industry (DTI) and the HRD Roadmap initiated by the Department of Labor and Employment (DOLE). This would equip TESDA with empirical and up-to-date data and materials necessary in addressing TVET concerns. Profiling of existing industries in the country would help assess the current level of industrialization and identify skills requirements per industry.

5. With regard the technological requirements, it is but proper for TESDA to acquire the necessary equipment for its programs to remain relevant. It is about time the TESDA Technology Institutes (TTIs) be developed and elevated as technology and innovation centers on TVET. For the private TVET providers, TESDA should find ways on how they can be assisted to upgrade their equipment.
6. The Agency could also look into its Dual Training System as it is the fusion of school and business in educating trainees. With DTS, the need for necessary equipment could be easier addressed with the strong support of the private sector; given the limited resources of the government and the dynamic technological requirements of businesses. The strengthening of DTS is also in line with the Human Capital Outlook-ASEAN (2016) finding that some low-performing countries in ASEAN are, surprisingly, rated higher than the rest in terms of OJT training. Incontestably, DTS gives businesses a more active role in securing their own pipeline of human resource. In this system, the actual specific skills requirements are taught by the human resource end users themselves- which lessens skills instability/ skills redundancy and consequently, unemployment.
7. TESDA must continue and initiate benchmarking with other countries, especially those that are already moving towards the development of skills and competencies required by the Fourth Industrial Revolution. Per the Forum (2016), the frontrunners in the Revolution include: Finland,

Switzerland, Sweden, Israel, Singapore, the Netherlands and the United States. Incidentally, these countries were considered frontrunners as they are all known for being early and enthusiastic adopters of ICT- this, coupled with a supportive enabling environment, infrastructure and skills supply, among other factors – is the groundwork in paving the way for the full blooming of the Revolution- something the Philippines may reference its future development into.

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