Education in the Asia-Pacific Region: Issues, Concerns and Prospects 55

Brajesh Panth
Rupert Maclean *Editors*

Anticipating and Preparing for Emerging Skills and Jobs

Key Issues, Concerns, and Prospects

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Education in the Asia-Pacific Region: Issues, Concerns and Prospects

Volume 55

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Series Editors' Introduction

This timely, cutting-edge volume by Brajesh Panth et al., on *Anticipating and Preparing for Emerging Skills and Jobs,* is the latest book to be published in the long-standing Springer Book Series 'Education in the Asia Pacific Region: Issues, Concerns and Prospects'. The first volume in this Springer series was published in 2002, with this edited book by Panth and Maclean being the 55th volume to be published to date.

Anticipating and Preparing for Emerging Skills and Jobs examines the main, powerful drivers of change impacting upon society and the economy and, through them, on the evolving world of work, changing occupational structures and patterns, and workplaces. The book identifies and explores the implications of such developments for changes in education and training with regard to Kindergarten through to Grade 12, Technical and Vocational Education and Training (TVET), and Higher Education.

The volume is divided into seven main parts, with an introduction and a conclusion, and consists of 40 cutting-edge articles. The book brings together eminent policy-makers, practitioners, and researchers with a keen interest in skills development for employability, and the changing nature of education and training, as they seek to adjust to meet the demands of the workplace and a dramatically changing world of work.

The articles vary a lot in style with some adopting a traditional academic approach to the particular topic being examined, while other articles are opinion pieces or case studies. All the articles are relatively short, being up to 3,000 words in length. As such the intention of this book is to provide a wide-ranging smorgasbord of ideas on the topic of *anticipating and preparing for emerging skills and jobs.*

In terms of the Springer Book Series in which this volume is published the various topics dealt with in the series are wide-ranging and varied in coverage, with an emphasis on cutting-edge developments, best practices, and education innovations for development. Topics examined in the series include: environmental education and education for sustainable development; the interaction between technology and education; the reform of primary, secondary, and teacher education; innovative approaches to education assessment; alternative education; most effective ways to achieve quality and highly relevant education for all; active aging through active learning; case studies of education and schooling systems in various countries in the region; cross country and cross-cultural studies of education and schooling; and the sociology of teachers as an occupational group, to mention just a few. More information about the book series is available at http://www.springer.com/series/5888.

All volumes in this series aim to meet the interests and priorities of a diverse education audience including researchers, policy-makers, and practitioners; professionals working in international development; tertiary students; teachers at all levels within education systems; and members of the public who are interested in better understanding cutting-edge developments in education and schooling in Asia and the Pacific.

The main reason why this series has been devoted exclusively to examining various aspects of education and schooling in the Asia and Pacific region is that this is a particularly challenging region. It is renowned for its size, diversity, and complexity, whether it be geographical, socioeconomic, cultural, political, or developmental. Education and schooling in countries throughout the region impact on every aspect of people's lives, including employment, labor force considerations, education and training, cultural orientation, and attitudes and values. Asia and the Pacific is home to some 63% of the world's population of 7 billion. Countries with the largest populations (People's Republic of China, 1.4 billion; India, 1.3 billion) and the most rapidly growing mega-cities are to be found in the region, as are countries with relatively small populations (Bhutan, 755,000; the island of Niue, 1,600).

Levels of economic and sociopolitical development vary widely, with high-income, middle-income, and low-income countries. Asia contains the largest number of poor of any region in the world, the incidence of those living below the poverty line remaining as high as 40% in some countries in Asia. At the same time, many countries in Asia are experiencing a period of great economic growth and social development. However, inclusive growth remains elusive, as does growth that is sustainable and does not destroy the quality of the environment. The growing prominence of Asian economies and corporations, together with globalization and technological innovation, are leading to long-term changes in trade, business, and labor markets, to the sociology of populations within (and between) countries. There is a rebalancing of power, centered on Asia and the Pacific, with the Asian Development Bank in Manila declaring that the twenty-first century could be 'the Asian Century' if Asian countries are able to avoid the middle-income trap.

We believe this book series makes a useful contribution to knowledge sharing about education and training in Asia and the Pacific.

Any readers of this or other volumes in the series who have an idea for writing their own book (or editing a book) on any aspect of education and/or schooling, that is relevant to the region, are enthusiastically encouraged to approach the series editors either direct or through Springer to publish their own volume in the series, since we are always willing to assist perspective authors to shape their manuscripts in ways that make them suitable for publication.

February 2020

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Foreword

The former Secretary-General of the United Nations, Kofi Annan, often argued that literacy is the *key* to unlocking the cage of human misery: that it is essential to realizing the potential of every human being, and to opening up a future of freedom and hope for all.

If education is the key to improving the human condition, then skills development for employability and entrepreneurship is the *Master Key* to achieve individual and societal development. The reason is that work is a major feature of most peoples' lives. Quality jobs have a major impact on their self-identity, social and economic status, standard of living, and quality of life. It is, therefore, the Master Key that opens many important doors including: poverty alleviation; sustainable development; the promotion of greater equity, justice, and fairness on society; peace building; and community development.

The dominant feature of the opening decades of the twenty-first century has been the undeniable fact that we are all living through a period of seismic change and disruption. This is true, to varying degrees, for populations in all regions and countries of the world, regardless of their particular level of economic development, and sociopolitical characteristics.

This enormous sea change is to a large extent due to the combined impact, and multiplier effect, on both work and life, of the Fourth Industrial Revolution, globalization, urbanization, unprecedented labor mobility, and harnessing of both new and continuously emerging information and communication technologies. The COVID-19 pandemic has led to a surge in online learning at all levels of education as well as a way of continuing to provide training. This is the time to learn from global good practices and build evidence to transform teaching and learning.

This disruptive change has brought about a paradigm shift in the ways in which individuals, societies, and governments think and prepare in response to the rapidly changing world of work.

Policy-makers and practitioners alike are increasingly debating about the emergence of a fundamentally changing economic paradigm in which long standing, taken-for-granted assumptions and norms concerning work and life have been thrown into question. While the disruption is creating new opportunities from unseen power of artificial intelligence and big data analytics to augment human intelligence, it is also creating important new challenges and uncertainties that could exacerbate inequities. The response to the magnitude of impact that this revolution is having on skills and workforce development requires transformation of the education and training systems in close collaboration with different sectors and stakeholders.

In the light of such change and developments, this is an opportune time to re-examine important matters relating to the changing world of work, as countries seek to reconfigure their economies to meet emerging demands of the Fourth Industrial Revolution or Industry 4.0. The changes are in fact so profound and far reaching that skill formation has to be reengineered to provide solid foundational skills comprising literacy, numeracy, digital, and soft skills, followed by occupational skills in partnership with employers.

The various articles in this book examine the views, and often radical perspectives, of eminent policy-makers, practitioners, and researchers regarding *Anticipating and Preparing for Emerging Skills and Jobs,* with particular reference to the Asia and Pacific region.

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Abbreviations

4IR	Fourth Industrial Revolution
ADB	Asian Development Bank
AI	Artificial Intelligence
AI2	Allen Institute for Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
BMZ	German Federal Ministry for Economic Cooperation and Development
CARE	Cooperation for Advancement, Rehabilitation and Education (Pakistan)
CBT	Competency-based Training
CET	Continuing Education and Training
CFL	Center for Flexible Learning (Fiji)
CGE	Center for Global Entrepreneurship (Republic of Korea)
CROP	Council of Regional Organizations of the Pacific
CSC	Civil Service College (Singapore)
CVIF	Central Visayan Institute Foundation (Philippines)
DepEd	Department of Education (Philippines)
DET	Dual Education and Training
DGT	Directorate General of Training (India)
DLP	Dynamic Learning Program (Philippines)
DTS	Dual Training System
EdTech	Education Technology
ELLN	Early Language Literacy and Numeracy
ESG	Enterprise Singapore
ETF	European Training Foundation
ETH	Swiss Federal Institute of Technology in Zurich (*Eidgenössische Technische Hochschule Zürich*)
FIT	Fashion Institute of Technology (Republic of Korea)
FY	Fiscal Year
GEMP	Gender Equity Model Program (Tajikistan)

GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit* (German Society for International Cooperation)
GNI	Gross National Income
GOLWS	General Office for Labor and Social Welfare Services (Mongolia)
GSSTU	Graduate School at Shenzhen, Tsinghua University (People's Republic of China)
HKUST	Hong Kong University of Science and Technology
HRD	Human Resource Development
IACs	Industry Advisory Committees
IDEB	Basic Education Development Index
IGC	Incheon Global Campus (Republic of Korea)
IGNITE	Inspiring Goals Now In Technology and Entrepreneurship
IGSC	Incheon Global Startup Campus (Republic of Korea)
IHLs	Institutes of Higher Learning
IoT	Internet of Things (Republic of Korea)
ITB	Institut Teknologi Bandung (Indonesia)
ITC	International Trade Centre
ITE	Institute of Technical Education
ITF	Industry Training Federation
ITOs	Industry Training Organizations
ITT	International Trading Track
K-12	Kindergarten to Grade 12
KAIST	Korea Advanced Institute of Science and Technology
KCISA	Korea Culture Information Service Agency
KMUTT	King Mongkut's University of Technology Thonburi (Thailand)
LAS	Learning Activity Sheet
LFS	Labor Force Surveys
LSE	Lower Secondary Education
MBOT	Maritime Business and Operations Track
MET	Maritime Economics Track
MFI	Meralco Foundation, Inc. (Philippines)
MOET	Ministry of Education and Training (Viet Nam)
MOLME	Ministry of Labor, Migration and Employment (Tajikistan)
MOOCs	Massive Open Online Courses
NAM	National Achievement Monitoring (Viet Nam)
NAT	National Achievement Test (Philippines)
NGOs	Nongovernment organizations
NSDC	National Skill Development Corporation (India)
NSDP	National Skills Development Policy (Bangladesh)
NTL	Next Technology Leaders
OECD	Organization for Economic Cooperation and Development
OJT	On-the-job training
PACREF	Pacific Regional Education Framework

PAG	Project Administration Group
PCCI	Philippine Chamber of Commerce and Industry
PCP	Professional Conversion Program (Singapore)
PES	Public Employment Services (Republic of Korea)
PET	Pre-employment training
PHES	Pacific Heads of Education Systems
PILNA	Pacific Islands Literacy and Numeracy Assessment
PISA	Programme for International Student Assessment
PLC	Professional Learning Circles
PMEs	Professionals, Managers, and Executives
PRC	People's Republic of China
PTRCA	Porsche Training and Recruitment Center Asia
R&D	Research and Development
RCs	Regional Centers
RIEE	Research, Innovation, Education, and Entrepreneurship
RMG	Readymade Garment
ROK	Republic of Korea
SBU	Stony Brook University
SDGs	Sustainable Development Goals
SEAMEO	Southeast Asia Ministers of Education Organization
SEIP	Skills for Employment Investment Program (Bangladesh)
SESDP	Secondary Education Sector Development Program (Viet Nam)
SMEs	Small and Medium sized Enterprises
SMILE	Stanford Mobile Inquiry-based Learning Environment
SMU	Singapore Management University
SSG	SkillsFuture Singapore
STEAM	Science, Technology, Engineering, Arts, and Mathematics
STEM	Science, Technology, Engineering and Mathematics
STVETP	Strengthening Technical and Vocational Education and Training Project (Tajikistan)
SUNY	State University of New York
SY	School Year
TAESTP	Training and Adult Education Sector Transformation Plan (Singapore)
TBSI	Tsinghua-UC Berkeley Shenzhen Institute
TESDA	Technical Education and Skills Development Authority (Philippines)
TESS	Teacher Education through School-based Support (India)
TIMSS	Trends in International Mathematics and Science Study
TOP	TESDA Online Program (Philippines)
TPD	Teacher Professional Development
TVET	Technical and Vocational Education and Training
TVIs	Technical Vocational Institutions
TVL	Technical Vocational-Livelihood
UGC	Universities Grants Committee

UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
USE	Upper Secondary Education
USP	University of the South Pacific
UVC	University Virtual Campus (People's Republic of China)

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Chapter 1
Introductory Overview: Anticipating and Preparing for Emerging Skills and Jobs—Issues, Concerns, and Prospects

Brajesh Panth and Rupert Maclean

Education provides the foundation for skills and lifelong learning opportunities to thrive in professional and social life. However, unlike in the past, the current generation of learners is facing unprecedented uncertainty in how they anticipate and prepare for emerging skills and jobs, due to the impact of automation and continuous technological disruptions. On the one hand, many countries are facing a "learning crisis" although they have achieved remarkable progress in improving access to education at all levels. On the other hand, skills mismatches are growing to a point where many graduates are unable to get jobs, while employers are often unable to fill vacancies due to the changing nature of skills and jobs. The current schooling systems, which was founded around 100–150 years ago to enhance the efficiency of the first and second industrial revolutions, is no longer adequate for people to thrive and prosper in the current world, which is increasingly driven by artificial intelligence, automation, and innovation.

Research evidence clearly shows that student learning outcomes, as measured by tests such as the Organization for Economic Cooperation and Development's (OECD) Programme for International Student Assessment (PISA), and Trends in International Mathematics and Science Study (TIMSS), are more closely associated with economic development and innovation than are mean years of schooling (Hanushek and Woessmann 2012).[1] Most developing countries have made remarkable progress in enhancing access to education, including an improved gender balance

[1]Hanushek and Woessmann. 2012. Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. Journal of Economic Growth.

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at all levels of education. However, it is also clear from research that going to schools does not guarantee learning (World Bank 2018).[2] Research on the outcomes of the Programme for the International Assessment of Adult Competencies (PIAAC) also shows that poor learning at the initial stage can continue at the higher levels (Pritchett 2019).[3] Therefore, without ensuring learning for all, life choices of students who are disproportionately affected by poor learning, will be more limited.

It is critical to understand that the same strategy that has worked well to expand access to primary and secondary education, may not contribute to making substantial improvements in student learning outcomes (Pritchett 2019).[4] The current education system is no doubt overdue for essential transformation to adapt to the needs of the Fourth Industrial Revolution (4IR), which is described as a stage of continuous digital disruptions, involving the fast-changing nature of jobs and short shelf life of skills. In order to prepare self-directed learners who can reskill and upskill themselves, throughout their long professional life, to adapt to new and emerging requirements, it is important to equip learners with different types of skills (whether they be cognitive, noncognitive, and/or occupational skills).[5] This means it is essential to rethink and reimagine teaching and learning, since learning is not only happening in formal settings such as in schools, colleges, and training centers, but also in the home, workplace, and in other nonformal and informal settings.

At the postsecondary level, there is a growing advocacy for competency-based and performance-based education away from prestige based, elitist education, particularly in the United States, in order to enhance employability and reduce the costs of tertiary education.[6] This is also happening in a wide range of other countries. It has been estimated that about 80% of all jobs worldwide require some form of vocational skills (Maclean and Wilson 2009). Vocational skills are classified as those which allow an individual to master a particular subject, procedure, or area of understanding, that is applicable to a work career. With the acquisition of knowledge, skills, and values for working, there is an increase in opportunities for productive work and sustainable livelihoods. According to UNESCO, "TVET refers to those aspects of the education process that involves, in addition to solid general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding, and knowledge related to work and occupations in various sectors of economic life". This is sometimes also called Applied Learning.

The urgent challenge facing all countries is to take effective action to match their systems of education and training to meet the actual, and rapidly evolving, employment needs of their economy and society's vocational skills. That is why

[2]World Bank. 2018. World Development Report: Learning to Realize Education's Promise.

[3]Lant Pritchett. February 13, 2019. Research on Improving Systems of Education (RISE). https://www.riseprogramme.org/blog/learning_crisis_at_top.

[4]Discussions with Lant Pritchett at the Asian Development Bank. August 2019.

[5]Cognitive skills refer to literacy, numeracy, and analytical skills; noncognitive skills refer to soft skills such as critical thinking, creativity, communication, and collaboration; and occupational skills refer to skills needed to perform specific jobs.

[6]Horn and Dunagan. June 2018. Innovation and Quality Assurance in Higher Education. Christensen Institute.

relevant and high-quality basic skills for all comprising foundational skills is vitally important for the continuing prosperity and development of all countries, and to help achieve greater equity, justice, and fairness in the countries concerned.

This book is concerned with taking a holistic approach to different types of skills that employers are looking for and examining how education and training systems are responding to rapidly changing requirements in light of the 4IR. The book highlights the importance of different types of skills (cognitive, noncognitive, and occupational), as well as lifelong learning, to improve the life choices of a growing number of mobile workforces that expect to have productive employment during an increasingly longer working life and with a changing definition of jobs.

There are several important matters that greatly impact on education and training during what is a period of unprecedented change due to disruptions in virtually all areas. The shift from the industrial age to the information age and knowledge economies, and from localization toward globalization, has considerable implications for TVET, as do moves to effectively harness information and communications technologies.

Dominant importance of the 4IR: As Klaus Schwab, Founder of the World Economic Forum has pointed out: "we stand on the brink of a technological revolution that will fundamentally alter the way in which we live, work and relate to one another" (Tadeu and Brigas 2018). With the 4IR there have been major innovations in production techniques and in the ways of organizing work, accommodating changing employment arrangements, and increasing the use of technology, in particular high-speed internet, robotics, and artificial intelligence. There has also been a shift toward more and more occupations requiring an expanding repertoire of high-level skills and technology.

The 4IR has profound implications for how we best prepare people for the changing world of work, particularly in the area of applied learning and skills development for employability and for life. For example, it is estimated that 75% of future jobs will involve science, technology, engineering, and mathematics (STEM) knowledge and skills (Maclean 2019). But it is also important to integrate and promote the "arts" to stimulate imagination, creativity, and entrepreneurship.

The provision of such higher-order cognitive skills cannot be adequately satisfied by our present education and training systems. The types of changes occurring will mean that increasing numbers of people will need new skills, reskilling, and upskilling.

Twenty-first Century Skills and the greening of economies: In order to combine human intelligence to innovate with the computing power of machines, countries need to prepare their workforce with vitally important twenty-first century skills such as critical thinking, creativity, communication, collaboration, problem-solving, cross-cultural competencies, work ethic, empathy and social, emotional and digital intelligences. In other words, there is a need for workers with "multiple intelligence". Such skills constitute a different dimension of teaching and learning and, alongside core literacy and numeracy skills, are viewed as important for helping students ensure a successful transition to life and work after education, and to remain up-to-date. It is also equally important to foster academic and sustainable mindsets so that educators are able to improve students' research and development capacity for sustainable development, collaboration, and positive attitudes toward healthy and green growth.

Referring to anticipating and preparing for emerging skills and jobs, Satya Nadella, the CEO of the technology giant Microsoft, says that society needs to acknowledge the massive displacement of jobs that has occurred, and will increasingly occur, due to globalization. He said that "What has happened in the first phase of globalization is that, a lot was created. A middle class was created even in Asia. The second phase of globalization has to tackle the inequities that got created in every country. I see a future of innovation which distributes computing and human collaboration around technology".

Quality education and relevant skills to catalyze economic and social transformation: Many reports are highlighting the transformational changes affecting the ways we work and live. The nature of work and the structure of economies are being changed through rapid changes in technology, unprecedented labor mobility, globalization, and demographic changes. The evolving world of work calls into question the skills that people need to develop in order to navigate these changes. Those who are able to adapt to emerging needs in a flexible and integrated manner are more likely to thrive. What this means is the need to transform education and training systems to mimic the real-world situation through experiential and project-based learning. In this regard, there are four key questions that need to be answered: (1) what are employers looking for when recruiting for their workplaces? (2) what are individuals looking for in their life's work? (3) what role does education and training play in addressing these expectations? and (4) how can technology enhance learning and employability?

Equity issues with particular reference to gender and youth: There are more than 100 million school-age children and youth in the Asia and Pacific region, mostly girls/women and disadvantaged groups, that are either out of school or lack employable skills despite schooling and college education, due to the poor quality of education received. To realize the ambitious quantitative and qualitative targets of Sustainable Development Goal 4 (on education) and Goal 8 (on employment), it is important to prioritize the following three critical areas: (i) going beyond physical access, to enhancing opportunities for females, disadvantaged groups and people with disabilities; (ii) finding nontraditional ways of preparing such target groups; and (iii) promoting partnerships to enhance the delivery and quality of education and training through better targeting.

Need to be future-oriented: It is widely recognized that the rapid pace of technological, social, demographic, and political changes will continue to accelerate and create more volatility and uncertainty in the future. But this will also create new opportunities, as new jobs requiring new set of skills are being created. There is a need to develop a future-oriented curriculum framework for education and training so that learners can prepare and adapt to emerging needs with confidence and know how to reskill and upskill to remain current and effective.

Vocationalization of education: Many countries view secondary education as academic preparation for entrance to higher (postsecondary) education. Over the past two decades, greater attention has been given to the relevance of what is taught at the secondary level to best prepare learners for the workforce and vocational work. In doing so the aim has been to meet the needs of students who not only go onto higher education, but also those likely to enter the workforce directly from secondary school. This trend has resulted in what has been called the "vocationalization of secondary education". Vocationalized secondary education refers to a curriculum which remains overwhelmingly "general" with foundational skills (cognitive, digital, and soft skills), but which also includes vocational subjects as a minor portion. In addition, some tertiary institutions, including famous, high standard institutions such as the University of Oxford in the United Kingdom, are also exploring the "vocationalization of higher education" to prepare their graduates for a smooth transition into the workforce. This is a "competency-based" approach.[7]

Assessing the Appropriateness of Various Skills for Employability

When examining the matter of "anticipating and preparing for emerging skills and jobs", there are several key matters that need to be addressed regarding the appropriateness of the repertoire of skills necessary for effective employability.

- The definition of foundational skills is changing from the 3Rs (reading, writing, arithmetic) which have traditionally been addressed in all education and training programs, to the 3Rs plus digital literacy, soft skills, and occupational skills. A major challenge is how to both teach and assess the soft skills over time.
- Many developing countries are facing a "learning crisis". The reality is that despite significant improvements in enrollment and attendance, many students are not successfully learning in schools due to a wide variety of reasons such as an irrelevant and outdated curriculum, unprepared teachers, and a weak or incomplete assessment system. In many cases, teachers are not able to teach students at the grade level due to diverse needs and an uneven readiness of students, and weak assessment. As a result, fast learners are progressing well while slow learners lag behind or they end up preparing for the tests through rote learning or dropout.
- Many students going to TVET programs come from weak schooling, and lack the foundational skills needed to better understand and apply what they learn. It is important to ensure that TVET programs also include foundational skills that help learners to learn better and create opportunities for them to pursue different pathways by investing in lifelong learning and strengthening their skills as a continuous process. Employers also need to be incentivized to invest in reskilling and upskilling their workforce to be competitive, productive, and innovative.

[7]UNESCO-UNEVOC in Bonn organized a regional UNESCO Forum on "*Vocationalization of Higher Education: Issues and Prospects*" at the University of Oxford in 2014, with the Education Department in the University of Oxford as partner in organizing the Forum, which addressed the matter of the "Vocationalization of Higher education".

- Online blended and simulated learning is evolving as a cost-effective way of massifying teaching and learning without compromising on education quality. For instance, Indonesia is embarking on a large scale online learning ecosystem to expand enrollment in regular higher education by allowing students in universities to earn up to 50% credit from online courses. Such initiatives also help to strengthen lifelong learning. Curriculum could become highly relevant by curating and including some of the best online courses offered by the providers of massive open online courses (MOOCs). Countries could draw on world-class courses to prepare teachers and to ramp up skills in priority areas, such as machine learning, artificial intelligence, and big data analytics. With continued improvements in technology, it will be possible to make learning more authentic and experiential. However, it is important to collaborate with proven regional and global partners to ensure high-quality blended learning.
- The demand for online learning has surged during the COVID-19 pandemic due to school closures in over 180 countries, affecting over 1.5 billion students worldwide. Governments are scrambling to provide online learning to students to continue uninterrupted learning. Public education has never seen such a large scale of online learning initiative. Some important lessons have come out from the People's Republic of China[8]: (i) more equitable access to infrastructure (connectivity, platforms, and devices), (ii) preparing teachers to manage and deliver high-quality instructions, (iii) ensuring high-quality content aligned to national curriculum and reliable assessment tools, (iv) preparing students to learn at their own pace, (v) ensuring parents are able to get feedback on their children's performance to support learning, and (vi) facilitating partnership between public and private institutions to ensure synergy in enhancing teaching and learning. It is important to draw on other good practices to build on the experience emanating from the COVID-19 pandemic.
- Artificial Intelligence and big data analytics are very promising in a number of areas, such as (i) to help teachers assess students continuously through personalized and adaptive learning to ensure that everyone is acquiring the needed competencies; (ii) to develop a real-time labor market intelligence system to identify how occupations are changing, including how new ones are emerging and old ones are disappearing, leading to reduced skills mismatches and improved matching between emerging needs and individual profiles of job seekers; and (iii) to make teaching and learning more transparent and accountable by generating and sharing data on learning and engagement.

[8] Xu et al. (2020).

Overview of the Contents of This Book

This edited volume on *Anticipating and Preparing for Emerging Skills and Jobs* consists of a compilation of eight parts, including the introductory and concluding parts, and 40 articles which refers to three levels of education (K-12, TVET, and higher education) as well as important themes such as educational technology, and technology platforms for bridging skills gaps and mismatches, and cross-sectoral collaboration for skills development.

The book draws on presentations made at the past four International Skills Forums organized by ADB in its headquarters in Manila. The articles presented here seek to capture the essence of the important topics discussed at these ADB Forums: current priorities on TVET, innovative practices in skills development, anticipating and preparing for emerging skills and jobs, and, the future of skills and jobs in the age of digital disruption.

The 40 articles included here are clustered under major, uniting themes concerning key aspects of education and training for the changing world of work. Each article is intended to be a discussion starter for the particular matter examined.

These articles have been written by eminent researchers, policy-makers, and practitioners working in universities, Ministries of Education and Ministries of Labor, international education for development agencies such as the OECD and ADB, and various other nongovernment organizations. Although the authors have been drawn worldwide there is an emphasis on the Asia and Pacific region.

The objective of this volume is to

1. Showcase transformational practices to equip youth with employable and life skills
2. Highlight the perspectives of those from government, universities, the private sector, international development agencies, and other partners involved in education and training to showcase innovative good practices
3. Demonstrate and highlight real examples of effectively transforming education and training with technology, eLearing, and innovative partnerships
4. Share new ideas at the regional and country levels, and build upon current knowledge and experience in implementing effective and relevant education training systems that are more responsive to change.

Chapters in this book are organized under eight main sections. The introductory overview (Part 1) sets the overall context. It examines the implications of automation on jobs and the need to focus on higher level skills for developing countries to leapfrog. While EdTech solutions, including online learning, are expanding due to technological advancements, the focus needs to be on improving the quality of education for countries to ensure sustained economic growth and building evidence. Universities have to innovate to create academic entrepreneurs by working closely with industry. For people to prosper and countries to sustain development, everyone needs to develop the right skills to take advantage of technological, economic, and social progress.

Kindergarten to Grade 12 (K to 12) reforms are then examined (Part 2) by looking at effective ways of boosting student learning, including as measured by PISA through technical partnership (OECD's experience on PISA); drawing on locally driven models to develop effective learning strategies in schools by improving student engagement where highly prepared teachers may be scarce (Philippines); using technology-based assessment tools to support teachers to continuously monitor student learning levels and adjust pedagogy accordingly (EdTech solution); partnering with nongovernment providers to expand quality education for all (Pakistan); and drawing lessons from successful developing countries on how they have improved student learning outcomes (Viet Nam).

The book then moves on to examine the specific impact of such transformational changes on TVET (Part 3). Examples presented highlight how the dual training approach is preparing job-ready graduates by addressing skills mismatches (Philippines); how a more strategic focus on infrastructure and pedagogy innovation can transform TVET to raise the image of TVET and prepare job-ready graduates (Singapore); how partnerships with industry associations can lead to quality-assured and responsive TVET programs that are owned and supported by employers (New Zealand); how market-driven TVET, targeting priority sectors, can prepare youth for meaningful jobs (India); how ADB's support to skills development is working closely with industry associations and proven institutions in priority sectors (Bangladesh); and how TVET programs need to prepare trainers and link with information and communications technology to enhance the quality of training (PRC).

Higher education has an important role to play in promoting higher level skills (Part 4). The articles highlight how world-class universities are being set up to promote innovation and research and development (Hong Kong, China; Indonesia; and the Republic of Korea); how university-industry linkages are promoting research and development and commercialization (Shenzhen, PRC); how ADB's support to the University of the South Pacific is taking a regional approach to strengthening higher education institutions in the Pacific; and how universities are innovating by helping to establish start-ups and an entrepreneurship ecosystem (Republic of Korea).

Education Technology (EdTech) has the potential to improve teaching and learning at all levels of education (Part 5). Blended learning can support universal access to high-quality and relevant education and training including teacher professional development at scale. While EdTech has a huge potential to enhance the quality of TVET, concerted efforts are needed to bridge existing skills gaps. The power of mobile technologies is proving to be effective in massifying access to quality education, but this will require large-scale public-private partnerships. MOOCs curated by global experts are also helping learners across the globe to learn new skills linked to global demand. Specialized training for IT industry can be effective in meeting global demand of such skills. Similarly, coding skills can be taught from early age to prepare learners with design thinking.

Artificial Intelligence and big data analytics are fueling the development of technology platforms (Part 6) to support career counseling and guidance (Philippines), workforce transformation by linking labor market information with skills profiles of job seekers (Singapore), improving labor market intelligence to ascertain which occupations are emerging and which ones are disappearing (ADB's analysis), and preparing the workforce in response to IR4 needs.

Education and training contributes to all the SDGs. Cross-sectoral collaboration is therefore critical for skills development for employability (Part 7). This section examines how skills development can be embedded in infrastructure projects (Mongolia); how science, technology, engineering, arts, and mathematics (STEAM) can help youth to develop leadership, build confidence, and cultivate employability skills (Thailand); how ADB's support is leading to increase in female enrollment in nontraditional TVET (Tajikistan); how countries are developing sectoral approaches to skills development in energy, automobile, textile, and IT (European Training Foundation's Torino process); and how lifelong learning can stimulate demand for skilling and upskilling (Singapore).

The final section (Part 8) draws together all the ideas and case study material presented in earlier sections of the book by providing specific, concrete conclusions and recommendations regarding the most effective ways to move ahead to anticipate and prepare for emerging skills and jobs.

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Part I
Introduction

Chapter 2
The Future of Work: Is This Time Different?

Carl Benedikt Frey

The key point I would like to make is that, even though I am confident that there will be enough jobs to go around in the next decades, there are transitional and social costs associated with technological progress. As I argue in my forthcoming book, *The Technology Trap: Capital, Labor, and Power in the Age of Automation*, technological change is welfare-improving but not Pareto-improving, at least in the short run. And as the experience of the British Industrial Revolution illustrates, what economists regard as the short run can be a lifetime. The Industrial Revolution was also a time when there was significant resistance to technological change. And to avoid such resistance, governments need to manage the short run and provide people with the right skills.

The second point is that for the emerging world, cheap labor will soon no longer constitute a comparative advantage. We see new jobs emerging—primarily skilled ones—and those tend to overwhelmingly cluster in places that already have an educated workforce.

It may be said by the commentator Frederick Soddy that civilization is pursuing two precisely opposite goals at one and the same time. On Mondays, Wednesdays, and Fridays it invents new methods of abolishing labor, and on Tuesdays, Thursdays, and Saturdays new labors to relieve the consequent unemployed.

If we look back historically, there can be no doubt that we have been extraordinarily productive on Mondays, Wednesdays, and Fridays. Few readers will know anybody who works as a lamplighter, elevator operator, or switchboard operator. And looking only at the occupations that have vanished hugely understates that the transformation has happened in advanced economies.

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Think of the work of a farm laborer in 1900. If you were to take that person onto a modern farm, he would for the first time in his life encounter tractors, automobiles, electricity, global positioning system or GPS technology, milking machines, computers, and so on. It would probably take years to train him. In fact, I would go as far as to suggest that nearly all jobs that existed in 1900 have already disappeared. The occupational titles that remain from that time exist only on paper. Their content has changed so dramatically that they are almost no longer recognizable.

The potential scope of automation has expanded significantly over the centuries. If we go back a hundred years, distinguishing between humans and computers was meaningless. Humans were computers; computer was an occupation specializing in basic arithmetic, and tabulating the results. Since then, automation has largely been confined to rule-based activities that can easily be specified in computer code. But what we are seeing now is that—for the very first time—computers are actually able to learn themselves. Instead of having a programmer specifying what a computer should do at any given contingency, we can use bottom-up machine learning. According to our estimates, roughly 47 % of jobs are at high risk of automation as a consequence.

So what does this mean for the future? Some people have taken our estimates to suggest that we can all just retire and enjoy a life of leisure and fulfillment. But we could have decided to do that a long time ago. In the United States, for example, over the past century, labor productivity has grown by 800 %, while leisure time has increased only by 10 %. The main reason is that we are greedy—for lack of a better word. Most people are very happy to work long hours to go to those hot yoga classes, stay at nice hotels, and travel around the world. And as long as there is demand for things that only humans can produce, I predict there will still be jobs to go around.

A much greater concern is that the labor share of national incomes has fallen across the board. Even before the days of strong labor unions, compensation was growing roughly in tandem with productivity. But since the Computer Revolution of the 1980s, we see that a gap has emerged between productivity and compensation.

While most research has focused on advanced economies, when I worry about this, I actually worry primarily about developing economies. The reason is what the economist Dani Rodrik has called premature de-industrialization. The way that countries like the United States, Germany, and the United Kingdom got rich was simply by shifting low-skill workers from agriculture into routine manufacturing. But that route to prosperity might not be open in developing countries going forward as the automation of factory work progresses.

At the same time, we see that new jobs are emerging as new technologies are being introduced, but those are jobs primarily for the highly skilled. If we take new industries that have emerged since 2000, we find that most of them relate to digital technologies or biotech. And we find that the workers in those industries are much more likely to have a college degree or a STEM degree.

However, these tech jobs also support many jobs in the local service economy: In the United States, for example, one high-tech job creates five new jobs in the nontrader sector in a given city. And our research shows that the multiplier is even higher in most developing countries.

By leapfrogging industrialization to the high-tech economy, a lot of demand for the new jobs can actually be created in the local service economy. And I believe that is the route that the next generation of emerging economies needs to follow. They need to leapfrog industrialization by investing in human capital and new industries. The main priority of development banks should, therefore, be to invest in people's skills rather than physical capital.

Link to the presentation material: https://events.development.asia/materials/20171212/future-work-time-different.

Chapter 3
Future Implications of the Fourth Industrial Revolution on Education and Training

Paul Kim

The Fourth Industrial Revolution spurred many debates and discussions on how education sectors and industries can cope with the rapid pace of technological advancements and the implications for workforce and industry. In this regard, innovators have been pursuing development of learning technology solutions that could help society cope with these advancements. In particular, innovation leaders have been working on solutions to explore the potentials, and to leverage emerging technologies, of Artificial Intelligence (AI) and machine learning.

Countries such as the United States, France, the People's Republic of China (PRC), and those of the European Union have started including AI in their national strategies, investing in research, integrating it in their education systems, and preparing their workforce for an automated future.[1] For instance, the Silicon Valley community in the United States is progressing fundamental research and development of AI in numerous directions, but the PRC has been making more significant headway in developing numerous AI-integrated applications with an unimaginably vast amount of data that they accumulate under much less stringent regulations. Considering these two differently competent camps, governments need to pursue prudent strategies to find a good balance between protecting privacy and fueling the advancement of AI to ultimately improve the lives of their own citizens.

[1]Kim, P. and Lee, J. (n.d.). Evolution of Online Learning Environments and the Emergence of Intelligent MOOCs.

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Issues and Challenges

The rise of frontier technologies, including AI, is a disruptor that society should be prepared for. While AI holds immense potential in advancing societal developments, many organizations and companies are too slow to adapt and leverage the technology in their work. This can potentially cause huge challenges in addressing job-skills mismatch productivity and in preparing workers who may be affected by automation of jobs, filling new occupations created by emerging fields, and enabling small and medium-scale companies to adopt new technologies, among others.

Proposed Solutions

Many governments have been investing in lifelong learning as they anticipate and prepare for emerging skills and jobs. Aside from efforts in raising the quality of formal education systems, continuing education and retooling or upskilling have also been made more accessible through modalities such as work-based trainings, distance education, and massive open online courses, among others. To make these modalities efficient and effective, technologies are also being used and integrated in the classrooms as well as in various training programs.

Recently, there has been an increased volume of Education Technology (EdTech) solutions being released in the market because of the speed of advancement of technology. This is not surprising, as the value of investment in innovative EdTech companies is also increasing according to studies such as those by McKinsey & Company in 2018 and Research and Markets in 2018.[2] Most of these EdTech systems and solutions are integrating AI and deep learning models to maximize and enhance their existing services or create new possibilities toward better outcomes for students and teachers.[3]

Significant Examples of Good Practices

Teacher Advisor with Watson 1.0

A free AI tool called Teacher Advisor with Watson 1.0 was developed by the IBM Foundation to help teachers strengthen their mathematics instruction. Teacher Advisor provides quality resources as well as instructional context and support to help teachers understand grade-level content in-depth, and enable them to use strategies that will be effective for their students. The AI tool, through its cognitive computing capabilities, can respond to teachers' queries and deliver the most relevant answers. IBM collaborated with the American Federation of Teachers, math teachers, and national education leaders to develop this resource. Its teaching materials are also

[2] Ibid.

[3] Ibid.

vetted by a range of education experts and nonprofit entities including UnboundEd, Student Achievement Partners, Illustrative Mathematics, CPALMS, EngageNY, Achieve, and American Federation of Teachers Share My Lesson (Ascione 2017 as cited in Kim and Lee n.d.).[4]

Teacher Advisor helps ensure that teachers (i) save time finding quality resources by coming to a curated site for all of their planning needs, and (ii) have the context they need to implement those resources effectively for all students.[5] It has recently been awarded as a Webby Honoree in two categories: Best Use of Machine Learning and Best Education Website.

Georgia Tech's AI-Backed Teaching Assistant

In a course at Georgia Tech, an AI-backed Teaching Assistant (TA), dubbed Jill Watson, made a debut by answering student questions and providing discussion topics (Goel and Polepeddi 2016).[6] This teaching assistant was based on IBM's Watson platform. Jill was developed for an online Knowledge-Based Artificial Intelligence (KBAI) class, specifically to handle the high number of forum posts by students enrolled in an online course that is a requirement for Georgia Tech's online master of science in computer science program.[7] The level of sophistication of this AI-based TA for student-question answering is still at an early stage, but with increasing data and the availability of deep learning models, the quality of system-generated responses is expected to improve over time.[8]

PRC's AI-Enabled Education

The PRC Government has made AI-enabled education a national strategy, consistent with its goal to make the country a global center of AI innovation by 2030.[9] Given the amount of investments they have poured out and the volume of big data that they can organize, the PRC Government will most certainly become a key player in

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[4] Ascione, L. (2017, October). *New AI tool helps teachers tackle math.* Retrieved from Eschoolnews Website: https://www.eschoolnews.com/2017/10/12/ibm-ai-tool-teachers-tackle-math/2/?all.

[5] IBM. (n.d.). *Teacher Advisor With Watson.* Retrieved from https://www.ibm.com/ibm/responsibility/initiatives/activitykits/teacheradvisor/.

[6] Kim and Lee (n.d.). *op. cit*.

[7] Lipko (2016) *Meet Jill Watson: Georgia Tech's first AI teaching assistant.* Retrieved from Georgia Tech Website: https://pe.gatech.edu/blog/meet-jill-watson-georgia-techs-first-ai-teaching-assistant.

[8] Kim and Lee (n.d.). *op. cit*.

[9] Jing (2017. China wants to bring artificial intelligence to its classrooms to boost its education system. Retrieved from https://www.scmp.com/tech/science-research/article/2115271/china-wants-bring-artificial-intelligence-its-classrooms-boost.

advancing AI in the near future.[10] The PRC is even expected to overtake the United States in AI research.

Education has emerged as one of the hottest markets for the application of AI in the PRC based on market research.[11] As a result, more online education companies have been looking into tapping AI to offer higher quality education and improve educational outcomes. For instance, a Shanghai-based educational platform called Master Learner uses AI to develop a "super teacher" to aid teachers in reviewing students' assignments and conduct diagnoses that will allow them to come up with personalized teaching plans. This super teacher is also capable of answering 500 million of the most tested questions in the PRC's middle schools. A company in the PRC also focused on boot camp education to train information technology workers to help address a shortage. These boot camps became so successful that they were able to have an initial public offering in the National Association of Securities Dealers Automated Quotations.[12]

Allen Institute for Artificial Intelligence

The Allen Institute for Artificial Intelligence (AI2) was created by Microsoft co-founder Paul Allen and renowned AI researcher Dr. Oren Erzioni to develop AI research and engineering for the common good. Aside from pursuing world-class research and development on AI, it also undertakes projects that create open-source data and resources for the community, holds activities that foster breakthroughs, and supports underexplored but critical research.

One of AI2's notable projects is ARISTO, an intelligent system that reads, learns, and reasons about science. The goal is to develop a "knowledgeable machine" about science—where the system is able not just to retrieve answers from texts, but also to have a deeper understanding of the world and a capability to demonstrate understanding through question answering and explanation.[13]

Aside from developing deep learning systems, AI2 also has an incubator program to support and launch AI-fueled start-ups. In October 2017, it accepted Blue Canoe Learning as one of the first AI companies to join its incubator program. Using speech recognition and machine learning, the Seattle-based Canoe Learning has successfully developed an app to help users learn how to speak English. The collaboration's

[10] Kim and Lee (n.d.). *op. cit*.

[11] Ibid.

[12] National Association of Securities Dealers Automated Quotations, a global electronic marketplace for buying and selling securities.

[13] Allen Institute for Artificial Intelligence. (n.d.). Aristo: Building Machines that read, learn, and reason. Retrieved from AI2 Website: https://allenai.org/aristo/ (https://allenai.org/aristo/).

objective is to enhance this technology to help non-native English speakers improve their pronunciation.[14]

California Community College System's "Doing What Matters"

In California, the community college system is implementing a program named "Doing What Matters." It is a sophisticated enterprise resource planning system that takes and analyzes regional job market data to help colleges plan local programs and courses (DWM 2018). The initiative uses big data to timely link geolocation-specific job needs with precise job skill training initiatives through tailored degree or just-in-time micro-credential programs. In this scenario, AI services are also able to advise instructors in designing effective lesson plans (especially in math and science courses) for diverse groups of learners with different needs so that students can individually strengthen their skills at their own pace (Ascione 2017 as cited in Kim and Lee n.d.).[15]

Stanford Mobile Inquiry-based Learning Environment (SMILE)

The Stanford Mobile Inquiry-based Learning Environment (SMILE) is an assessment/inquiry maker that allows students to quickly create own inquiries or homework items based on their own learning for the day.[16] As the application enables homework generation, completion, and competition games during class, it offers students the opportunity to review their lessons and create their own inquiries from them. This fosters a learning environment where students are not only engaged in discussing course topics, but are also enjoined to generate challenging questions that trigger higher order thinking.[17]

This education project has great potential for changing the landscape of generating and answering higher order thinking questions. Implemented in more than 30 countries, SMILE is collecting various types and levels of questions from learners in all types of education and training scenarios. As more higher order thinking questions are collected and discussed through the system, it becomes more possible to develop

[14] Soper (2017). New incubator program at Paul Allen's AI institute accepts English learning start-up. Retrieved from https://www.geekwire.com/2017/new-incubator-program-paul-allens-ai-institute-accepts-english-learning-startup/.

[15] Kim and Lee (n.d.). *op. cit*.

[16] Stanford School of Graduate Education. (n.d.) SMILE: Stanford Mobile Inquiry-based Learning Environment. Retrieved from Stanford GSE Website: https://gse-it.stanford.edu/smile.

[17] Kim and Lee (n.d.). *op. cit*.

more accurate and intelligent services (digital assistants or AI-backed personalized tutors) that are able to deal with a much higher level and complex questions in Massive Open Online Course (MOOC) learning environments in the near future.[18]

Application of These Good Practices or Examples

The opportunity to leverage such models in learning systems, especially in online/distance education and MOOCs, is very promising. While AI research and its integration in education systems are not yet as successful, scalable, and accessible as we would like, continuous research and development of such initiatives may eventually significantly transform education systems on a massive scale.

As these practices are mostly pursued and successful in highly developed countries, international collaborations (among governments, international universities, and AI-supportive institutions) would be crucial for developing countries to be able to replicate them. Most of these models thrived because of partnerships and investments that fostered long-term research and development.

Implication for the Future/Moving Forward

While the difference that AI may present today may still seem miniscule or even undetectable, the potential that it may bring to the global education ecosystem will become much more transformative and widespread in an accelerating manner. Future learning environments will evolve quite rapidly to better understand and support learners at all stages of their learning cycles. At the same time, future learning models could be redesigned to move away from a knowledge dissemination system and toward a more knowledge co-creation system or environment (Peters and Besley 2017 as cited in as cited in Kim and Lee n.d.) that is intelligent enough to accommodate individual learning needs and goals as they are pursuing higher order learning opportunities on a massive scale. These innovations, when fully developed and made widely accessible, are expected to be embraced by educators.

Although such developments have positive impacts on enhancing education systems, they will also bring major challenges, particularly in ensuring that teachers are capable to quickly adapt to new teaching approaches and instructional technologies. This would entail extensive preparation, training, and, possibly, significant cultural shifts in classrooms (as cited in Kim and Lee n.d.). Ensuring data privacy and security is also expected to be a challenge, given inequalities of access to data and relevant technologies even among countries. Relatedly, given existing inequalities in access to Information and Communication Technology (ICT) infrastructure

[18] Ibid.

and technologies among many countries and regions, the digital divide may worsen globally with the rapid advancement of AI and other technologies.

Finally, these challenges caused by anticipated advancements in technologies also spur the discussion on rethinking the kind of skills that education systems should be cultivating. For instance, there have been many discussions suggesting that one way of preparing learners for the future is by teaching them to code at an early age. Teaching children how to code has become a trend not only to steer STEM interest, but also because the huge potential of computational thinking in achieving holistic learning is being recognized—coding fosters logic, sequential thinking, curiosity, and problem-solving among learners. Such an approach, if integrated appropriately in the curriculum, could be instrumental in producing innovative learners with the ability to develop societal solutions for a better and more sustainable world.

Conclusion

Given the anticipated impacts of the Fourth Industrial Revolution, it is important to also direct discussion about how AI and other technologies' substantial strides in education systems to ensure that anticipated challenges are addressed, and how opportunities will be timely taken advantage of. Governments, especially those lagging behind, will have to pursue aggressive partnerships and increase investments in science, technology, research, and innovation to be able to keep up. Consequently, protecting data privacy and intellectual property rights also need to be ensured.

Education and training systems are also pressured to prepare learners for the future and to ensure that they have the skills to adapt—twenty-first century skills (a combination of foundational literacies, competencies, and character qualities), flexibility, and the capacity to innovate. While pursuing advancements in technologies such as AI and leveraging their potential to enhance education systems are also critical, the key to preparing for the future is fostering an attitude among people to continuously reboot thinking skills and pursue lifelong learning. Learners have to be encouraged and trained to ask questions, as this is where great innovations spring from.

Link to the presentation material: https://events.development.asia/materials/20171212/entrepreneurship-education-industry-and-fourth-industrial-revolution.

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Chapter 4
Quality Education and Economic Development

Eric Hanushek

The United Nations ratified its Sustainable Development Goals (SDGs) in 2015. The 17 goals set out the range of objectives for world development. They are obviously challenging goals, and it is doubtful that all can be accomplished by 2030. Nonetheless, they do focus attention on important measures of world welfare.

When looking across the SDGs, two stand out because they will determine the ability to approach the other 15. Specifically, the set of goals cannot be accomplished without substantially larger resources than currently available, and that means that economic growth is paramount. The only way to expand the world's resources is to have economic growth.

The only way to have economic growth, in the long run, is to improve the quality of schools. Countries that can improve their schools can look forward to substantial gains in economic welfare and can begin moving toward accomplishing all 17 SDGs.

Schooling and Growth

The SDGs are an expansion of the Millennium Development Goals that previously set the goal of universal primary schooling by 2015. While developing countries substantially expanded access to schooling, many did not secure the hoped-for improvements in economic well-being. The simple explanation for this is the insufficient emphasis or appreciation for the importance of learning outcomes, or cognitive skills.

The skills of individuals and nations have traditionally been measured by school attainment, i.e., years of schooling. In particular, assessing school attendance and

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attainment has been done across much of the world, and this presents a ready standard for judging the human capital of nations. But school attainment and access to schools are very incomplete and ineffective measures of relevant skills, and thus they serve as an imperfect basis for setting development goals.

The existence of international tests is now well known. The TIMSS and PISA assessments of math and science performance now cover a wide range of countries.[1] What is less known is that they provide a good indication of the skills of a country's labor force, skills that are important for development.

History shows that it is cognitive skills, which in the aggregate I call the knowledge capital of nations, that drive economic growth.[2] Moreover, these cognitive skills can be proxied by the international tests.

Figure 4.1 shows the relationship between knowledge capital and long-run growth rates in gross domestic product (GDP) per capita over the period 1960–2000. This figure is based on a statistical analysis that includes a single other factor (not shown)—the initial level of GDP per capita. Including the initial income level simply acknowledges the fact that it is easier to grow when starting behind because it is necessary only to copy what others are doing; if starting ahead, it is necessary to innovate and to invent new things, which is more difficult.

Nations fall quite close to this line. Differences in the skills in each country explain most of the variation in growth across countries. Moreover, this is a very steep line, a fact that will be demonstrated below.

Importantly, school attainment has no additional explanatory power once one takes into account what has been learned as measured by the tests. Of course, this does not say that schooling is worthless. There is a strong correlation between school attainment and test scores. Nonetheless, since schooling builds on what was learned previously, the test scores given at the end of lower secondary schooling (when TIMSS and PISA are tested) are good predictors of how much people will know when they complete more schooling.

Before considering the strength of this relationship, however, it is important to consider the issue of causality. For policy purposes, we want to know whether long-run growth will increase if we find a way of improving school quality. While it is difficult with macro data to obtain conclusive support for a causal interpretation, a variety of complementary investigations supports such an interpretation.[3] Most importantly, there is direct evidence, that countries improving their test scores over time have seen an increase in their annual growth rates.

[1] TIMSS is the Trends in International Mathematics and Science Study (https://timssandpirls.bc.edu/), and PISA is the Programme for International Student Assessment (http://www.oecd.org/pisa/test/).

[2] Hanushek and Woessmann (2015a).

[3] Hanushek and Woessmann (2012).

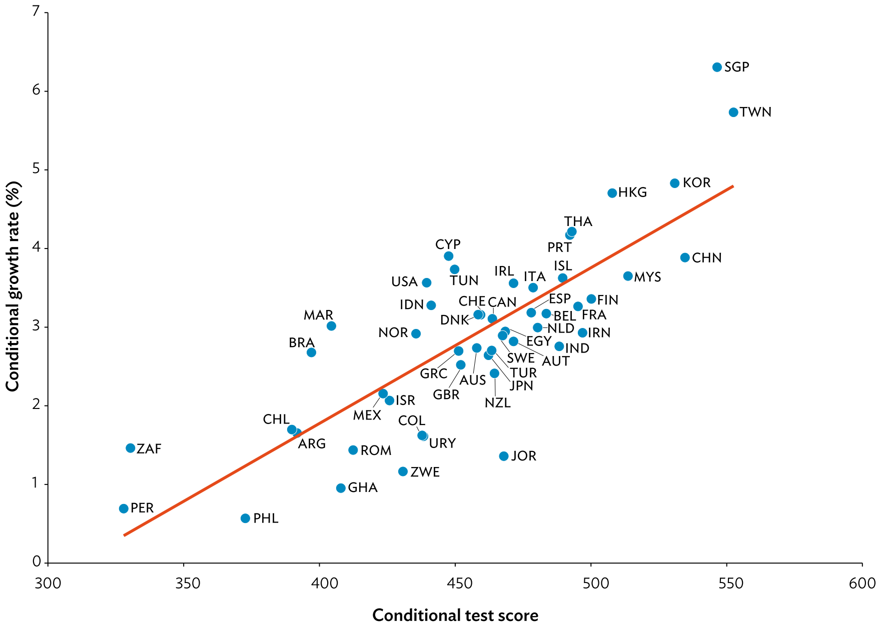

Figure 4.1 Knowledge Capital and Long-Run Growth Rates, 1960–2000. ARG = Argentina; AUS = Australia; AUT = Austria; BEL = Belgium; BRA = Brazil; CAN = Canada; CHE = Switzerland; CHL = Chile; PRC = People's Republic of China; COL = Colombia; CYP = Cyprus; DNK = Denmark; EGY = Egypt; ESP = Spain; FIN = Finland; FRA = France; GBR = United Kingdom; GHA = Ghana; GRC = Greece; HKG = Hong Kong, China; IDN = Indonesia; IND = India; IRL = Ireland; IRN = Iran; ISL = Iceland; ISR = Israel; ITA = Italy; JOR = Jordan; JPN = Japan; KOR = Korea; MAR = Morocco; MEX = Mexico; MYS = Malaysia; NLD = Netherlands; NOR = Norway; NZL = New Zealand; PER = Peru; PHL = Philippines; PRT = Portugal; ROM = Romania; SGP = Singapore; SWE = Sweden; THA = Thailand; TUN = Tunisia; TUR = Turkey; TAP = Taipei,China; URY = Uruguay; USA = United States; ZAF = South Africa; ZWE = Zimbabwe. *Note* Marginal relationship of test scores and growth rates of GDP per capita after allowing for the initial level of GDP per capita in 1960. *Source* Hanushek and Woessmann (2015a)

Educational Challenges

With that background, it is possible to consider the position of countries in terms of their current educational outcomes. We can do this for the 76 countries that have participated in one of the recent international tests of math and science skills.[4] This group includes six ADB countries: Georgia, Indonesia, Kazakhstan, Malaysia, Thailand, and Viet Nam. We record two measures of the educational challenge facing developing nations: the proportion of students completing lower secondary schooling and the proportion reaching basic skill levels.

[4]The details of this analysis including data for all 76 countries can be found in Hanushek and Woessmann (2015b).

Countries around the world have made considerable progress in approaching universal access and attainment of lower secondary schooling, but not all countries, including some developed ones, have fully accomplished this goal. For example, fewer than half of Ghanaian children complete lower secondary schooling. It is also still the case that this represents an extraordinary challenge for many countries (and is almost certainly larger for countries outside the 76, for which we have data). Thailand, Viet Nam, and another 15 of the 76 countries have less than 80% of children not leaving school before lower secondary schooling completion. Clearly, this group of school leavers will have trouble competing against workers in a wide range of countries. Moreover, it does not bode well for growth, although there we must look more specifically at the quality of education.

Instead of the vague SDG goal to "ensure inclusive and equitable quality education," it is useful to consider setting an explicit quality goal. For concreteness, this analysis will consider the implications of the measurable goal that *all youth obtain basic skills*. This goal incorporates two components, which are the full enrollment of youth in secondary school (the quantity part of the SDG) and the expansion in achievement that provides a basis for economic and social participation.

We assume that Level 1 skills on the PISA tests (fully attained) for 15-year-olds represent the minimal skills necessary for participating productively in modern economies. The borderline between Levels 1 and 2 is 420 points on the PISA mathematics scale. With a mean of 500 and a standard deviation of 100 for Organisation for Economic Co-operation and Development (OECD) countries, this score of 420 implies performance at the 23rd percentile of the overall distribution for OECD.

The different levels of performance correspond to the distinct skills of individuals (OECD 2013). The description of the performance at Level 1 (for math) is that students can answer questions that involve familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations.

Achieving Level 1 is meant to be a minimal skill level required as economic development proceeds around the globe. But, again, the challenges are clear—a large portion of the developing country population *that is still in school at age 15* cannot meet these minimal levels. Only one in ten Ghanaian 15-year-olds still in school can reliably answer Level 1 math questions, and for six countries (including Indonesia) in the restricted group that has participated in the international tests the proportion reaching basic levels is less than 20%.

Note that Viet Nam is a real exception, with just 11% of its students in school being unable to reach this basic level. The challenge to Viet Nam remains, however, that one-third of its 15-year-olds are out of school—and presumably likely to perform at a lower level on these tests.

The Economics of Universal Basic Skills

It is possible to put the education situation in each country together with the economic growth picture given previously in Figure 4.1. For this discussion, we concentrate on the subset of ADB countries that have participated in international testing: Georgia, Indonesia, Kazakhstan, Malaysia, Thailand, and Viet Nam. We can use the historical economic relationship to forecast the economic impact on individual economies of three separate scenarios that take different perspectives on development goals:

1. Provide full access to lower secondary schooling at current quality levels;
2. Bring all students currently in school up to the basic skill level; and
3. Provide full access to all students at the basic skill level.

Our analysis considers achieving universal basic skills in response to the changing performance of each country's schools over a 15-year period ending in 2030, consistent with the SDGs. The projections must of course take into account the dynamics of school improvement and of labor force improvement. Over time, the knowledge capital of the nation improves as better-educated youth enter the labor force. The more skilled workforce leads to increased economic growth and other social outcomes.[5] The economic value of the policy change is calculated as the difference between the GDP expected with the current workforce and the GDP expected with the improved workforce, calculated over the expected lifetime of a child born today. Because the benefits of growth are spread out over future decades, near-term gains are weighted more heavily than those farther in the future. Specifically, all future values are discounted back to 2015 at a 3% discount rate so that the future economic benefits can be compared in present-value terms.[6]

The economic impact of achieving each of the three scenarios for the six ADB countries participating in international tests is shown in Figure 4.2,[7] which shows the increase in the present value of gains in GDP expected from the educational improvements.

Considerable heterogeneity exists across the countries, reflecting both their current enrollment rates and current achievement levels. With the exception of Viet Nam, the first overall result is that improving quality only for those currently in school has a much larger impact than just bringing all children through lower secondary schooling at current quality levels. Second, the gains from universal basic skills are large. In both Georgia and Indonesia, the added GDP from universal basic skills approaches 20 times the current GDP. For these two countries, it would amount to lifting the average level of GDP over the next 80 years by more than 18%.

The other ADB countries get smaller gains—because they are currently closer to universal basic skills. Nonetheless, the gains are still large: 7.6% increase in the average level of GDP for Kazakhstan, 8.9% for Thailand, and 6.5% for Viet Nam.

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[5] Hanushek and Woessmann (2015b:10).

[6] Hanushek and Woessmann (2015a).

[7] The details of this analysis and the extension to all 76 countries can be found in Hanushek and Woessmann (2015b).

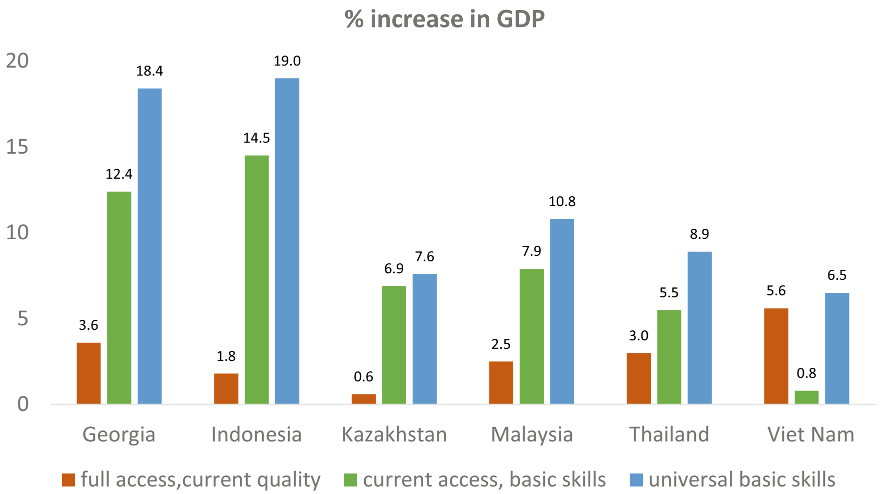

Figure 4.2 Increases in GDP from Achieving Universal Basic Skills, ADB Countries. *Source* Hanushek and Woessmann (2015b)

Viet Nam, as indicated previously, is a special case. The quality of schools is very high, but they do not reach substantial portions of the population. This country's challenge is expanding access while maintaining the current quality level.

It is extraordinarily unlikely that Georgia and Indonesia could move their schools quickly enough to meet the universal skills goal in 15 years. But, if they stretched reform out for 30 years, they could still expect an increase in the average level of GDP over the next 80 years by more than 13%.

The most important step for improvement is to establish a clear development goal and indicator in terms of measured skills—such as accomplishing Level 1 in mathematics and reading for 15-year-olds on PISA or its equivalent. There are three important facets to this: 1. It calls for regular assessments of student skills; 2. It calls for setting national policy and actions on the basis of measured student outcomes; and 3. It permits setting a realistic bar.

Importantly, relying on input measures of schools such as pupil–teacher ratios or spending has proven to be a bad approach to policy, because these measures are inconsistently related to student outcomes. Existing evidence suggests quite simply that to improve school outcomes there is no substitute for measuring and focusing on outcomes.[8] While measurement of outcomes by itself is not sufficient, it is a very necessary step.

The evidence of improvements in achievement over the past decade and a half shows that many countries could feasibly meet the goal of universal basic skills over the next decade and a half, assuming they duplicate the record of the best performers. For example, Poland was able to reduce the share of underperforming students by

[8]Hanushek and Woessmann (2015c).

one-third from 22 to 14% within just a decade. Shanghai in the People's Republic of China reduced the share of underperforming students between 2009 and 2012 from 4.9 to 3.8%. There is no single policy that has led to these gains. Instead, there are local approaches informed by regular monitoring of student performance.[9]

Improvement is clearly difficult, and some countries have even seen their achievement levels fall. If countries wish to improve, there is no substitute for measuring achievement outcomes and evaluating policies on the basis of achievement. The inclusive growth made possible through the universal achievement of basic skills has tremendous potential as a way to address issues of poverty and limited healthcare, and to foster the new technologies needed to improve the sustainability of growth. No substitute for improved skills has been identified that offers similar possibilities of facilitating the inclusive growth needed to address the full range of development goals.[10]

This analysis also considers only the 76 countries that have participated in international assessments. For these countries the magnitude of the challenge is apparent, but for the many countries—generally at the low end of the income distribution—that have not participated, the challenges are likely to be even greater. Importantly, no country classified as lower income is included in the analysis, because they lack the necessary data. Without data on either achievement status or challenges, it is unlikely that these countries will be able to improve at a satisfactory rate.

It is not always true that "what gets measured gets done." But, it is more universally true that "what does not get measured does not get done."

Link to the presentation material: https://events.development.asia/materials/20160919/quality-education-and-economic-development

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[9] Hanushek and Woessmann (2015b:10).

[10] Hanushek and Woessmann (2015b:16).

Chapter 5
Human Capital Development in South Asia

Jong-Wha Lee

This paper reviews South Asia's achievements, prospects, and policy challenges in human capital development, particularly in education and skills. It also looks at how progress in these areas in South Asia compares with the improvements seen in other Asian economies, including the People's Republic of China (PRC), the Republic of Korea (ROK), and selected Southeast Asian countries, and analyzes the role of various factors that have contributed to differences in human development.

An important question is how a South Asian country may be able to bridge the huge development gap to catch up with more advanced Asian countries. To catch up, South Asia must improve workers' education and skills. Human capital has been an important factor in the growth of income and productivity across economies in the long run (Barro and Lee 2015). Studies show a strong correlation between the level of higher education and training and technological readiness in an economy (ADB 2017).

However, in South Asia, education and skills remain a binding constraint. Raising the quantity and quality of a workforce's education and skills is necessary to reach the level of human capital and economic development of the ROK, the PRC, and the more successful Southeast Asian economies.

This paper is based on the author's presentation, "Human Capital Development in South and Southeast Asia: Achievements, Prospects, and Policy Challenges" at the 5th International Skills Forum at ADB in December 2015 and final publication by ADB (2017).

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Achievements and Challenges in Education and Skills Development

Education

There has been strong—albeit uneven—educational progress in South Asia, with enrollment ratios at the primary and secondary levels rapidly increasing. This has allowed South Asian countries to narrow the gap with other Asian countries, even closing it at the primary level. However, at the higher levels, South Asia continues to have much lower rates of enrollment, with the tertiary level seeing especially limited progress between 1960 and 2010.

The number of years of schooling in South Asian countries also increased significantly, while the percentage of those with no schooling has been reduced, but there remains the challenge of how to train this portion of the population.

An analysis of the situation regarding educational attainment (Barro and Lee 2013) shows that, while South Asian countries notably increased access to schooling and average educational attainment between 1960 and 2010, all except Sri Lanka remain less educated than other Asian countries. As of 2010, Nepal's average years of schooling of 4.2 years is comparable to that of the ROK in the 1960s, while both Bangladesh and India have figures—6.0 and 6.3 years, respectively—similar to the ROK in the 1970s. Sri Lanka, however, has excelled, obtaining a level of educational attainment on par with the ROK in the 1990s. As of 2010, 79.4% of Sri Lanka's adult population (aged 15–64) had obtained at least some secondary education, with only a limited number never having attended school. In contrast, Bangladesh, India, and Nepal see greater gaps in schooling accessibility, with 30–50% of the adult population having some secondary education or higher, but around a third remaining uneducated. This striking observation suggests that, in most of South Asia, these gaps in educational attainment among the population continue to be a major concern.

Despite significant progress, there remain disparities in access, participation, and completion across gender, income, and social groups throughout South Asia. As in other Asian economies, gender disparities in educational access have narrowed, bringing the gender parity index for enrollment closer to 1 (i.e., equal ratios for males and females) in the 2010s, especially at the primary and secondary levels. However, except in Sri Lanka, there remains significant gender disparity at the tertiary level. The high disparity in educational quality and earning outcomes is also an issue. School completion rates in the region are also low, as many of those who enroll in school drop out. In India, for instance, about 35% of students who enroll do not reach grade 10 (Sabharwal 2013).

Beyond school attendance, the goal of education is ultimately to improve learning and develop both cognitive and noncognitive skills. Recent literature has shown that a substantial part of the variation in individuals' labor market outcomes and differences in national economic growth rates can be explained by the quality, rather than the quantity, of schooling (Hanushek and Woessmann 2008). Hence, governments must both improve access and ensure that children are learning in school.

In South Asia, educational investments have led to large improvements in access and reduction in enrollment gaps but have not translated into improved learning outcomes. Low learning outcomes across all levels of education in comparison to international standards indicate the poor quality of education (Dundar et al. 2014; Panagariya 2008). This undermines South Asia's competitiveness and economic growth, especially considering the rapid evolution of technology. Nonetheless, South Asian governments are increasingly recognizing that a focus on improving education is essential to fully realize the returns on their investments and increase labor productivity and income.

South Asia urgently needs to shift focus from increasing educational access toward improving learning outcomes, especially at the primary and secondary levels, as well as narrowing regional and social gaps in learning (Dundar et al. 2014). To ensure that all children have the opportunity to learn, it is also necessary to address disparities in early childhood. This means addressing early gaps in health, nutrition, and education.

Although learning is influenced by many factors, motivated and capable teachers play an important role in both imparting knowledge and supporting students, especially weak learners, to develop their cognitive and noncognitive skills (Hanushek and Woessmann 2011). In some South Asian countries, the pupil–teacher ratio is very high. Teacher absenteeism—a symptom of having poorly motivated workers—is also pervasive, with absenteeism rates ranging from around 15–25% (Dundar et al. 2014). The lack of motivated and well-trained teachers results in learning that is mainly procedural. Students can read and execute mathematical operations but are unable to express thoughts in their own words and to relate the mathematical concepts to their everyday applications. To address this, we need to improve teacher training.

As public expenditure in education as a percentage of total government expenditure has been declining, improving education and training must again be made a government priority.

Skills Development

South Asian countries are going through a very fast structural transformation. At the same time, the young population is growing in many countries, leading to the challenge of how to train them to meet industry demands. The public and private sectors need to work together to meet both capacity and quality demands. There is a need to address the many systemic problems in technical and vocational education and training (TVET)—in inputs, processes, and outputs—to reduce the mismatch between the supply of and demand for skills.

Though there are variations by country, skills development policies and systems in South Asia share many weaknesses. For example, girls from poor families and rural residents usually have less access to quality education and training. Many South Asian countries also have few teachers qualified and well equipped to teach in TVET and quite limited public resource allocation for skills training. As a result, the share of students, on average, participating in formal TVET at the secondary level is quite low compared with East Asia (ADB 2017). For example, India's training system has the capacity to train only a quarter of the annual 13 million people entering India's labor market.

There is also very little involvement by potential employers, resulting in TVET systems in South Asia that rarely respond adequately to labor market changes. The lack of well-qualified teachers and good governance and management also lead to poor outcomes in terms of TVET systems. As a result, the employability of graduates is low.

Similarly, the private sector provides limited worker training in South Asia, despite the participation of the private sector in skills development increasing globally. For instance, in Bangladesh and Sri Lanka, less than a fourth of companies formally conduct in-firm training. This is also true in Indonesia (ADB 2017). Vocational training is rarely available to workers in small- and medium-sized enterprises (SMEs) and the informal sector. However, the majority of the South Asian workforce is in the informal sector (Mehrotra and Biggeri 2007). In India, 78% of the workforce is employed by small enterprises with fewer than ten workers, as of 2011–2012 (Mehrotra et al. 2014). This figure is even higher in the smaller South Asian economies, although lower for Sri Lanka (around 62% of nonagricultural sector employment in 2010).

Firms should play a greater role in providing and financing training. As there is a significant variation in skill level among employees, the challenge for firms is how to train these workers, especially how to upgrade the low-skilled workers, alongside the development of the economy.

Wage inequality in South Asia has also been affected by an increasingly skilled workforce and changing labor market demand. Microdata from 1994 to 2010 show that the least-educated group and those with university degrees gained the most, while the relative wage of the secondary-educated grew less (ADB 2017). This is due mainly to the weak growth of manufacturing industries and the demand for middle-skilled workers. Continuous technological progress in manufacturing industries alongside the upskilling of workers can help reduce both wage inequality and skill-job mismatches.

Policy Actions for Human Capital Development

Human capital has been an important factor in economic growth in South Asian economies. Estimates from growth accounting suggest that, between 1981 and 2010, human capital growth through education contributed directly to about 22% of annual gross domestic product per worker growth in India, around 21% in Bangladesh, and 16% in Sri Lanka (ADB 2017).

Skills improvement also contributes to economic growth, with an impact quite comparable to that of education. Education and skills should be developed together to improve the human capital necessary for economic growth.

Educational policies in South Asia should focus on improving access to good quality education for all children to address poor and highly disparate learning outcomes. More efforts are also required to improve the readiness of graduates to satisfy the changing demands of today's job market and compete in the global economy.

The following policy actions may be considered to develop a more productive, well-skilled, and relevant labor force for a modern, competitive economy:

- Implementing a human development strategy in line with national development policies and relevant to changing demand. This is essentially mainstreaming skills development in national development policies and ensuring the commitment of policymakers.
- Broadening access to quality education and skills development training to reduce geographical and gender disparities. Disparities among social groups could be reduced by offering education scholarships and stipends to socially or economically disadvantaged students. Empowering local governments and rural communities to demand and use local resources to support better learning outcomes can also reduce geographical disparities.
- Increasing investment devoted to educational quality and skills, partly through improved teacher quality. This is necessary if the quality of education and training is to improve.
- Improving accountability and governance. Greater efforts should be made to improve the autonomy and accountability of school operations. Strengthening monitoring and evaluation mechanisms also helps to improve education outcomes. Increasing competition among institutions can improve the quality of education and training provision.
- Improving the quantity and quality vocational education at the secondary level (where vocational education constitutes a very small proportion and is of very low quality), as well as in tertiary education. Bringing in the participation of employers is also very important.
- Boosting the quality of training and skills development systems to meet industry standards and hasten job skill matching. While private sector participation is encouraged, the public sector should provide information about employees and future labor requirements, evaluate system performance, and provide quality training opportunities for those in the informal sector.
- Pursuing sustainable mechanisms for financing. Setting up sustainable financing mechanisms for all public systems is very important. Training voucher systems, training levies, competitive financing, and other financing mechanisms should supplement public resources.
- Forging closer regional cooperation for human development. For instance, sending teachers to countries with better teacher training will enable exchange trainings and knowledge-sharing. Another area of cooperation is using information and communications technology in distance education and TVET.

Conclusion

Education and skills development should be prioritized and mainstreamed in South Asian national development policies. This is important to strengthen commitment and to ensure that education and skills development support economic development priorities.

Over the coming decades, South Asia will continue to provide a huge influx of workers to the global labor market. The future of the South Asian and global economy hinges on these workers, and on whether they can upgrade their skills to meet changing demand.

Link to the presentation material: https://events.development.asia/materials/20151201/human-capital-development-south-and-southeast-asia-achievements-prospects-and.

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Chapter 6
Anticipating and Preparing for the Future—One Example from Higher Education: The Singapore Management University (SMU) Experience

Annie Koh

Today's students and graduates are facing an exciting future filled with many varied possibilities and options. As such, it has become imperative to prepare our next generation of talent with future skills for future jobs to meet the challenges of Industry 4.0. Therefore, institutions of higher learning have to be agile, bold, and collaborative in curating new and innovative programs. One approach is to cocreate the curriculum with industry to help their students stay relevant.

In fact, universities have to view themselves as strategic assets of the country to build impact. It is no longer business as usual for institutions of higher learning, wherein their mainstay activities are centered only around academic research and delivery of courses. Rather, universities should play the role of being academic entrepreneurs working closely with industry to create not just a one-size-fits-all pool of talent. Today's employers demand that the future workforce be equipped with a mix of hard and soft skills, as well as deep knowledge and flexibility, to take on multifunctional roles in their organizations.

In the past 20 years, we were increasingly aware of such challenges faced by companies and have experimented at Singapore Management University (SMU) with different initiatives and innovative programs to stay relevant. I am very honored to share some of the learning—focusing on the three Ts—*Talent, Technology,* and *Trust* working in public–private partnerships with government and industry.

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Talent Pipeline to Prepare for the Future

Universities have to be mindful that a key purpose of education is to ensure that new generations of human capital are equipped with relevant skills and knowledge to create value for the country. As such, universities need to closely monitor the pulse of industry and develop programs to align with industry's needs. A university existing in an ivory tower will not be in a good position to anticipate and prepare its students for emerging skills and jobs.

Although SMU is a fairly young institution, set up in the year 2000, it has established itself as a leading university in Asia. This was achieved in no short measure by taking a different approach when it came to educating our undergraduate students.

Among the many differentiating factors is a program known as SMU-X, wherein the university partners with the public, private, and nongovernment sectors to provide opportunities for students to work on real-world challenges faced by the partnering organizations. Mentored by our faculty and industry experts, deep learning is developed as the students put into practice the knowledge acquired in class. This practical approach to learning also provides opportunities to develop skills such as critical thinking, teamwork, and cross-discipline collaboration that are typically difficult to cultivate in a classroom environment. SMU-X courses also allow our faculty to be closely connected with the industry.

Another example is the International Trading Institute (ITI@SMU), which was established in 2008 as a unique public–private–university partnership. It was the first of its kind in the world, set up as a direct response to the call from the commodities trading industry for a pipeline of home-grown trading talent to ensure the sustainability of Singapore as a global trading hub. As illustrated in Figure 6.1, trade is critical to Singapore's growth, accounting for 12% of our gross domestic product, and a quarter of a million jobs are related to trading and trading-related companies.

Singapore was and still is the overseas Asian headquarters of leading trading companies in need of specialized human capital to grow their businesses and thrive internationally. In 2008, with the support of 13 industry partners (the number of which has grown to 40 today) and Enterprise Singapore (ESG; the government agency in charge of trade and internationalization), SMU undergraduates from the finance major were introduced to the International Trading Track (ITT). In 2013, our economics majors were introduced to the Maritime Economics Track (MET) with support from another government agency, the Maritime and Port Authority of Singapore (MPA), and a group of maritime and shipping companies. Resulting from industry feedback, the MET was revamped in 2019 to become the Maritime Business & Operations Track (MBOT) which shifts the curriculum focus from Economics to Operations Management (See Figure 6.2). To date, ITI@SMU has nurtured at least 400 students through the ITT, MET, and MBOT of whom 70% have chosen to enter related sectors upon graduation. Recurring feedback received from the sponsoring industry partners is that students graduating from these programs have a shorter learning curve and are almost job and skill ready from day one.

Figure 6.1 Importance of trade to Singapore's economy

Figure 6.2 Undergraduate tracks (ITT & MBOT) illustrating Public–Private–University partnerships

These two programs did not consist of just a set of "for-credit" courses. Even in 2008, the university was quick to realize that, given the dynamic and demanding nature of the trading and maritime sectors, adopting a traditional structure towards the development of job-ready talent would not suffice, and a more holistic approach would have to be implemented.

Consequently, ITI@SMU introduced a number of innovative "firsts" that enabled us to attain the objective of job-ready talent. The curriculum included noncredit classes taught by industry professionals, who were able to bring their extensive work experiences into the classroom. Rich experiential learning opportunities were also provided through local site visits and overseas industry study missions wherein different cohorts of students had the opportunity to visit the world's largest refinery in Jamnagar, India; coffee plantations and processing facilities in Da Lat, Viet Nam; and oil storage facilities in Fujairah, United Arab Emirates, just to name a few. These were augmented by internships with leading trading and maritime giants such as Shell, ABN AMRO, Vitol, Trafigura, Louis Dreyfus, Maersk, Norden, and Klaveness, which provided an invaluable learning experience to prepare students for their future careers. That is why we strongly believe in having public–private–university partnerships to make work come alive.

Technology—Disruptor and Enabler

With Industry 4.0, the world is in need of critical skills in the area of digitalization, the demand for which traditional universities are finding it a challenge to keep up with. At the same time, many mid-career professionals are being laid off as their jobs are being replaced by automation and digital enhancements. These mid-career professionals are well educated, with many years of useful work–life ahead. Their jobs are being displaced but not the skills—they need new skill enhancements to work in new job roles in growth sectors.

This is where ITI@SMU stepped in once again as a strategic asset of the country to transform the wholesale trade sector with support from the government and industry partners. We went into the continuing education and training (CET) space and offered the International Trading Professional Conversion Program (PCP) to help mid-career professionals, managers, and executives (PMEs) switch career paths into wholesale trading. This is a "place and train" program made possible through the collaboration of two government agencies—Enterprise Singapore (ESG), encouraging trading firms to employ mid-career switchers, and Workforce Singapore (WSG), granting both salary and training support to the employers for helping PMEs with their career conversion journeys.

The lessons learned from running the PCP have led us to realize that digitalization is affecting all industries, and both the current and the future workforce have to be equipped with the appropriate digital skills going forward.

In addition, the existing trading and maritime undergraduate programs will be revamped and refreshed with new noncredit offerings to include courses such as data analytics, blockchain, and artificial intelligence applications as well as lean business processes to enhance the skills needed to help our students create value in their future jobs. Learning has indeed come full circle, with CET innovations enhancing the Pre-Employment Training (PET) programs. Even our colleagues at ITI@SMU need to retool to prepare our students for changes in skills and future jobs.

Trust—The Way Forward

The various initiatives highlighted above would never have taken place without the strong level of trust established among the various stakeholders. New technology and digital solutions would never have been adopted if there were no trust in enhancing value for end-users and employees. Partnerships among industry, government, and society would not have succeeded if "Purpose" and "People" were not at the center of the various conversion programs or new university partnership programs.

In fact, a key characteristic of the digital age will be the acceleration of globalization, as technological advances will result in the erosion of traditional boundaries. We are already witnessing the rise of e-connected platforms serviced by tech giants such as Ali Baba and Amazon that have facilitated global connectivity in trade. The internationalization of businesses and global supply chains will be a common feature as world geographical boundaries and distance, which used to restrict global trade, disappear.

Consequently, there will be a high demand for skills training that enables employees to help their companies on their internationalization journey. Adopting the right mindset towards internationalization and the acquisition of skills such as relationship building, cultural sensitivity, and international project management will be as important as understanding the technological intricacies of data analytics and how blockchain works to make supply chains sustainable.

Therefore, the way forward for both our undergraduates and professionals looking at retooling for a brave new connected world requires ITI@SMU to add trust-building and internationalization skills into the programs to help our companies build partnerships beyond the home base. In the age where dominance of technology seems to be at the heart of so many business transactions, it is important to remember that human relationships are still at play when it comes to building cross-border partnerships and networks. Therefore, anticipating and preparing for emerging skills and jobs also require that we spend time building trust and have standards and governance in place to share data across the trade value chain. The university will be adopting these new projects in our core curriculum over the next lap, with emphasis on competencies, communities, and civilizations. Such exciting times ahead as we continue to build trust through talent and technology!

Conclusion

The ever-changing world will require companies and individuals to adopt a flexible and nimble approach when it comes to learning. As a society, we cannot stick to the same learning format. Curricula and programs will have to be regularly refreshed and kept up to date to meet demands for new skills. As institutions of higher learning, we have a responsibility to society to be responsive to industry trends and to work closely with industry to develop human capital at all levels to meet the job needs of the future. Both innovative learning and impactful programs are needed to prepare our students and lifelong learners with the necessary competitive advantage for the future workplace. We owe it to society for the trust they have placed in education providers.

Link to the presentation material: https://events.development.asia/materials/20171212/singapore-management-university.

Chapter 7
Developing Twenty-First-Century Skills for Future Jobs and Societies

Andreas Schleicher

Everywhere, jobs, wealth, and individual well-being depend on nothing more than on what people know and what they can do with what they know. There is no shortcut to equipping people with the right skills and providing people with the right opportunities to use their skills effectively. And, if there's one lesson the global economy has taught us over the last decades, it is that we cannot simply bail ourselves out of a crisis that we cannot solely stimulate ourselves out of a crisis, and that we cannot just print money to get out of a crisis.[1]

The backdrop to twenty-first-century education is our endangered environment. Growing populations, resource depletion, and climate change compel all of us to think about sustainability and the needs of future generations. At the same time, the interaction between technology and globalization has created new challenges and new opportunities. Digitalization is connecting people, cities, countries, and continents in ways that vastly increase our individual and collective potential. But the same forces have also made the world volatile, complex, and uncertain.[2]

The times when we could address inequalities mainly through economic redistribution are gone, not just because this is an uphill struggle economically, but more importantly, because it does not address the much more pressing issue of social participation, where an increasingly complex world with blurring boundaries between life

[1]Schleicher, Andreas. March 1, 2016. Learn to Earn: *Skills, Inequality and Well-being*, OECD Insights. http://oecdinsights.org/2016/03/01/learn-to-earn-skills-inequality-and-well-being/.

[2]Schleicher, Andreas (2018), World Class: How to build a twenty-first-century school system, Strong Performers and Successful Reformers in Education, OECD Publishing, Paris.

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and work demands high levels of cognitive, social, and emotional skills from all citizens. Perhaps one day machines will be able to do much of the work that is now occupying humans and reduce the demand for many skills at work. But the demands on our skills to contribute meaningfully to an increasingly complex social and civic life will keep rising.[3]

Issues and Challenges

But apart from Singapore and Viet Nam, Programme for International Student Assessment (PISA) data show that most Southeast Asian countries can do much better in equipping more people with better skills to collaborate, compete, and connect in ways that lead to better jobs and better lives and drive economies forward. Just think of the economic dimension. Take a large country like Indonesia. This is a country that made good progress on PISA but still has a large minority of 15-year-olds who did not even reach the most basic level of reading and numeracy skills on the PISA assessment. If the country would fix that such that every student attains at least the PISA baseline level of performance, the economic gains could reach more than $2 trillion in additional income for the Indonesian economy over the working life of these students.

This is important. If there is one central message emerging from the Organisation for Economic Co-operation and Development's (OECD) new Survey of Adult Skills, it is that what people know and what they do with what they know have a major impact on their life chances. For example, on average across countries, the median hourly wage of workers scoring at Level 4 or 5 in literacy—those who can make complex inferences and evaluate subtle truth claims or arguments in written texts—is more than 60% higher than for workers scoring at Level 1 or below—those who can, at best, read relatively short texts to locate a single piece of information that is identical to the information given in the question or directive, or understand basic vocabulary. Those with low literacy skills are also more than twice as likely to be unemployed. The survey also shows that this impact goes far beyond earnings and employment. In all countries surveyed, individuals with poorer foundation skills are far more likely than those with advanced literacy skills to report poor health, to believe that they have little impact on political processes, and not to participate in associative or volunteer activities.[4]

It works the same way for nations: The distribution of skills has significant implications for how the benefits of economic growth are shared within societies. Put

[3] Ibid.

[4] OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing.

simply, where large shares of adults have poor skills, it becomes difficult to introduce productivity-enhancing technologies and new ways of working, which then stalls improvements in living standards.[5]

In short, without the right skills, people will languish on the margins of society, technological progress will not translate into economic growth, and countries cannot compete in the global economy. We simply cannot develop fair and inclusive policies and engage with all citizens if a lack of proficiency in basic skills prevents people from fully participating in society.

And for no group is all that more important than for today's youth, who cannot compete in experience or social networks in ways that older people can.[6]

So in one way, skills have become the global currency of twenty-first-century economies. But this "currency" can depreciate as the requirements of labor markets evolve and individuals lose the skills they do not use. For skills to retain their value, they must be continuously developed throughout life.

Proposed Solutions

So what to do? To begin, countries need to be able to better anticipate the evolution of the demand for skills: We need to know what skills will be needed to fuel economies and move up in global value chains. That is particularly important for Southeast Asia, where the next production revolution will hit particularly hard.

The coexistence of unemployed graduates on the street, while employers say they cannot find the people with the skills they need, shows clearly that more education alone does not automatically translate into better jobs and better lives. The dilemma for educators here is that the kind of skills that are easiest to teach and easiest to test are also the kinds of skills that are easiest to digitize, automate, and outsource.

The world no longer rewards students just for what they know—Google knows everything—but for what they can do with what they know. Algorithms behind social media are sorting people into groups of like-minded individuals. They create virtual bubbles that amplify our views and leave us insulated from divergent perspectives; they homogenize opinions while polarizing our societies. Tomorrow's learners will need to think for themselves and join others, with empathy, in work, and citizenship. The growing complexity of modern living, for individuals, communities, and societies, suggests that the solutions to our problems will also be complex: in a structurally imbalanced world, the imperative of reconciling diverse perspectives and interests, in local settings with often global implications, will require people to become adept in handling tensions, dilemmas, and trade-offs. Striking a balance between competing

[5]OECD (2019), *Skills Matter: Additional Results from the Survey of Adult Skills*, OECD Skills Studies, OECD Publishing.

[6]Schleicher, Andreas (2016). *Learn to earn: Skills, inequality, and well-being* in OECD (2016), Debate the Issues: New Approaches to Economic Challenges, OECD Insights, OECD Publishing, Paris (pp. 123–126).

demands—equity and freedom, autonomy and community, innovation and continuity, efficiency, and democratic process—will rarely lead to an either/or choice or even a single solution. Individuals will need to think in a more integrated way that recognizes interconnections and transcends the boundaries of school subjects. At work, at home, and in the community, people will need a deep understanding of how others live, in different cultures and traditions, and how others think, whether as scientists or artists.[7]

But perhaps most importantly, the future is about pairing the artificial intelligence of computers effectively with the cognitive, social, and emotional skills and values of human beings. It will be our imagination, our awareness, and our sense of responsibility that will enable us to harness technology to shape the world for the better. Learning needs to enable students to create new value, which involves processes of creating, making, bringing into being, and formulating, and to generate outcomes that are innovative, fresh, and original, contributing something of intrinsic positive worth. It suggests entrepreneurialism in the broadest sense—of being ready to try, without being afraid of failing. Creativity in problem-solving also requires the capacity to consider the future consequences of one's actions, evaluate risk and reward, and assume accountability for the products of one's work.

Second, countries need to put a greater premium on skills-oriented learning throughout life instead of on qualifications-focused education, which ends when the working life begins. Skills development is far more effective if the world of learning and the world of work are integrated. It is not difficult to understand why: Compared with purely government-designed curricula taught exclusively in schools, learning in the workplace allows young people to develop both "hard" skills on modern equipment and "soft" skills, such as teamwork, communication, and negotiation, through real-world experience. Hands-on workplace training can also help to motivate disengaged youth to stay in or re-engage with the education system. But that is only working when employers are truly engaged. In our experience, this requires that work-based learning be systematically integrated into all vocational programs in a way that is mandatory, credit-bearing, and quality assured. This is something with which many Southeast Asian countries still struggle.

Employers are often in a good position to assess whether the content of curricula and qualifications meet current labor market needs; they can guide their adaptation to emerging requirements; and they can help develop qualifications and workplace training arrangements. In our work at OECD, we also learned how important it is that vocational teachers have the good technical expertise and labor market experience and that trainers in the workplace have adequate pedagogical skills. There is also a lot that we can do much earlier on in educational pathways by given children during their schooling much better information on potential careers.

Building skills is the relatively easy part of the plan; far tougher is providing opportunities for young people to use their skills. Employers might need to offer greater flexibility in the workplace. Labor unions may need to reconsider their stance on

[7]Schleicher, Andreas (2018), World Class: How to build a twenty-first-century school system, Strong Performers and Successful Reformers in Education, OECD Publishing, Paris.

rebalancing employment protection for permanent and temporary workers. Enterprises need reasonably long trial periods to enable employers to give those youth who lack work experience a chance to prove themselves and facilitate a transition to regular employment.[8]

Developing skills and making them available to the labor market will not translate into better social and economic outcomes if those skills are not used effectively on the job. The way in which people use their skills at work is important in explaining differences in labor productivity.

Examples of Good Practices

There are many areas where governments can do better. The lowest hanging fruit is telling young people more of the truth about the labor market outcomes of their studies, and to incentivize educational institutions to pay attention to that. Better information and greater transparency about skills demand and supply across economies are essential for addressing skills mismatch. In the Republic of Korea, the National Skills Outlook by the Korea Research Institute for Vocational Education and Training (KRIVET) anticipates skills mismatch to make adjustment of structural reform or legislation at the national level, while it provides important guidance on future skills demand to various stakeholders such as students, parents, enterprises, and providers of education and training services.[9]

It is also important to create flexible labor market arrangements. Labor market arrangements, including employment protection, can facilitate or hinder the effective use of skills and address skill mismatches. These can have a particularly bad effect on young people making the transition into the labor market as well as on others such as displaced workers or those seeking to re-enter the workforce. They may also discourage workers from moving from one job to another that would offer them better skills match but also expose them to greater risk. Support for parents is one of the examples of employment conditions that facilitate participation in the labor market. In Austria, Denmark, Finland, and the Netherlands, parental leave programs to involve adjustment of working hours and part-time jobs.[10]

Last but not least, knowing which skills are needed in the labor market and which educational pathways will get young people to where they want to be is essential. High-quality career guidance services, complemented with up-to-date information about labor market prospects, can help young people make sound career choices.

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[8]Schleicher, Andreas. May 28, 2013. *Getting our youth back to work.* ECD Education and Skills Today. https://oecdedutoday.com/getting-our-youth-back-to-work/.

[9]OECD (2015). OECD Skills Strategy Diagnostic Report: Korea.

[10]OECD (2012), Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies.

Application of These Good Practices or Examples

Countries are facing common challenges driven by the rapid pace of change in today's world. Megatrends such as globalization, digitalization, and demographic change are having a major impact on the way people work and live in communities, and, in turn, increasingly influence the skills that people need to navigate this complexity and uncertainty regardless of the economic status of countries. At the same time, global connectedness is also an opportunity for countries to learn from lessons and good practices identified worldwide.

For example, key policy lessons on developing relevant skills were drawn from research and international peer learning. These policy pillars are (i) encouraging and enabling people to learn throughout life, (ii) fostering international mobility of skilled people to fill skills gaps, and (iii) promoting cross-border skills policies.[11] More than ten countries, including developing ones, have developed national skills strategies referring to this framework for analyzing a country's own strengths and challenges, as well as identifying good practices of other countries.

Not least, skills development is far more effective if the world of learning and the world of work are linked. In addition to more theoretical learning in schools also learning in the workplace allows people to develop "hard" skills on modern equipment, and "soft" skills, such as teamwork, communication, and negotiation, through real-world experience. Hands-on workplace training can also help to motivate disengaged youth to stay in or re-engage with education and smoothen the transition to work.[12]

Implication for the Future/Moving Forward

Competent personnel who have the latest labor market information at their fingertips can steer individuals to the learning programs that would be best for their prospective careers.

Public employment services can also play a crucial role in facilitating skill matching, especially at local levels working closely with local employers as well as education and training providers. Ensuring that qualifications are coherent and easy to interpret will make a big difference. Qualifications should thus not only be clear but consistently awarded. Continuous certification that incorporates nonformal and informal learning over the working life is also essential, as is recognition of foreign diplomas.[13] Countries also need to maintain and expand the most effective

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[11] Ibid.

[12] Schleicher, Andreas. April 23, 2013, Norrag Blog Transforming Education into Better Jobs and Better Lives. https://www.norrag.org/transforming-education-into-better-jobs-and-better-lives/.

[13] Schleicher, A. The OECD Survey of Adult Skills. https://www.nier.go.jp/kankou_kiyou/143-101.pdf.

active labor market measures, such as counseling, job-search assistance, and temporary hiring subsidies for low-skilled youth; and we need to link income support for young people to their active search for work and their engagement in measures to improve their employability.

But none of this is going to work unless everyone is involved: governments, which can design financial incentives and favorable tax policies; education systems, which can foster entrepreneurship as well as offer vocational training; employers, who can invest in learning; labor unions, which can ensure that investments in training are reflected in better quality jobs and higher salaries; and individuals, who can take better advantage of learning opportunities and shoulder more of the financial burden.[14]

Not least, digital technology now allows discovery of entirely new responses to what people learn, how they learn, where they learn, and when they learn, and enrichment of and extension of the reach of excellent teachers and teaching. Massive open online courses (MOOCs) provide a great example for digital technology in education, such as free online courses that support learning in many subjects and that are open to anyone with access to a computer and the internet. They also connect learners from across the globe with educators and with each other. Digital technology can enable teachers and students to access specialized materials well beyond textbooks and lectures, in multiple formats and in ways that can bridge time and space. They can support new ways of teaching that focus on learners as active participants. There are good examples of technology-based solutions enhancing experiential learning by supporting the project- and enquiry-based learning methods, facilitating hands-on activities and cooperative learning, and delivering formative real-time assessments. There are also examples of technology supporting learning with interactive, nonlinear courseware based on state-of-the-art instructional design, sophisticated software for experimentation and simulation, social media, and educational games. These are precisely the learning tools that are needed to develop twenty-first-century knowledge and skills.[15]

And perhaps most importantly, one teacher can now educate and inspire millions of learners and communicate their ideas to the whole world, so students do not need to put up with the teacher who happens to be around, but can choose the teacher and learning methods that speak most directly to their individual learning needs, pathways, and styles.

[14] Schleicher, Andreas. *Better Skills, Better Jobs, Better Lives*. Global Comparative Education: Journal of the WCCES Volume 1, Issue 1 144.

[15] Schleicher, Andreas. Nov. 30, 2018. *Why Good Teaching Is Crucial For Preparing Students For A Digitised World*. https://hochschulforumdigitalisierung.de/de/blog/shaping-digital-turn-andreas-schleicher.

Conclusion

Securing employability and social progress means giving more people better skills to compete, collaborate, and connect in ways that drive our societies forward. It requires putting the premium on skills-oriented learning throughout life instead of qualifications-focused education upfront. The social partners can make an important contribution to developing curricula that include broader, transferable skills and ensuring that good quality training is available to all. Quality career guidance is essential: People who have the latest labor market information at their fingertips can help steer individuals to the education or training that would best prepare them for their prospective careers. Coherent and easy-to-understand qualifications are important to help employers identify potential employees who are suitable for the jobs they offer. Not least, helping employers make better use of their talents is key.

None of this is easy; none is done overnight. But the world is indifferent to tradition and past reputations, unforgiving of frailty, and ignorant of custom or practice. Success will go to those individuals and nations that are swift to adapt, slow to complain, and open to change. The task of governments is to help citizens rise to the challenges.

Link to the presentation material: https://events.development.asia/materials/20160919/what-we-can-learn-pisa-and-piac.

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Part II
Kindergarten to Grade 12 (K–12) Reforms

Chapter 8
Boosting Student Learning: PISA for Development

Yuri Belfali

Introduction

The international community is committed to ensure inclusive and equitable quality education. Education Goal 4 of the Sustainable Development Goals (SDGs) sets clear objectives for all countries to advance cooperation among countries, international organizations, and other partners to identify challenges, take actions, and monitor the progress. SDG 4 also represents a shift of the focus from access to quality of education. Monitoring of the quality requires a system that can measure the actual learning outcomes of children and young people at various ages and levels of education. The Organisation for Economic Co-operation and Development (OECD) international assessments of learning outcomes and skills reflect the magnitude and importance of challenges faced in education and offer measurement tools.

One important contribution of OECD is the Programme for International Student Assessment (PISA). Since 2000, every 3 years, some 80 countries and economies—including 40 middle-income countries and 4 low-income countries—collaborate through the PISA to compare how well their school systems prepare young people for life and work.

The PISA has been providing policy-makers with a powerful tool for policy-making. It assesses competences in reading, mathematics, and science. The assessment is not linked to the school curriculum and it evaluates to what extent students at the end of compulsory education can apply their knowledge to real-life situations and be equipped for full participation in society. The information collected from students and school leaders through background questionnaires also allow understanding of the context of teaching and learning, allowing analysis of the factors related to

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B. Panth and R. Maclean (eds.), *Anticipating and Preparing for Emerging Skills and Jobs*, Education in the Asia-Pacific Region: Issues, Concerns and Prospects 55,
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the performance of students. The PISA has been continuously stepping forward in order to respond to emerging policy questions through its innovative assessment. For example, it has paved the way for the assessment of problem-solving in the past, has conducted the assessment focusing on collaboration, and is now responding how we could appreciate the learning of competences that are increasingly becoming critical yet difficult to assess and compare across countries, such as global competence or creative thinking.

Issues and Challenges

Participating countries see that the value of the PISA lies in international benchmarking and peer learning. When OECD asked questions about the policy impact of the PISA on the participating countries, the majority of countries reported that the policies of high-performing countries or improving systems had been influential in their own policy-making processes. Many countries have also developed and introduced new elements of a national assessment strategy or curriculum framework inspired by how the PISA assesses students' competencies to apply skills and knowledge and to solve unknown problems.[1]

The PISA can help countries reflect on what policies and practices appear to be related to students' performance in countries and economies that are recording high performance or showing significant improvement over time. OECD is very aware of the various circumstances in different countries and economies (with more than 80 participating in PISA 2018). There is no "one size fits all" education model for countries and economies, but the PISA provides countries with the evidence to appreciate challenges, to learn from the experiences of other successful countries, and to create a momentum for collective actions to make change happen for improvement.

Proposed Solutions

Enhancing PISA to Make it Relevant to a Wider Range of Countries

As more countries joined the PISA, it became apparent that the design and implementation models for the assessment needed to evolve to successfully cater to a larger and more diverse set of countries, including a growing number of middle- and low-income countries. In response to this challenge, OECD and a number of partners launched the PISA for Development initiative in 2013, which further develops

[1]OECD. (2012b). The Policy Impact of PISA: An Exploration of the Normative Effects of International Benchmarking in School System Performance

and differentiates the PISA data-collection instruments to produce results that better support evidence-based policy-making in middle- and low-income countries.[2]

PISA data show that most of the middle- and low-income countries share the concern of the concentration of students at the lower levels of the PISA proficiency scales, and an important share of 15-year-olds who are out-of-school. For policy-makers in these countries to better understand how to improve students' learning and how to support teachers and school systems to help their students more effectively, they need data that illustrate more in detail the status of schooling and learning of 15-year-olds. Conducting a large-scale international survey like the PISA is another challenge for middle- and low-income countries, which have no or little experience with international or national large-scale assessment. Building the capacity of participating countries to conduct large-scale assessments, and to analyze and use the results to support evidence-based policy-making, is a key for success.

In view of contributing to the monitoring and achievement of the SDGs, and of facilitating and encouraging the participation of a wider range of countries in the PISA, the initiative of PISA for Development aims at enhancing the PISA survey through the following means:

- The descriptive power of cognitive assessments in reading, mathematics, and science enhanced to meet a wider range of student abilities. This entails the extension of the conceptual frameworks to describe in more detail baseline skills, and the selection and use of existing PISA items that are targeted at lower levels of student performance and enhanced to reflect the context of a wider range of countries while also guaranteeing international comparability.
- Contextual questionnaires and data-collection instruments adapted to a wider range of economic and social contexts (e.g., for students, teachers, parents, schools). This output involves adapting the existing PISA background questionnaires to the realities of developing countries to improve the understanding of how these factors relate to students' performances.
- An approach developed, including a methodology and analytical framework, for including out-of-school 15-year-olds in the assessments. This most challenging output reflects the reality that in most developing countries more than one-third of 15-year-olds are out of school.
- Country capacity in assessment, analysis, and use of results for monitoring and improvement strengthened among participating countries. This output will help to ensure that participation in the PISA helps to strengthen the countries' own large-scale national assessments and the use of results for policy development and decision-making.
- Engagement established with project countries, development partners, and, prospectively, with other countries in order to identify peer-to-peer learning opportunities regarding participation in the PISA.

[2]PISA for Development Background. https://www.oecd.org/pisa/aboutpisa/pisa-for-development-background.htm.

Partnership for Success

Participation in international large-scale assessments, such as the PISA, is a significant financial and technical challenge for low- and middle-income countries, and the partnership of development partners is crucial in this regard. These development partners include multilateral development banks including the Asian Development Bank, the Global Partnership for Education, bilateral donors, foundations, and private donors. Moreover, the PISA is technically complex, operationally demanding, and statistically advanced and requires a significant commitment from countries to implement successfully.

Countries that are participating in PISA for Development benefit from the "capacity building" option and will benefit from a range of capacity-building and peer learning activities. At the outset of the assessment cycle, the country undergoes a detailed analysis of its ability to implement the PISA, measuring existing capacities, and identifying the competencies that require development. Based on this analysis, the country develops a capacity-building plan and a project implementation plan. These plans address the human and financial resources required to implement the assessment successfully and to achieve the target capacities in accordance with the PISA schedule. The capacity-building plan includes training and development facilitated by OECD on a variety of topics, including framework and item development, translation and adaptation, sampling, and coding of students' responses. In addition, OECD and its contractors support the country's implementation of the assessment at each stage. Countries also engage in peer-to-peer learning exchanges with experienced PISA countries.[3] For example, Cambodia is accompanied by the Republic of Korea throughout the implementation of PISA for Development, in the framework of peer-to-peer support.

Countries also benefit from "analysis and reporting" support for the preparation of national PISA analysis in collaboration with OECD. For the purpose of making the best impact out of PISA participation, countries also engage in (i) developing a strategy to engage and communicate with a variety of stakeholders throughout the project, including policy-makers, academics, media, school leaders, teachers, parents, and students; (ii) building national capacity for data analysis, interpretation of assessment results, and reporting; (iii) producing a country report presenting PISA results for international benchmarking of performance, including relevant analyses and information based on national policy priorities defined during the implementation process; and (iv) presenting the country report and disseminating results, particularly for use in evidence-based policy discussions and decision-making.[4]

[3]PISA for Development Brief 14. https://www.oecd.org/pisa/pisa-for-development/14-Capacity-building.pdf.

[4]PISA for Development Brief 25 https://www.oecd.org/pisa/pisa-for-development/25_Strengthening_analysis_reporting_in%20PISA_D_countries.pdf.

Examples of Good Practices

PISA results set the agenda for policy dialogue among policy-makers and experts. For example, based on the results of the PISA, Korean policy-makers have seriously considered the fact that gender difference has been increased and the student ratio of high performance has been lower than the other high-performing countries.[5] This resulted in the development of strategies to monitor and improve the proportion of top performers. The Republic of Korea has also studied how its students are performing by item types and reflected the findings on the curriculum review and the reform of teaching practices.

Brazil took a major step forward for accountability, inspired by the PISA. A national census-based assessment for students in grades 4 and 8 and its results were combined with repetition and dropout rates in 2005 to create an index of school quality, the Basic Education Development Index (IDEB). This index gave schools, municipalities, and states an incentive to improve the quality and equity of education and a benchmark against which to which monitor progress. The IDEB is set individually for each school and is scaled so that its levels are aligned with those of the PISA.[6]

Application of These Good Practices or Examples

Viet Nam joined the PISA in 2012 and continued its participation in 2015 and 2018. Participation helped Viet Nam to compare its performance with other countries worldwide, and to develop capacity to conduct large-scale assessments. International benchmarking has been used for Viet Nam to know where it stands internationally and to monitor the quality and equity of the national education system. Since its first participation in the PISA, Vietnamese students have scored above the OECD average, which triggered the interest of the international educational community. It requires further research to fully explain the success factors of Viet Nam. But its approach to reform and policy-making based on evidence is an illustration of the environment where policy-making is supported by evidence on students' performance and factors related to teaching and learning. Viet Nam has a high potential to continuously improve the access of young people to schooling and at the same time to provide quality education to those who are in school, which has been demonstrated as possible by other PISA countries.

But what do high-performing and improving education systems look like and what success factors and lessons could countries consider for their own education

[5]OECD (2012a). The Policy Impact of PISA: An Exploration of The Normative Effects of International Benchmarking in School System Performance OECD Education Working Paper Number 71.

[6]OECD (2010), Lessons from PISA for the United States, Strong Performers, Successful Reformers in Education, OECD Publishing. http://dx.doi.org/10.1787/9789264096660-en.

reform? Some common features of successful education systems were identified through international comparison of PISA data and analysis of policies and practices of strong performers such as Canada, Finland, Japan, and Singapore. Many of these countries are developing and improving their education systems with the following features:[7]

- Making education a priority and developing a commitment to education and a conviction that all students can achieve at high levels
- Attracting, preparing, and continuously developing high-quality teachers and school leaders
- Providing a work organization in which teachers can use their potential and exercise their professionalism
- Aligning incentives for teachers, students, and parents
- Investing resources where they can make the most difference
- Balancing local responsibility with a capable center with authority and legitimacy to act, and finding the right level of school autonomy
- Ensuring coherence of policies and practices.

Countries in Asia, despite their differences in social and economic situations, could reflect on these lessons, along with their in-depth analysis of available data on students' learning, when they design changes in policies and practices for better learning.

Way Forward: Collaboration with Current and Future PISA Countries

In 2018, seven countries (Cambodia, Ecuador, Guatemala, Honduras, Paraguay, Senegal, and Zambia[8]), successfully completed the school-based assessment of the PISA for Development. These countries benefited from the capacity development activities for analysis and reporting, and launched their national report on PISA for Development results. The analysis of the seven participating countries highlighted the important educational challenges these countries will have to address: Only around 23 % of students across the PISA for Development countries attain at least the minimum level of proficiency in reading, compared with the OECD average of 80 %. The PISA for Development results also tell us what is possible in education in the participating countries and highlight some of the factors that can drive improved outcomes, such as eliminating grade repetition, particularly among boys; ensuring quality learning time; and allocating resources more equitably.

[7]Adapted from OECD (2011), Strong Performers and Successful Reformers in Education: Lessons from PISA for the United States and Schleicher (2018), World Class: How to Build a 21st-century school system.

[8]Bhutan participated in the PISA for Development and launched its national report in 2019.

The PISA for Development initiative demonstrated that the PISA can increase the resolution and relevance of its instruments for low performers in OECD countries. More generally, all countries in the PISA have been benefitting from the opportunity PISA for Development has provided for including more diversity in policies and practices, enriching analyses by having a greater range of points of comparisons, and also increasing the opportunities for peer learning. The outputs of PISA for Development have already been integrated in the main PISA assessment starting with PISA 2021.

This helped the PISA both to incorporate increasing numbers of participants in the assessment and to offer existing participants a wider range of benefits, such as capacity building for data analysis and reporting, and the inclusion of out-of-school youth. The education systems of the PISA for Development countries, and low-to-middle-income countries more generally, have the potential to ensure that all their children and young people achieve at least minimum levels of proficiency in basic skills.

Conclusion

Boosting student learning starts with a good understanding of challenges that countries face and best practices that could be learned from the experiences of others. In the context of international commitment to achieve Sustainable Development Goal 4 in the field of education, countries could build on the results of international assessments like the PISA. To do so, international and regional cooperation could provide more support for countries to strengthen capacity to conduct policy-relevant analysis of survey data, to reflect evidence of areas for improvement in their educational reforms, and to develop policies drawing on experiences of other countries while taking into account each country's specificities.

Link to the presentation material: https://events.development.asia/materials/20160919/boosting-student-learning-programme-international-student-assessment-development.

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OECD. (2012a). The Policy Impact of PISA: An Exploration of The Normative Effects of International Benchmarking in School System Performance OECD Education Working Paper Number 71. https://www.oecd-ilibrary.org/docserver/5k9fdfqffr28-en.pdf?expires=1586276266&id=id&accname=ocid84004878&checksum=6F863469BC38AFF0462F89DF59C9E99F.

OECD. (2012b). The Policy Impact of PISA: An Exploration of the Normative Effects of International Benchmarking in School System Performance http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=EDU/WKP(2012)8&docLanguage=En.
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Chapter 9
Essentials Over Peripherals: The CVIF Dynamic Learning Program

Christopher C. Bernido and Maria Victoria Bernido

Introduction

Sustainable cost-effective optimized education for the majority, if not for all, can be achieved if an academic program can meld (i) a rapidly changing technology-driven educational landscape, (ii) results of neuroscientific research enhanced by advanced medical technologies, and (iii) the evident natural curiosity and biological habit-forming capacity of humans. A conspicuous trademark of the evolving educational environment is the rapidly expanding knowledge bank and online libraries linked by Google and YouTube that can be easily and individually accessed by learners, thus bypassing the traditional role of teachers and classroom textbooks. Positron emission tomography scans of the brain are now routine, shedding light on brain activity during sleep and awake periods. Then there is the commonly observable high degree of engagement, both positive and negative, with information and communications gadgets displayed by very young people, even those in preschool. More developments in online resources, medical technologies, and response of the populace, yet unimagined, are on the horizon, even as common talk mentions the Fourth Industrial Revolution brought about by advanced automation and digitization, robotics, and artificial intelligence, and the internet. Because of these, there is an urgent need for the twenty-first century workforce to be educated and trained so as to be equipped with collaborative and communication skills, critical thinking, creativity, and the abilities to learn new skills and solve highly complex problems. “A nation’s precious human capital is nurtured through education and promoted through the labor market. This is the national resource that more than any other will determine success in terms

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of GDP, investment environment and so on as nations compete in the global market economy."[1]

The complexity and breadth of issues posed to educators by twenty-first century technological developments make it tempting for governments and educators to adopt (i) huge budget curricular reforms; and (ii) a tech-for-tech approach—a swarm of costly high technology gadgets and robotics kits introduced in schools and colleges. However, challenges remain formidable in the delivery of quality education for the general population, in the humanities and social sciences, and in particular, in science, technology, engineering, and mathematics (STEM), which is a cause for concern, since economic and political power has been linked to the strength of human resources in STEM disciplines.[2] Advanced and developing countries duly appropriate large portions of their national budget to education. However, *huge budgets do not necessarily create huge impact in educational outcomes*.[3] As noted in Singapore, "Recent OECD findings show that higher expenditure does not guarantee better student performance."[4] The Royal Society of the United Kingdom, in comprehensive state-of-the-nation reports on school science and mathematics leading up to higher STEM education, states, "It is clear from the evidence presented in this report that, as a whole, our education systems are failing to maximize the numbers of students who could go on to become STEM undergraduates".[5]

A Package of Solutions: The CVIF Dynamic Learning Program

In contrast to the tech-for-tech approach, we subscribe to the core-for-tech approach: building on strong fundamentals in scientific principles and the language of mathematics and computer science to facilitate the climb through the educational ladder from elementary school, to junior and senior high school, to college and university, with adaptability for unexpected exit at different steps of the ladder. However, for strong fundamentals to be developed in large student populations, not just the elite (since elitism goes against fair statistical distributions of talent), a solid framework is necessary. We have a design problem that can be stated following the disruptive

[1] http://www.china.org.cn/english/2004/Jun/99696.htm (downloaded May 29, 2016), trans. Ni Xiaoqiang: Report on an address of Acad. Wei Yu, Chinese Acad. of Engineering. (See also, for instance, the United States National Science Board report on, "Preparing the Next Generation of STEM Innovators: Identifying and Developing our Nation's Human Capital.").

[2] https://www.ed.gov/stem.

[3] M. V. Carpio-Bernido, Executive Summary of Invited Plenary Talk, 2016 Annual Scientific Meeting of the National Academy of Science and Technology (Philippines).

[4] http://www.moe.gov.sg/media/parliamentary-replies/2013/10/government-expenditure-on-education.php (downloaded August 5, 2015).

[5] "State-of-the Nation" reports on 5–14 (2010) and 14–19 (2008) Science and Mathematics Education, Royal Society; https://royalsociety.org/topics-policy/projects/state-of-nation/.

design demand of Henry Ford's Model T[6] but modified for educational lingo: "*We* will *design a learning program* for the great multitude. It will be large-*scale* enough for *state school systems*, but *individualized* enough for *each student in any school, private or state-run, in any part of the country.* It will be *composed* of the best *evidence-based features*, *chosen* by the best *team* to be *formed*, after the simplest designs that modern *pedagogy and learning sciences* can devise. But it will be so low in *cost* that no *nation* will be unable to *effectively implement* one." [7]

This program, which addresses multifaceted issues, was conceptualized and first implemented in 2002 in a secondary school, the Central Visayan Institute Foundation (CVIF), in Jagna, Bohol, Philippines. The CVIF Dynamic Learning Program (DLP)[8] works with (i) *small input:* least cost in human and material resources, in energy—both physical and fuel—and in social cost in terms of learner leisure and family time; and (ii) *big output*: wide spectrum of learners with high criterion-based performance levels in STEM and other disciplines. The program has built-in mechanisms to mitigate debilitating socioeconomic conditions. Finally, for sustainability the program is systems-based,[9] with a purposefully designed and controlled coherent learning ecosystem for process-induced learning in contrast to conventional teacher-induced learning. It focuses primarily on developing the learner's biological and intellectual disposition for sustained engagement such that learner performance is much less dependent on teacher and peer personalities, as well as on national and foreign policies.

[6]Ford, Henry; Crowther, Samuel (1922), My Life and Work, *Garden City, New York, USA: Garden City Publishing Company, Inc. Various republications, including* ISBN 9781406500189. *Original is public domain in US.*

[7]M. V. Carpio-Bernido and C. C. Bernido, Invited talk for the 10th Global Business School Network Annual Conference: *Disruptive Education Models from the Developing World*, November 2015, Asian Institute of Management, Makati, Philippines; adaptations, with apologies, in italics.

[8]M. V. Carpio-Bernido and C. C. Bernido, "Science Culture and Education for Change, Part I: Innovative Strategies for Secondary Education in the Philippines," *Transactions of the National Academy of Science and Technology,* vol. 26, No. 2 (2004), pp. 243–267; M. V. Carpio-Bernido and C. C. Bernido, "CVIF Dynamic Learning Program: A Systems Approach to Process-Induced Learning" in *epiSTEME 4: International Conference to Review Research on Science, Technology and Mathematics Education*, eds. S. Chunawala and M. Kharatmal (Homi Bhabha Centre for Science Education, Mumbai, 2011) pp. 269–273.

[9]L. von Bertalanffy, General System Theory: Foundations, Development, Applications. (New York: George Braziller, 1968).

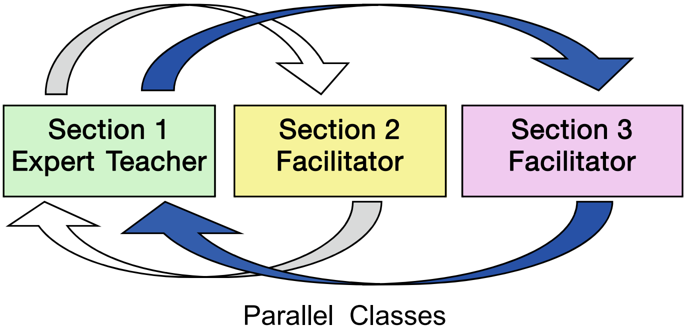

Figure 9.1 Classes for a given subject are held simultaneously for three sections

Essential Program Components

There are four key pillars in the CVIF-DLP,[10] which find analogy with efficient practices in other professions and are validated by recent neuroscientific findings. There are other features of the program, but these four components are the most essential and are non-negotiable for faithful implementation, which leads to significantly enhanced outcomes.

Parallel Classes

A subject or expert teacher handles two or three sections of the same subject simultaneously during one class period (Figure 9.1). This component strategically sets bounds on teacher intervention, because the hallmark of the CVIF-DLP is independent, personally active learning; 80 % of the time the expert teacher is not with the class, which is supervised by a teacher facilitator, who may not be a content expert.

In the context of managerial efficiency, the parallel class approach is able to minimize the number of subject teachers needed, because students are on their own doing learning activities most of the time. The approach, in which there is still structure, is in between the traditional teaching-learning setup and the no-teacher or distance learning setup. It is particularly helpful for alternative learning systems and for learning with online educational resources.

[10] M. V. Carpio-Bernido and C. C. Bernido, "Science Culture and Education for Change, Part I: Innovative Strategies for Secondary Education in the Philippines," *Transactions of the National Academy of Science and Technology,* vol. 26, No. 2 (2004), pp. 243–267; M. V. Carpio-Bernido and C. C. Bernido, "CVIF Dynamic Learning Program: A Systems Approach to Process-Induced Learning" in *epiSTEME 4: International Conference to Review Research on Science, Technology and Mathematics Education*, eds. S. Chunawala and M. Kharatmal (Homi Bhabha Centre for Science Education, Mumbai, 2011) pp. 269–273.

The parallel classes scheme is an inversion of the Jigsaw Strategy[11] devised by E. Aronson in 1971 in Austin, Texas, United States, where students are grouped into so-called home groups and expert groups. Each student contributes his or her understanding and explanation of a given concept as students transfer from the expert groups to their home groups. Successful achievement of learning objectives depends on the synergy of contributions. In the CVIF inverted format, the exchange between expert teachers and teacher facilitators enhances the learning process by fostering strategically proportioned independent and collaborative learning with specially designed learning activities.

Activity-Based Learning by Doing

The emphasis is on strategic thinking, writing, and doing. Students copy by hand and accomplish learning activities *without* introductory lectures from their subject teacher. Indeed, they do such activities without direct supervision and help from the subject teacher, with the class only managed by a teacher facilitator. This allows students to apply comprehension skills and analytical thinking, while fostering much peer tutoring.

Since 2002, a hallmark of the CVIF-DLP, which has encountered much opposition, is that each new lesson digest to be learned is copied by hand on the Learning Activity Sheet (LAS). For each new topic, all students write the Activity Title, Learning Target, and Concept Digest; draw illustrations; and answer questions (deliberately designed to fit one long-size page, font 14). This seemingly medieval strategy was purposefully chosen to coax learner disposition by such an initially intellectually nonthreatening mechanical action. The daily practice eventually becomes habit-forming for most students, and even if initially is resisted, most often there is a turning point at which the students discover whether they like it or not; whether they are aware of it or not; and many eventually find themselves *enjoying* learning as intellectual stimulation, especially since independent learning gives them more confidence. Thus, such development of biological and intellectual habits bypasses the common problem of motivation, with teachers resorting to song and dance, theater, and fun games, yet observing the rapid decline in motivation when the fun ends. Indeed, intellectual habits are more important when doing advanced activities in physics, chemistry, and calculus, among others. Moreover, copying by hand slows down the learning pace, allowing more time for deeper absorption and understanding of concepts and principles, in contrast to listening to lectures or discussions that often proceed at a rapid pace, especially when teachers are pressured to cover the given scope of competencies. The effect of writing by hand on learning has been analyzed in recent studies.[12]

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[11] www.jigsaw.org/history.htm.

[12] P. A. Mueller and D. M. Oppenheimer, "The Pen is Mightier than the Keyboard: Advantages of Longhand over Laptop Note Taking," *Psychological Science* (2014) https://doi.org/10.1177/0956797614524581; F. Bara and E. Gentaz, "Haptics in Teaching Handwriting: The Role of Perceptual

Finally, since monitoring and evaluation of the progress of learning is extremely important, the accomplished LASs by different classes and grade levels provide an extremely huge source of data for assessment of learning. Prototype LASs have been uploaded for open access from anywhere in the world. For example, a sample LAS in Chemistry may be found at https://eduversum.org/cvif, which is an offshoot of a CVIF collaboration with Science-Corps (see, e.g., https://www.youtube.com/watch?v=M3KETUt0OlQ), a nonprofit organization based in California, United States. With the help of a telecommunication company, Smart Communications, and the PLDT-Smart Foundation, a collection of 239 LASs in Physics may also be accessed in the e-learning section of https://dlp.ph, which is an output of the "Learning Physics as One Nation" project of the Fund for Assistance to Private Education (Philippines).[13]

In-School Comprehensive Portfolio

Portfolios in school have been popular since the last century, but most were for selected school work or mini projects. In the CVIF-DLP, the concept is expanded into a Comprehensive Portfolio for compiling all the daily LASs, small projects, quizzes, and examinations accomplished by the student. A single-subject portfolio could easily be more than 200 written pages when the school year ends, at which time they finally bring this home.

As the compilation of daily LASs and assessments, the portfolio ensures not only that learnings that happen within the day are well documented, but also that the process of systematic organization of data is imbibed—a skill necessary in the world of work.

Strategic Rest

Since its initial implementation in 2002, the CVIF-DLP has already incorporated (i) a no-homework policy, (ii) a light midweek load (Wednesday for Physical Education, Music, Arts, and Health), and (iii) deterrence against external tutors after school hours. This is because the intensity of learning during school hours necessitates rest and recreation after school, which also makes external tutors unnecessary for enhanced learning. Moreover, parents are advised to make sure their children

and Visuomotor Skills," *Human Movement Science* (2010), https://doi.org/10.1016/j.humov.2010.05.015; and K. James and L. Engelhardt, "The Effects of Handwriting Experience on Functional Brain Development in Pre-Literate Children" *Trends Neurosci. Educ.* 1 (2012) 32–42.

[13]Carpio-Bernido, M. V., Bernido, C. C. and Porio, C. C. (2011) The Learning Physics as One Nation Initiative: Bypassing the National STEM Teacher Shortage. In *Proc. of the* epiSTEME 4 (Mumbai: HBCSE).

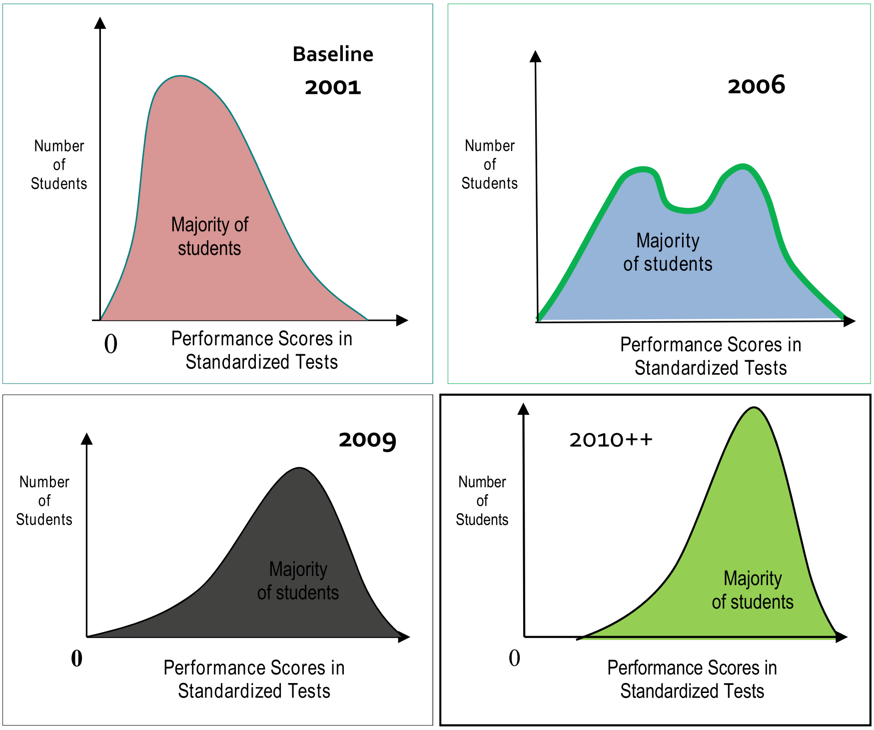

Figure 9.2 Frequency distribution of CVIF students based on percentile rank in national examinations

have enough sleep following the requirements recommended by the National Sleep Foundation. Recent neuroscientific studies also show that sleep is good for learning.[14]

Performance Indicators

Every year the Philippine Government conducts a national examination, which the CVIF has been monitoring. Figure 9.2 shows the results of the National Scholastic Achievement Test and later the National Career Assessment Exam. Prior to the implementation of the CVIF-DLP in 2002, the majority of the students were clearly underperforming (upper left graph). However, starting in 2010 up to the present

[14]https://www.sleepfoundation.org/excessive-sleepiness/support/how-much-sleep-do-we-really-need (downloaded April 2019); J. M. Saletin, A. N. Goldstein, and M. P. Walker, "The Role of Sleep in Directed Forgetting and Remembering of Human Memories" *Cerebral Cortex*, 21, (2011) 2534–2541; and J. Tamminen, J. D. Payne, R. Stickgold, E. Wamsley, M. Gaskell, "Sleep Spindle Activity is Associated with the Integration of New Memories and Existing Knowledge," *Jour. of Neuroscience*, 30 (2010) 14356–60.

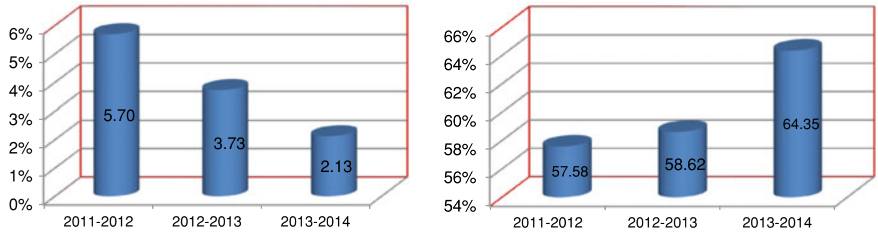

Figure 9.3 Declining failure rate (left) and rising NAT scores (right) in the division of Bohol during the first 3 years of CVIF-DLP implementation

(lower right graph), the truncated tail shows no student having a percentile rank below Below Average, in spite of the fact that the CVIF has a very liberal admission practice, with the majority of incoming Grade 7 students coming from public elementary schools (the CVIF has only a high school department).

In 2011, with the joint efforts of the Department of Education (DepEd) Division of Bohol and the Office of the Governor, more than a hundred public secondary schools in Bohol adopted the CVIF-DLP approach. The results, as reported by a Division of Bohol DepEd official during the annual CVIF-DLP workshops, are improved performance in the National Achievement Test (NAT) and declining failure rate (Figure 9.3), among other behavioral indexes such as the rise in love for learning and the conditions children find at school that keep them in school, hence improving retention. Dropouts and absenteeism have been minimized despite the fact that some children also walk for kilometers to attend school and no additional support is provided to them.

However, after the first 3 years, many administrators tweaked the CVIF-DLP and pursued selective implementation of the program features. A comprehensive assessment of the Bohol implementation is presently being undertaken so as to distill contributing factors to improved learning outcomes.

Many CVIF graduates went on to show exemplary performance in college, and some students were able to get scholarships to prestigious schools abroad. One is pursuing his PhD in Marine Science at ETH Zurich; another graduated with a BS in Anthropology from the University of California, Berkeley; an alumna is pursuing her PhD in Physics in Germany under the Max Planck Institute-University of Dresden collaboration; and an information and communication technology (ICT) graduate landed a job with Google Philippines within a year of finishing Grade 12.

Conclusion

Strategizing on and operationalizing the vision of a good school inside the classroom is very important. The CVIF did this by adopting the four key learning pillars encapsulated in the CVIF-DLP (see, e.g., https://www.youtube.com/watch?v=cmYljCepS-8) that target the development of learners' disposition and skills development habits helpful for the twenty-first century despite challenges such as the insufficient number of quality teachers, equipment, and textbooks. Through its main features/pillars, the CVIF-DLP fosters the development of the following habits among students: (i) independent learning—because they tackle new lessons without prior lectures, and they are encouraged to comprehend new learning materials and frame answers to questions; this habit-forming feature of the CVIF-DLP will be crucial in the coming decades wherein an individual has to learn several new skills in a lifetime; (ii) organized logical thinking and big picture perspective—developed primarily through the practice of sequential filing of the year-long plan of activities, the daily accomplished activities, examinations, and quizzes into portfolios; and (iii) collaboration and teamwork—enhanced because peer tutoring is pronounced in the CVIF-DLP since subject teachers intervene during only around 30 % of the class period. All these important learning habits can be developed in spite of minimal resources.

Link to the presentation material: https://events.development.asia/materials/20171212/essentials-over-peripherals-central-visayan-institute-foundation-dynamic-learning.

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Chapter 10
Guiding Kindergarten to Grade 12 Students to Mastery with Next Generation Digital Assessments

Satish Kumar

As technology rapidly advances, learning dynamics also evolve in terms of curricula, pedagogy and teacher–student dynamics. Education technologies that emerged over the course of the last couple of decades enable teachers to make instruction and learning more efficient and effective. Edulastic, for example, is an online assessment tool with interactive question types that provides teachers real-time data on student understanding of the lessons. Through Edulastic, teachers and school leaders can create a plan of action to effectively teach based on what still needs to be learned, depending on individual student progress. Such digital assessment platforms with instant feedback and interactive formative assessments encourage to learn, grow and improve every single day, helping them to reach their full learning potential.

Technology has changed society, without a doubt, and we are now more interconnected than ever. Education has seen this trend through the education technology (EdTech) that has emerged over the course of the last couple decades. Teachers now guide their instruction with technology; this makes them teach more efficiently, and their students learn more thoroughly. Schools across the United States and world are moving closer to 1:1 technology. This means that every student will eventually have a personal technological device to learn from and research on. EdTech is prevalent in schools and this prevalence will only continue to grow.

With new technology comes new dynamics between teachers and students, new curricula, and new ways to learn. The world is rapidly developing, and so is EdTech. One of the ways technology is positively affecting learning is through online assessments. Now, students can take a quiz or test online instead of with pencil and paper. These online platforms grade assessments automatically, giving students immediate results and relieving teachers from grading work. Beyond this, online testing platforms produce powerful data. School leaders, district administrators, and teachers

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can review reports in real-time to understand where their students are finding success and where they need to intervene and reteach.

These online assessments are effective for both summative (end of unit) and formative (informal, quick) assessments. When a teacher does not want to wait until the end of a unit to give an assessment, he or she can use various tactics like formative assessment to "check in" with students and see how they are progressing. Together the words "formative" and "assessment" refer to a guiding evaluation that helps to shape something. With formative assessment, teachers mold or form instruction to better suit student learning. To glean actionable insights, the best formative assessments are generally easy to implement and offer immediate results that lead to instant intervention or instructional adjustments (Tookoian 2017).

While most educators are rapidly accepting this move to technology and toward online formative assessments, others are slower to adopt this new way of instructing. Formative assessments allow teachers to focus on individual student learning. The results from these quizzes help teachers differentiate their instruction to guide individual students toward overarching understanding. That said, giving individual attention to students can be especially difficult when there are large class sizes. Large class sizes tend to result in less personalized learning. Oftentimes, students in large classes move onto the next lesson (and the next level) without acquiring some kind of mastery of the skills they need. It is challenging to solve the problems associated with large class sizes, so many schools are turning to technology as a solution. Technology helps educators create such personalized learning environments that begin with formative assessments.

One of the most popular formative assessment tools is Edulastic, an online assessment tool with interactive question types that provides teachers real-time data on student understanding. Edulastic empowers educators to proactively intervene with their students and to guide their instruction based on immediate and powerful reports.

Edulastic is easy to use and is readily available for teachers in classes of all sizes. Because Edulastic is a cloud-based application, it is effective all over the world. More than 400,000 teachers use Edulastic to gauge student learning and effectively differentiate their instruction. Since Edulastic was launched in 2014, more than 1.4 billion technology-enhanced items have been answered on the platform. Teachers can create their own teacher education institutions, mix and match and/or collaborate with colleagues in the school or district. All questions, including sophisticated equation response, graphing, etc., are auto-graded, resulting in instant data with minimal teacher effort at manual grading.

Once a formative assessment is under way, the Edulastic Live Class board gives teachers real-time data on student performance. Figure 10.1 indicates how the class is performing per question. The blue line running through the bar graph shows the average time spent on each question by the class. This type of data allows teachers to evaluate student performance not only after the fact, but *while students are taking the assessment* (Edulastic 2019).

The Edulastic team of dedicated engineers consistently works to make Edulastic available and helpful to everyone in the education community. Not all schools have 1:1 technology, and it is important to be able to cater to all different communities around the world. In schools that do not yet have 1:1 devices, or even computer

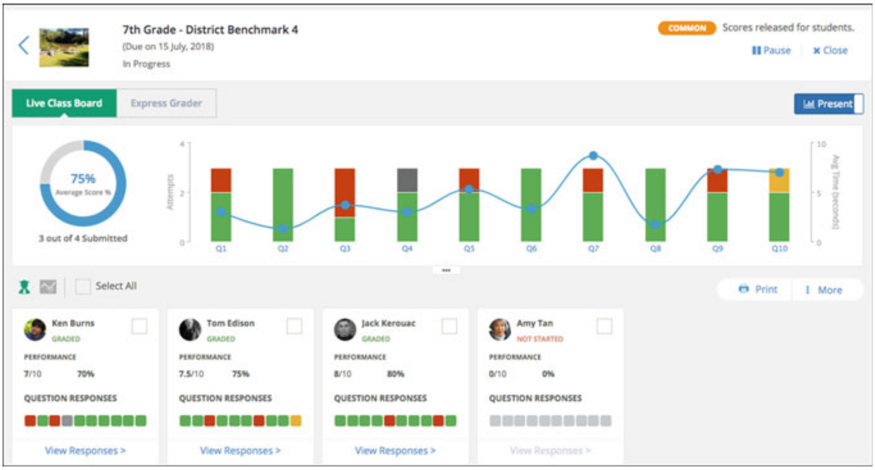

Figure 10.1 Edulastic live class board: teachers see real-time assessment results

laboratories, teachers can use Edulastic's SnapScore to track student progress. After creating an assessment in Edulastic, teachers can easily and conveniently print bubble sheets and open ended questions for students to complete on paper. When students have completed the assessment, a teacher uses the SnapScore app on a smartphone to scan and capture student responses via the phone camera for purposes of scoring and analyzing results (Edulastic 2018). SnapScore has taken the advantages of online assessment and creatively mixed them with the offline world—bringing forward solutions that have increased performance and efficiency in grading and teaching in all areas of the world.

Teachers, schools, and districts find the most success with Edulastic when they start with a diagnostic assessment. Diagnostic assessments are pretests. They usually serve as a barometer for how much preloaded information a student has about a topic. Diagnostic tests help to tell the teacher (and the student) know how much they know and do not know about an upcoming topic. This helps to inform the teacher's lesson planning. Though both diagnostic assessments and formative assessments aim to inform teachers to instruct more effectively, they emphasize different aspects of teaching. Formative assessments are taken during a unit to assess how students are learning the material that the teacher has been teaching. Diagnostic assessments come before this, analyzing what students have learned in the past, many times from different teachers or classes (Tookoian 2018a, b). Based on the results of diagnostic tests given on Edulastic, teachers and school leaders can create a plan of action to effectively teach based on what still needs to be learned.

Take the example of the Paragould School District in the State of Arkansas, United States (Tookoian 2019). In 2015, educators there received discouraging news: Their test scores on the ACT Aspire, their state's standardized test, were significantly below the state average. For example, just 27% of Paragould's middle school students scored proficient in mathematics, compared with a statewide average higher than 40%. These

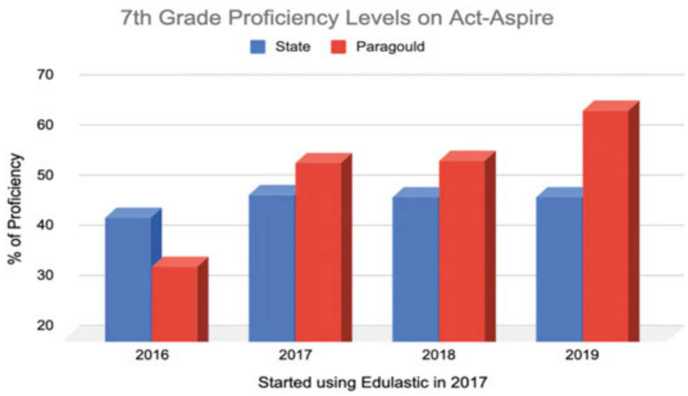

Figure 10.2 ACT Aspire data, Paragould school district

test results served as diagnostic information for Paragould leaders. They were able to understand where their students stood on essential mathematics, social studies, and science assessments. With this information, teachers and administrators came together to set a growth goal and create a structured program to monitor and support students' daily, weekly, and monthly progress.

They turned to Edulastic for help, and their efforts have paid off tremendously. Teachers in the Paragould School District use Edulastic to administer common formative assessments. Because these custom assessments are administered online, teachers and administrators get immediate feedback on skill gaps. These insights not only allow for better conversations among educators, they also promote collaboration and identify areas where support or instructional adjustments are needed. This, in turn, sets the stage for targeted remediation for those students most in need of assistance (Tookoian 2019).

> "Without the common assessments we wouldn't know where our students are standing throughout the school year and what we need to do to get them to where they need to be," says Melissa McPherson, a Paragould 8th grade mathematics teacher. "The common assessments just open our eyes much earlier than if we waited until the ACT Aspire at the end of the year."

Teachers share goals, strengths, and areas for improvement with students as well. This transparency gives students ownership of their learning and motivates them to do their best. If students demonstrate standards proficiency on their assessments, designated remediation time becomes free time where they can choose to do art or read. Otherwise, students spend the remediation period working on understanding and mastering the standards (Tookoian 2019).

When results came out for the 2017–2018 school year, middle school mathematics proficiency jumped 10 percentage points, surpassing the statewide average and earning the district recognition for top growth scores in the state (Figure 10.2).

This success has started to change the culture in the district, adding momentum to the upward learning trajectory. "Any time your test scores go up, and any time you start seeing success, it changes the culture of the building," Technology Integration and Math Specialist at Paragould School District Matt McGowan says. "We've seen that in two or three of our buildings so far. Teachers are wanting to push the kids a little bit further because they want to keep getting better" (Tookoian 2019).

This success story is representative of the power of digital formative assessment. With that in mind, it is important to also recognize that not all schools have access to the type of technology that the Paragould School District has. Regardless, this should not act as a roadblock to using Edulastic to drive instruction.

There are several ways schools around the world are mainstreaming Edulastic. Edulastic can be taken to scale even in schools without 1:1 technology in their classrooms. SnapScore, as described above, is one of these ways. Teachers in Asia, Africa, Europe, and around the world use Edulastic to advance their teaching through SnapScore. This provides data and accurate student reports to those teaching in the offline world. With these data, teachers in all academic settings are able to inform their instruction accordingly. Beyond this, teachers who do not have access to 1:1 technology can quickly and easily manually enter their scores into Edulastic and leverage the data for more personalized instruction. The information collected through Edulastic can feed to a bigger database for analysis purposes of school development and planning of provincial, regional, and national education systems.

Edulastic is also used by universities in India for computer science programming. With Edulastic, professors can track student data and monitor progress in real-time, so they can take action and see growth.

This is the way forward. Digital assessment platforms like Edulastic can help all students reach their potential. With instant feedback and interactive formative assessments, students are encouraged to learn, grow, and develop every single day. A positive and collaborative learning environment can be achieved as education systems around the world move toward online formative assessments.

Link to the presentation material: https://events.development.asia/materials/20190829/empower-educators-proactively-intervene.

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Chapter 11
Nongovernment Organizations' Role in Providing Quality School Education in Pakistan: The Experiences of CARE Foundation

Seema Aziz

Nongovernment organizations (NGOs) have played a crucial role in Pakistan since the country's independence in 1947 to assist in the establishment of the new government, mostly concentrating on rehabilitation and basic services (e.g., health and education). Since then, many NGOs have existed to champion human rights, and to cater to the poor and marginalized.[1]

Issues and Challenges

Pakistan faces significant challenges in providing access to education for its people. Aside from being among the countries with the world's highest out-of-school population, more than half of its adult population is unable to read and write. Latest data (2016–2017) also show that there are almost 22.5 million out-of-school children, with more girls than boys. These children do not go to school due to lack of access or because they do not see it worthwhile to pursue poor quality education. The Government of Pakistan attributes these poor education outcomes to low financing, inefficient budget spending, and weak management.[2]

Given these challenges, numerous NGOs have taken an active role in supporting the education sector. Many NGOs directly provide primary education in areas where

[1] Asian Development Bank. 1999. A Study of Nongovernment Organizations (NGOs) in Pakistan.

[2] Ministry of Federal Education and Professional Training 2018, Pakistan National Education Policy Framework 2018.

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there are no public or private schools, and give support for teacher training, curriculum development, and others.[3]

Proposed Solutions

In general, NGOs are encouraged to actively get involved and complement government initiatives. Particularly, NGOs have strengths in the areas of advocacy, service delivery, capacity building, grassroots community mobilization, innovation, social experimentation, and research.[4] Such roles and areas of partnership have strong potential in aiding the Government to come up with replicable practices and innovative interventions to address education challenges in the country.

CARE Foundation's Good Practices

CARE Foundation Pakistan is a nonprofit organization that was founded in 1988 when the founder was visiting flood-affected areas to contribute to helping people rebuild their homes. CARE stands for cooperation for advancement, rehabilitation and education. It was established by first seeking donations from friends and family. The day CARE opened the first school's doors, 250 children were standing outside, waiting to be enrolled.

CARE is on a mission to provide every child in Pakistan with an equal opportunity and access to quality and marketable education. Education is a great equalizer, and it has the potential to reduce economic disparity within segments of the Pakistani population. CARE set up model schools in underdeveloped areas to provide children with equality of opportunity by providing education equal to the best schools in Pakistan.

In 1998, the local government approached CARE and requested it to adopt 10 government schools in failing condition. CARE transformed these schools by providing trained teachers and missing facilities and later took over another 180 government schools. CARE Foundation led the Government School Adoption Program in Pakistan and pioneered the public–private partnership model within K–10 education. This was a unique partnership that helped provide quality education to the masses. Although faced with a lot of opposition from within the public school setup, this model turned out to be the most successful initiative to improve access and

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[3]Shah, G.H., Bari, F. and Ejaz, N. 2005. The Role of NGOs in Basic and Primary Education. LUMS-McGill Social Enterprise Development Programme, 2005.

[4]ibid.

quality of education throughout the country. CARE's public–private model has made a huge contribution toward improving education, as it is highly scalable, replicable, and cost-effective.

CARE Foundation brought a series of best practices to government schools by investing in infrastructure to ensure that children are provided with an environment conducive to learning. It transformed schools by building toilets, science laboratories, computer laboratories, libraries, and well-lit and ventilated classrooms, and it provided these schools with new furniture, clean drinking water, and proper sanitation. To inculcate and sustain the quality of education, CARE trained its own teachers, who later held training sessions for public school teachers to ensure that the curriculum being taught was comprehensive and the latest in K–10 schooling. The quality of education had a tremendous effect on the nearby populations' willingness to send their children to the schools. Enrollment went up by 400%, on average. CARE Foundation progressed from operating 10 government schools in 1998 to 855 schools by 2019, including double shift operations in 93 government schools to meet the increased demand. More than 285,000 students are currently studying in schools operated by CARE Foundation. In parallel, CARE also owns and operates 33 purpose-built schools today.

CARE runs the Teacher Training Program during the summer break, the winter break, and the induction period, wherein extensive training is provided. Under the CARE Teacher Training Program, the Foundation trains more than 7000 teachers on classroom management, activity-based learning, lesson planning, and more. Consequently, this helps teachers become more effective and empathetic educators.

In 1998, CARE Foundation felt that, while K–10 education is absolutely necessary, having a platform to attain university education definitely improves the odds of students successfully transitioning to the job market. The CARE Scholarship Program was introduced to offer a number of scholarships every year to bright and deserving students for university education. The 5000 recipients thus far have gone on to graduate from Pakistan's leading universities. The opportunity has been described as life-changing by these recipients. They become role models within their respective communities, encouraging more households to follow suit by committing to put their children through school and later university education.

With a focus on schools being the place where children's critical thinking and problem-solving and creative skills are nurtured, CARE also introduced several programs to meet the need. The Foundation provides its students with opportunities to learn new concepts, while enhancing an active interest in subjects that range from art to science, technology, and more.

For instance, CARE Foundation also implements the Access to English Language Program, launched in 2004, with the aim of developing English language skills in CARE schools. The Foundation currently has over 10,000 Access to English Language students enrolled in 280 CARE schools across Pakistan. On the other hand, CARE's Project-Based Learning Program fosters curiosity and promotes innovation. The program is centered on a specific theme each year. Students brainstorm and portray these themes through a spectrum of projects aimed at stimulating their critical thinking skills.

Another program that is designed to catalyze students' critical and creative thinking skills, particularly through the arts, is the "Creativity, Culture and Education" program. The program is currently being run in 100 schools across Pakistan; 7000 students along with 140 teachers have participated in the program so far. One of our latest initiatives is the STEM program, which is designed to encourage experiential learning among our students from the inception of their schooling years. STEM is a curriculum based on the idea of educating students in four specific disciplines—science, technology, engineering, and mathematics—through an interdisciplinary and applied approach. The CARE Alumni Network is also a major source of support for the alumni after they graduate. Resilience, strength, and courage are some key attributes CARE infuses in its students, which become core values as the students develop, enabling them to excel in their fields of interest.

After the first CARE school was set up in 1991, an industrial home was also set up to generate income opportunities for women affected by the devastating floods. The program has turned into a full-fledged enterprise development program known as CARE Crafts. The CARE Crafts project uses leftover textile pieces from local apparel houses to create accessories. The funds generated through this initiative are invested in CARE schools.

Education reduces poverty, boosts economic growth, encourages gender equality, and fosters peace. CARE Foundation's goal is to enroll 1 million children in our schools and provide them with an education on par with the best educational standards around the world.

Application of These Good Practices

CARE Foundation focuses on the quality of the basic education it provides. Instead of solely focusing on just building schools to reach poor and underprivileged children, CARE Foundation emphasizes ensuring quality education as a way of encouraging and keeping children in school. It recognizes that access/availability of schools is not sufficient to improve educational outcomes in Pakistan. The Foundation operates under the principle that student enrollment will improve if we raise the quality of education, even if we do not provide scholarships or financial assistance.

The CARE Foundation model also makes sure to consider culture and values in carrying out its curriculum and other programs. For instance, aside from providing quality education among Pakistani children, what is noteworthy about CARE Foundation is that it ensures an encouraging environment, and fosters creative and innovative approaches to learning. CARE believes that "it is more important how much the teacher cares, more than what the teacher knows."

CARE Foundation has not only improved enrollment, cohort survival rates, and quality of schools; it also promotes socioemotional or soft skills, which are deemed crucial in preparing children for the future world of work. Overall, CARE has been able to use its strategic strengths and expertise as an NGO (i.e., advocacy, service delivery, capacity building, grassroots community mobilization, innovation, social experimentation, and research) to come up with successful practices that complement and improve government education programs.

Implications for the Future

As rapid technology adoption is transforming skills requirements globally, it is imperative for education systems to ensure that children are well prepared to keep up with the pace of the changing world of work. Learners need to be equipped with skills that cannot easily be automated, such as ability to collaborate, communicate, and solve problems. These twenty-first-century skills are developed through social and emotional learning,[5] which the CARE Foundation model already integrates in its curriculum and teaching methodologies.

This model is cost-efficient and easy to replicate. However, such an approach entails consistent internal monitoring and evaluation for growth and replication. Sustained support from government and the private sector would also significantly help scale up and sustain such practices.

Conclusion

Given NGOs' strengths in performing various roles to contribute to society, they are key players in championing and achieving basic education reforms. Their nature as NGOs gives them strengths and strategic opportunities to come up with innovative practices that can help achieve desired outcomes and goals in education.

CARE Foundation's model schools in disadvantaged and underdeveloped areas in Pakistan have shown positive results. Enrollments in CARE schools have increased and some schools have even started running in double shifts. Subsequently, more schools in other rural areas were opened. These successes have motivated the Pakistan Government to collaborate and pursue public–private partnerships. Although initially faced with resistance and opposition within the system, this collaboration has notably contributed to increased access and improved quality of education in Pakistan. CARE was not only able to help in ensuring adequate infrastructure in government schools, but also in teacher training and curriculum improvement.

While such education initiatives from the private sector and civil society are easy to replicate, strong partnership with government will be crucial in ensuring success, as observed in the experience of CARE Foundation. Close cooperation among government, civil society, the private sector, and communities is instrumental

[5] World Economic Forum. 2016, March. What are the twenty-first-century skills every student needs? WEF Website, Retrieved from http://www.weforum.org/agenda/2016/21st-century-skills-future-jobs-students.

in identifying the challenges and needs of the education system to ensure that the right issues are being addressed. Such cooperation also facilitates productive and efficient pooling of resources, as well as complementation of programs being implemented by different stakeholders.

Link to the presentation material: https://events.development.asia/materials/20171212/care-foundation-changing-lives-through-education.

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Chapter 12
Kindergarten to Grade 12 Reforms in Viet Nam

Ron Cammaert, Thi Phuoc Lai Nguyen, and Sakiko Tanaka

Viet Nam has evolved from one of the world's poorest countries in the 1990s to a lower middle-income country with a per capita income of $2,111 in 2015—more than 20 times larger than that in 1990 ($98).[1] To make the most of its middle-income stage of development and to avoid being perpetually trapped there, Viet Nam will need to create productive job opportunities, support intermediate technology, and promote research and development and innovation. Ranked 77th out of 140 countries on the Global Competitiveness Index 2018, Viet Nam's labor productivity levels are lower than other countries in the region.[2] A shortage of skills and gaps in the labor force is affecting the country's ability to absorb new foreign investment and limiting prospects for expanding productive employment (only 21.5% of the employed labor force has qualified skills—24.1% of men and 18.8% of women).[3] The education system needs to be reformed to give students equitable access to relevant skills.

[1] World Development Indicators, World Bank, http://data.worldbank.org/country/vietnam (accessed 24 April 2017).

[2] World Economic Forum. 2018. *Global Competitiveness Report 2017–2018.* Switzerland.

[3] General Statistics Office (GSO). 2017. *Labor Force Survey Q1 2017*. Ha Noi.

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The Government's high priority on education has resulted in new teacher standards, student-centered teaching, a new school accreditation agency, and expanded learning opportunities for disadvantaged youth. The 2012 and 2015 results from the Programme for International Student Assessment (PISA) showed that Vietnamese students are internationally competitive.[4,5] The Socio-economic Development Plan 2016–2020 also indicates that the education sector performed well over the period 2011–2015. However, every Sustainable Development Goal requires education to empower people with the knowledge, skills, and values to build their lives and contribute to society. Science, Technology, Engineering, and Mathematics (STEM) education appears relevant and essential for preparing the young generation.

Issues and Challenges

Net Enrollment Rates Have Yet to Be Realized. The general education system consists of preprimary programs catering to 3–5-year-old students; a 5-year program of primary education for students starting at six years of age; Lower Secondary Education (LSE) covering grades 6–9 for 11–14-year-old students; and Upper Secondary Education (USE) for grades 10–12. Viet Nam's birth rate has been declining, which is reflected in the dip in the total number of students in the education system around School Year (SY) 2008/09. Enrollments in preprimary and primary have increased in the last five years, but enrollments in LSE and USE are still lower than historic highs. In SY2015/16, about 7.79 million students were enrolled in primary (3.74 million girls), 5.14 million in LSE (2.51 million girls), and 2.43 million in USE (1.30 million girls). In SY2015/16, universal primary education was achieved with a Net Enrollment Rate (NER) of 99%. However, the Government's targets of achieving an NER for LSE of 95 and 80% for USE have not yet been realized (in SY2015/16, LSE was at 92.3% and USE at 63.0%).[6]

Quality of Secondary Education Remains Weak and Not Relevant to Labor Market. As the economy becomes modernized and industrialized, the challenge is to produce graduates and school leavers who are technically skilled and able to critically analyze and solve problems. Although Viet Nam's results for PISA 2012 and 2015 were at or above the international average, the results for mathematics and reading declined from 2012 to 2015, were lower than neighboring economic

[4]OECD. 2016. PISA 2015 Results (Volume I): Excellence and Equity in Education, OECD Publishing, Paris.

[5]On the 2015 PISA assessment, the performance of boys and girls was not significantly different for mathematics and science, but as in all OECD countries girls outperformed boys in reading.

[6]National data is from *Education Statistics Yearbook 2015–2016*. Ha Noi and gender data are from *Household Living Standards Survey 2014*; the NER in LSE for boys was 83.8% and for girls was 85.1%; at the USE level, the NER for boys was 58.2% and for girls was 68.3%. While overall NER in LSE and USE is higher for girls, gender disparities in access and achievement remain an issue for certain regions and provinces, and for certain groups.

competitors, and had few high-performing students.[7] Having a low percentage of students performing at the top levels signals the absence of a highly educated talent pool for the future. Viet Nam's high performance could also reflect rote learning and proficient test-taking skills, rather than the ability to use knowledge in new situations.[8] The National Achievement Monitoring (NAM) test results show a decline at the grade 9 level in all subjects and a decrease in mathematics at grade 11. NAM results indicate that only 46.7% of grade 9 students passed the national 2012/2013 mathematics assessment (boys at 46.7% and girls equal at 46.6%), while only 52.2% of grade 11 students passed the 2014/2015 mathematics assessment (boys at 48.0% and girls significantly higher at 55.8%), and only 40.4% of grade 11 students passed English (boys at 38.5% and girls at 45.2%).[9]

Secondary Education Does Not Provide Students with Skills to Succeed in the Workplace The present curriculum was designed to be broader in scope and relevant to labor market needs.[10] New textbooks were developed, and teachers received extensive training on new approaches to learning and teaching. Despite these efforts, a 2010 study by Viet Nam's National Institute of Education Sciences concluded that (i) the curriculum did not equip students with the knowledge and skills needed for future careers, and (ii) the low quality of secondary education constrained the development of a skilled labor force.[11] For secondary education graduates—who enter the labor market immediately after graduation—and students who continue postsecondary education, jobs are difficult to find. Secondary education does not provide students with the cognitive, social, and behavioral foundation skills that are critical to succeeding in the workplace. The returns to education for LSE and USE graduates were only 1.2 and 1.5 larger than those of primary education graduates, respectively, while college and university graduates earn 2.4 times more than primary graduates and 1.8 times more than USE graduates.[12]

High Percentage of the Population Not Obtaining Secondary Education. Because too many young people are not receiving enough education, Viet Nam cannot move forward economically and socially. In SY2015/16, about 430,000 youths (240,250 boys and 189,750 girls) of LSE age were not enrolled in the school system. At the USE level, more than 1.4 million youths (821,400 boys and 602,600 girls) were not enrolled. Having such a high percentage of the population not obtaining secondary

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[7] OECD. 2016. PISA 2015 Results (Volume I): Excellence and Equity in Education, OECD Publishing, Paris.

[8] University of Oxford, Young Lives. 2017. *Thinking outside the box: Do students in Vietnam have 21st century skills?* https://www.younglives.org.uk/content/thinking-outside-box-do-students-vietnam-have-21st-century-skills (accessed 11 September 2017).

[9] Government of Viet Nam, Ministry of Education and Training, Center of Education Quality Assurance. 2016. *Results from the National Achievement Monitoring*. Ha Noi.

[10] ADB. 2011. *Project Completion Report: Upper Secondary Education Development Project in Viet Nam*. Manila.

[11] Viet Nam National Institute of Education Sciences. 2010. *Assessment of Quality of Upper Secondary Curriculum and Textbooks*. Ha Noi.

[12] Source: Labor Force Survey. 2014.

education represents a significant loss to the economy.[13] Lack of access to and poor quality of secondary education affect the labor force.[14] Despite the Government's continued efforts to increase access to education and retain school students from vulnerable groups, including ethnic minorities, disabled, and girls living in the Northern Midland and Mountainous regions, inequality in educational access and quality persists, especially among boys and girls from ethnic minority groups and various geographic regions.

Educational Opportunities for Ethnic Minority and Children with Disabilities Still Restricted. In addition to not being able to take advantage of access to education, ethnic minority students who are in school achieve considerably lower than those in the majority. There have been few targeted interventions for youth with disabilities. According to the 2009 Viet Nam Population and Household Census, around 7.8% (7.1% of males and 8.5% of females) of the population of 5-years-old and older live with one or more physical or mental disabilities. However, in SY2013/14, only 13,572 students with a disability attended LSE, which is 0.3% of the student population at this level, and 1,520 or 0.1% of students at USE.[15,16] While the Government has provided financial support programs to the disabled, education opportunities for these children remain restricted with fewer opportunities for employment and integration.

Proposed Solutions

Government Committed to Enhancing Educational Quality. The policy framework for the long-term development of education is defined by (i) the Socio-economic Development Strategy, 2011–2020; (ii) the Education Development Strategy, 2011–2020; (iii) Resolution No. 29; (iv) Resolution No. 44; and (v) Decision No. 2653.[17]

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[13] At both the LSE and USE levels, there are proportionally more boys than girls not attending school. Gender disparities exist between geographical regions, with a higher number of out-of-school boys in the Central Highlands and a higher number of out-of-school girls in the Northern Midlands and Mountainous area (54.3% of out-of-school children at USE were girls in that region). From *UN Vietnam Gender Briefing kit 2016*.

[14] General Statistics Office. Labor Force Survey Q1 2017. It defines "qualified skills" as workers with at least three months of vocational training, professional secondary, technical college, or university degree.

[15] Department of Planning and Finance, MOET. 2015. Ha Noi.

[16] According to the 2009 Viet Nam Population and Household Census, the ratio of girls to boys with a disability in school was about 0.7, indicating a disproportionate number of girls are not attending school.

[17] Government of Viet Nam. 2010. *Socio-Economic Development Strategy, 2011–2020.* Ha Noi. Central Committee of the Communist Party of Viet Nam. 2013. Resolution No. 29-NQ/TW 8 on *Comprehensive Innovations of Education and Training*. Ha Noi. Government of Viet Nam. 2014. *Prime Minister's Resolution No. 44/NQ-CP on Radical Changes in Education and Training*. Ha Noi. Government of Viet Nam. MOET. 2014. Minister of Education *Decision No: 2653/QD-BGDĐT Action Plan of the Education Sector for the Implementation of Resolution No. 29*. H Ha Noi.

The Government is committed to enhance education quality through comprehensive reforms that will foster integration of disadvantaged groups in education and competitiveness in the labor market and is committed to achieving the United Nations' Sustainable Development Goals (SDGs) and to achieve gender equality through the Action Plan on Gender Equality of the Education Sector for 2016–2020.[18]

Education reforms Are Being Planned. The Ministry of Education and Training (MOET) approved a new curriculum in December 2018 to achieve the desired renovation of the education system through (i) simplify and modernize the curriculum to better address labor market requirements; (ii) have teaching and learning methods that encourage the learners' independence, creativity, and application of knowledge; (iii) ensure that textbooks, teaching, and learning materials suit the needs of corresponding learners, remove gender stereotypes, and promote positive attitudes to ethnic minorities or those who are disabled; (iv) establish examinations and classroom assessments that measure the desired student competencies; (v) equip educators by changing the aims, content, methods of training, retraining, and evaluation of teachers and management officials; (vi) ensure that students receive career guidance; (vii) have local education administration agencies participate in decisions on personnel, finance, and administration; (viii) strengthen gender mainstreaming in education; and (ix) assess and disclose the quality of educational institutions throughout the country.

Government Targeting Spending 20% of Total Budget on Education and Training. In 2015, Viet Nam's expenditure on education and training was 15.3% of the total government budget, which is comparable to its middle-income neighbors and to the regional average of East Asia and the Pacific. At 5.5% of gross domestic product, Viet Nam's public expenditure on education compares well with some of East Asia's wealthiest nations. The Government is targeting spending 20% of its total budget on education and training, signifying the importance of education as a strategy for human resource development.[19] The Government has also made steady efforts to improve the efficiency of education expenditure. In 2015, it approved a revised State Budget Law, to address critical weaknesses in public financial management systems. This law introduced a 5-year medium-term expenditure framework and public investment plans that will allow for more strategic and disciplined expenditure planning, including for MOET.

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[18]United Nations. 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. New York. Goal 4 specifically addresses education, but education is a major strategy for many of the goals related to poverty reduction.

[19]Government of Viet Nam. 2012. *Education Development Strategy, 2011–2020*. Ha Noi.

Examples of Good Practices

One of the reform areas in the new curriculum MOET emphasizes STEM education to improve the quality of education. STEM education is defined as "an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy."[20] It emphasizes the importance of making connections between academic knowledge and real-world problems as the foundation for integrating STEM subjects in teaching. Due to its interdisciplinary nature, STEM education is seen as both curricular and pedagogical approach.[21] STEM education highlights the interdisciplinary framework, while in instructional practices, inquiry through representations, problem-solving/reasoning, challenge-based learning, design-based approaches, and digital technologies are the center of pedagogical approaches. The key of instructional practices of integrated STEM education in secondary schools is integration of STEM content, problem-centered learning, inquiry-based learning, design-based learning, and cooperative learning.

Application of These Good Practices

The Government of Viet Nam is aware of the need for investment in education for addressing the great social, economic, and environmental challenges of the country and ultimately for achieving the SDGs. Through Asian Development Bank loan support (ADB Loan 3494/3494-VIE), MOET has integrated STEM education into secondary schools through the Second Secondary Education Sector Development Program II (SESDP II). The objectives of STEM education setup by SESDP II are to (i) enhance comprehensive education for students; (ii) improve students' STEM literacy; (iii) develop students' soft and academic skills such as problem-solving, creativity, critical thinking, augmentation, intellectual curiosity, and collaboration skills; (iv) connect schools to communities; (v) orient students' career development; and (vi) prepare for Industry 4.0, which refers to the changes required by Industry to accommodate changes brought about by the Fourth Industrial Revolution.

SESDP II established an STEM research team at the national level, wherein research team members are from pedagogical universities of Viet Nam. Trainings on STEM concepts, integration frameworks, pedagogical approaches for teachers

[20] Tsupros, N., Kohler, R., and Hallinen, J. 2009. STEM Education: A Project to Identify the Missing Components. Pennsylvania.

[21] Margot, K. C. and Kettler, T. 2019. Teachers' perception of STEM integration and education: a systematic literature review. International Journal of STEM Education, 6(1), 2.

of both lower and upper secondary schools as well as trainings on STEM education and its role in development for school managers and provincial/district educational policy makers/implementers are being implemented. In these trainings, STEM research team members have played the role of trainers with observers invited from several pedagogical universities in different regions of the country. The program encourages teachers to develop and plan their own STEM lessons or topics through project-based learning approaches and submit them to the STEM research team for review, revision, and improvement. Several best teachers' STEM lessons/topics have been selected and used as examples during the above-mentioned trainings. An online STEM education platform was established in September 2019. wherein all STEM scientific papers, reports, lecture notes, training handouts, and video clips of best STEM teaching lessons developed by teachers on the ground were uploaded for the use of all teachers in the country.[22] This online platform is a resource for interactions, discussions, and feedback among teachers and researchers as well as a foundation for lifelong learning of teachers.

After three months of intensive STEM training activities, the program has received positive feedback and strong interest from teachers, school principals, and provincial education managers. Eighty-two STEM lessons have been voluntarily developed and submitted by teachers from lower and upper schools. Three departments of education and training of three provinces requested the program to provide STEM trainings to all teachers in their province. Although only 1,530 teachers were invited to the program's trainings, more than 15,000 teachers are active users of the online STEM platform every day. SESDP II gives priority of access to STEM education to ethnic minorities, remote and rural populations, females, and disabled groups.

Implications for the Future

The key to improving quality is the introduction of a new curriculum that is better attuned to the needs of economic development. MOET is already developing a competency-based curriculum that has the potential to better meet the needs of the workplace and society. However, MOET has not succeeded as yet in introducing the last new curricula. It will need to introduce professional development models, which go beyond the ineffective cascade model of teacher in-service, which merely transfers knowledge, to other models that change teacher behavior in the classroom. Models such as coaching/mentoring and community of practice have a larger potential to impact teachers. Changes in teacher and student assessments should also be a part of the new teaching and learning reforms. Viet Nam has made excellent progress in developing a teacher assessment system based on national professional standards, but it now needs to unify that system with the professional development of teachers.

The NER in primary and lower secondary education is close to reaching the targets, but enrollment in LSE and USE has dropped. Several recommendations suggest either

[22] taphuan.sesdp2.edu.vn.

removing barriers to transition or encouraging students and their parents to enroll in USE. The current elitist system of requiring students to graduate from LSE and pass an entrance examination to enroll in USE is restricting the number of students who can enroll. Some parents and students do not see the relevance of USE to future employment. Hopefully, the new curriculum and efforts to introduce career and vocational orientation will help address this perceived lack of relevance, but other strategies will likely be required such as making vocational education more appealing to students and their parents. Programs such as conditional cash transfers have been shown to increase enrollments by reducing the lost opportunity cost associated with attending, particularly among students from poor families such as those of ethnic minorities. An increase in USE enrollment will require more classroom space. As MOET has had difficulty in allocating funds for capital improvements, it will need to find alternative means such as using public–private partnerships to finance classroom improvements. Also, MOET needs to examine alternative cost-effective methods of delivering education, particularly in remote areas.

Links to the presentation materials: https://events.development.asia/materials/20200528/pisa-2012-vietnam-results-and-lessons-learned.

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Part III
Transformational Technical and Vocational Education and Training (TVET)

Chapter 13
Philippine Experience in Dual Training System

Andreas Dernbach

Dual system education programs combine school-based (theoretical training) and work-based (practical training) education. This is intended to address the job-skills mismatch and guarantee that students will gain adequate knowledge and practical skills that will enhance their employability. Such an approach is operationalized in the form of apprenticeships, on-the-job trainings, and internships, among others. Many highly developed countries like Australia, Germany, and Switzerland have successfully adopted this approach in their vocational education systems and have benefited remarkably from it.

Germany has one of the most esteemed and modeled-after training systems. The Government of Germany identifies shared responsibility between government, employers, and trade unions as one of its key strengths in ensuring quality education while also responding to the emerging needs of the economy.[1] Australia, which has adopted the dual training system approach, likewise highlights shared responsibility among stakeholders as the key to a successful and efficient Technical and Vocational Education and Training (TVET) system. Aside from industry engagement, effective regulation, and a quality training market, its notable strength is its qualifications system, which "meets both industry's needs (employment skills match) and individuals' needs (portable skills to move across the labor market and support lifelong learning)."[2] Given its success in maintaining low youth unemployment levels, Germany, together with other countries adopting the same system (Austria, Denmark, Luxembourg, and Switzerland), has launched an online "Apprenticeship Toolbox"

[1]Federal Ministry of Education and Research (BMBF). The German Vocational Training System. Retrieved from https://www.bmbf.de/en/the-german-vocational-training-system-2129.html.

[2]Caggiano, M. 2018. Technical Vocational Education and Training Models in the World: The Australian VET System. Retrieved from https://sustainableskills.org/australia-tvet-experience/.

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to provide support for decision-makers who want to implement the key principles of dual training system schemes.[3]

In the Philippines, the Dual Training System (DTS) was institutionalized in February 1994 through Republic Act No. 7686 or the Dual Training System Act of 1994. The law mandates the Technical Education and Skills Development Authority (TESDA) to promote, coordinate, and administer the dual training system and provides tax incentives to encourage the participation of companies in the DTS.

Issues and Challenges

Despite many initiatives and government programs, reducing unemployment continues to be a major challenge in the Philippines. Job-skills mismatch is often cited as one of the reasons for high unemployment, especially among the youth. Particularly, graduates are not equipped with the skills and competencies needed by industries. On the other hand, many businesses are also not aware of the qualifications that they need.

Reforms were instituted in basic education in 2013 through the K to 12 Program, to strengthen the relevance of the curriculum and better prepare high school graduates, whether they want to seek college education or employment. The Technical–Vocational–Livelihood (TVL) track introduced in senior high school was particularly designed to equip learners with job-ready skills. However, as with any newly implemented initiative, K to 12 Program implementation is facing birth pains or challenges in terms of lack of resources (i.e., infrastructure, teachers, classrooms, materials). The TVL track is particularly facing gaps in facilities (for practical learning, skills development), needed human resources (assessors for national certificates), and limited companies willing to engage/support student immersion programs.

Proposed Solutions

The DTS is being promoted by the Government, because such an approach specifically addresses the issue of job-skills mismatch, given that it promotes partnerships among Technical Vocational Institutions (TVIs). Such collaboration enables schools and TVIs not only to determine the skills needs of industries, but also to foster linkages that will encourage companies to directly employ students/graduates and/or support their partner schools and institutions (through, e.g., curriculum development, sharing of knowledge and facilities, investment in resources).

[3]Ibid.

Local studies in the Philippines affirm that dual training systems and other TVET modalities that promote industry partnerships result in high employment rates.[4] Further, a cost-benefit study also shows that DTS produces positive spillover effects, because DTS-trained workers are more productive.[5] However, despite these benefits, DTS accounts for only a very small portion of trainees in the TVET sector in the Philippines.[6] Promoting DTS as a mode of TVET delivery continues to be a challenge, despite existing laws and incentives intended to scale it up.

Examples of Good Practices in the Philippines

In the Philippines, several government–academe–industry collaborative initiatives and innovative programs have brought promising results in TVET.

K to 12 Plus Project

When a TVL track was rolled out as part of the K to 12 basic education reform in the Philippines, the K–12 Plus Project was initiated by the Philippine Chamber of Commerce and Industry (PCCI). It supports the K to 12 Program of the Government by introducing these features: (i) conduct of industry needs assessments, (ii) bundling of competencies to make the graduates attractive to employers, (iii) training supervisors in companies to become qualified in-company trainers, and (iv) increasing immersion in companies from 80 h to up to 1,000 h. With the goal of preparing students for high-quality jobs in the labor market, the K to 12 Plus Project provides Level III and Level IV Skills Certificate programs that last from six months to two years. It is also working on a ladderized arrangement to allow its students/graduates to work and enable them to pursue higher education later on, should they want to.

An important and strong feature of the K to 12 Plus Project is its facilitation of linkages among government, training centers, and industries. They have engaged with key industry chambers and associations (e.g., Philippine Chamber of Commerce and Industry, Human Resources Development Foundation, Cebu Chamber of Commerce and Industry, German–Philippine Chamber of Commerce and Industry, and Mindanao Microfinance Council) and German partners German Society for International Cooperation (GIZ) and German Confederation of Skilled

[4]Orbeta, A.C., and Esguerra, E.F. 2016. The National System of Technical Vocational Education and Training in the Philippines: Review and Reform Ideas. PIDS Discussion Paper 2016-07.

[5]Mapa, D., Almeda, J. and Albis, M. 2016, "Cost-Benefit Study of the Dual Training System (DTS) in the Philippines." School of Statistics, University of the Philippines Diliman.

[6]Orbeta, A.C., and Esguerra, E.F. 2016. *op. cit*.

Crafts and Small Businesses (ZHD), and government agencies such as the Department of Education (DepEd), Technical Education and Skills Development Authority (TESDA), and the Commission on Higher Education (CHED).

The K to 12 Plus Project and PCCI also supported initiatives to promote the Dual Training System (DTS) among businesses. Because many businesses do not know the qualifications they need and are not aware of the benefits of Dual Education and Training (DET), PCCI conducted qualifications mapping and identified training programs/institutions wherein businesses can obtain these qualifications. The qualifications mapping also serves as information for prioritizing of DET programs. A cost-benefit study of DTS implementation in the Philippines was conducted by PCCI, which revealed that the benefits of the DTS outweigh the costs incurred by businesses if they implement it. This will help PCCI convince businesses to adopt and/or engage DTS.

e-TESDA: TESDA Online Program (TOP)

The e-TESDA or TESDA Online Program (TOP), an initiative launched in 2012, caters to unreached Filipinos locally and globally through information and communication technology driven learning tools and methods. TESDA is also notably the first Philippine institution to offer free Massive Online Open Courses (MOOCs) in the country.[7] The goal of the TOP is to help workers trapped in low-paying jobs to upskill and find better job opportunities by giving them access to technical education anytime and anywhere for free. Its primary target clientele is those who do not have the opportunity to physically attend trainings due to workload, physical disabilities, and other restrictions. These include students, out-of-school youths, unemployed adults, local and overseas Filipinos workers, and professionals.

The program uses the Moodle platform to display both video and texts for self-directed learning. There are 647,000 registered users, 77% of them in the Philippines and the rest from abroad, mostly from countries with high concentrations of Filipinos. The male–female ratio is about equal (50:50).

Further, a case study also revealed that the TOP shows potential for improving the efficiency of TVET by reducing training costs.[8] Through the use of a blended program, students may combine face-to-face instruction with online learning. Such an approach allows students to finish the course in a much shorter time while still acquiring the required competencies and being certified successfully.[9] Surveys done

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[7] Dumaua-Cabautan, M., Calizo, S. C., Quimba, F.M., and Pacio, L.C. 2018. E-Education in the Philippines: The Case of Technical Education and Skills Development Authority Online Program. Philippine Institute for Development Studies (PIDS) Discussion Paper 2018-08.

[8] Ibid.

[9] Ibid.

by TESDA have also showed that e-TESDA users who have undergone national assessment perform well (high passing rate at 90%).[10]

Nonetheless, more needs to be done to maximize the potential of the TOP. Aside from improving the learning modules and course offerings, a daunting challenge for TESDA is the assessment and certification of e-TESDA users, especially those who live abroad. In nearby economies (e.g., Hong Kong, China), TESDA is able to send assessors several times a month. However, in places like Dubai and other countries in the Middle East, sending assessors on a regular basis would be too costly. To ensure sustainability, TESDA is training assessors in far countries and remote places, and exploring the possibility of online assessment for e-TESDA users/graduates.

Don Bosco Training Institute

The Don Bosco Training Institute, established in 1971, provides skills training to underprivileged youth so that they can find gainful employment. The school produces 800 graduates annually. Some students get free board and lodging. The school receives financial support from donors and equipment donations from corporate partners.

The duration of Don Bosco's training program is 15 months, comprising ten months of school training and five months of On-the-Job Training (OJT). Some students even do their OJT in Dubai, where partner companies are based. One of the keys to the success of Don Bosco's training program is its curriculum. The first two semesters provide students with basic skills, while the third and fourth semesters focus on specific skills required by partner companies. This implies the strong involvement of companies in the development of the training curriculum. As a result of this partnership, the employment rate of graduates is 98%.

Don Bosco has also pursued a successful partnership project with the Porsche Training and Recruitment Center Asia (PTRCA). Aside from financial support, PTRCA has also conducted training of trainers, curriculum development, quality management, and marketing of graduates. As a result, PTRCA received the "Innovation Award for Vocational Education" in 2015 from the German–Philippine Chamber of Commerce and Industry.

MFI Foundation

The MFI Foundation, Inc. (formerly known as the Meralco Foundation) is a nonstock, nonprofit science foundation that provides quality education and technical training anchored on work values to enable Filipinos, especially the less privileged, to be productive and competitive. It has two operating centers that utilize technologies to

[10] Ibid.

cater to the industry and agriculture sectors: the MFI Technological Institute and the MFI Farm Business Institute.

The MFI Technological Institute implements dual training system programs and the Industrial Technician Program (ITP), which offers postsecondary, nondegree courses in industrial technologies, especially to less privileged students. These courses are offered with scholarship on a selective basis. The Institute also offers free training under the Special Training for Employment Program (STEP) and Training for Work Scholarship Program (TWSP), in partnership with the Government (TESDA).

The MFI Farm Business Institute aims to provide quality education and training programs for the agribusiness sector, and to serve as a catalyst in the development of agri-entrepreneurship. It targets individuals and communities from all economic strata, gender, age, educational, and professional backgrounds. The MFI Farm Business Institute also partners with the University of Rizal System (URS) and the Management Association of the Philippines to offer a ladderized agriculture-focused entrepreneurship program.

On top of having produced successful graduates, the MFI is recognized as a "Model Center of Excellence" by the Association of Southeast Asian Nations (ASEAN) Economic Ministers–Japan Economic and Industrial Cooperation Committee, as attested by the Department of Trade and Industry Center for Industrial Competitiveness in industrial, technical, and vocational education.[11] It has become one of the leading TVET institutions by producing competitive and up-to-date programs needed by industry, and by strategically partnering with key government, academe, and industry stakeholders.

Application of These Good Practices or Examples

The models discussed above are easily replicable and scalable, given that their common strengths/features are well-targeted schemes and government–academe–industry linkages. These initiatives have been successful because the programs are focused, well targeted, and aligned with the needs and priorities of government and industry. They maximize their partnerships with stakeholders to identify needs of their target groups and adequately cater to them. The MFI and Don Bosco target poor and underprivileged youth to provide them with quality training, while the e-TESDA program caters to learners unable to physically attend trainings. On the other hand, the K to 12 Plus Project works with technical vocational institutions and enterprises to improve the dual system approach in the K to 12 TVL track. It is also notable that all of these initiatives strategically maximize their multi-stakeholder partnerships to pool the needed resources to achieve their program objectives.

[11] Information retrieved from http://apskills.ilo.org/network/mfi-foundation-inc.

Implication for the Future

Because of rapid changes in the skills and employment landscape due to the digital revolution, TVET also needs to evolve to become even more responsive to the needs of the economy. Particularly, training systems need to be flexible enough in terms of updating curriculum and adopting new and up-to-date technologies. This also entails capacitating trainers to enable them to swiftly adjust and foster the needed competencies among learners. Scaling up successful and innovative DTS models will be crucial in ensuring flexible training systems because of their strengths and features that facilitate expeditious sharing of labor market information, expertise, and/or resources.

Conclusion

Strong multi-stakeholder partnerships (among government, industry, schools/TVIs) are crucial in the success of TVET. Linkages brought about by these partnerships allow for strategic and productive opportunities to sustainably implement effective TVET programs. Because the nature of the dual training approach is rooted in such partnerships, promoting it would be a practical strategy to ensure a successful TVET system. As such, there is a need to intensify efforts in scaling up DTS. This would involve stronger advocacies and exploring more enticing incentives that would encourage TVIs, nongovernment organizations, and businesses to engage in DTS.

Link to the presentation material: https://events.development.asia/materials/20171213/k-12-plus-project-philippines.

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Chapter 14
Infrastructure and Pedagogy Innovation—A Differentiating Factor in TVET

Seng Hua Tan and Iris Seet

The Institute of Technical Education (ITE) is the principal provider of technical education in Singapore. Established as a postsecondary institution under the Ministry of Education (MOE), ITE is responsible for the development of national-level certification and skills standards for the training of youths and working adults to enhance the global competitiveness of the Singapore workforce.

As a public-funded technical and vocational education and training (TVET) institution, ITE plays an important role in developing the knowledge and skills of the workforce to secure the future for Singapore. It aims to achieve this by creating a robust TVET system to prepare students for jobs in growing sectors of the economy. This forms the key driving force behind ITE's training system.

This article highlights ITE's recent innovations in TVET infrastructure and pedagogy to support the implementation of industry-relevant TVET curricula. Specifically, the development of Authentic Learning Environment and Discipline-Specific Pedagogies uniquely characterize ITE's TVET system, and these have attracted the keen interest of many countries globally.

Issues and Challenges Faced by TVET Development

Despite its key role in supporting the socioeconomic development of a nation, in many countries TVET is still the weakest component of the national education system. Many governments regard TVET as low-value and relatively unpopular compared

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to other areas of education, failing to allocate adequate resources and render public support to ensure the relevance, quality, and attractiveness of their TVET programs. Consequently, in many countries TVET is somewhat disconnected from the skilled workforce needs of the economy, often disdained by parents and society. This is notwithstanding the difficulties faced by a sizable proportion of graduates of other education institutions in finding a job as compared with the job opportunities open to TVET graduates.

The often relatively low quality of TVET and its failure to attract a sufficient number of youths to enroll for skills training have long-term implications for a country's competitiveness. This will weaken a country's ability to attract or create new economic investments leading to sufficient jobs for its people. Singapore, being a small nation without any natural resources, has long since its independence recognized the importance of having a skilled workforce to support and grow its economy. In tandem with its economic development strategies, the Singapore Government has invested heavily over the past 5 decades to develop and transform the TVET system, enhancing its public image from one traditionally viewed by many to cater for school dropouts, to one that is now regarded as the jewel of its national education system. In fact, many countries now look upon the Singapore TVET system as a model for their own TVET reform movement.

So what are the strategies adopted by Singapore in the transformation of its TVET system?

Infrastructure and Pedagogic Innovation as a Differentiating Factor in TVET

The TVET system of ITE is geared to develop work-ready, world-ready, and future-ready graduates for the skilled manpower needs of the economy; and Singapore ITE has focused on five key factors to build a high performing TVET system for a world-class workforce:

- Industry-relevant and responsive curriculum,
- Learner-centric and discipline-specific pedagogies,
- Credible and reliable assessment and certification system,
- Engaging and authentic learning environment, and
- Passionate and competent staff.

The learning environment (and hence infrastructure development) and pedagogy innovation in the enhancement of the TVET quality and image are the two most visible components that will readily influence the perception of the community, in particular parents and potential students, of the overall quality, value, and attractiveness of the TVET programs. A modern, well-equipped campus carefully set up and filled with meaningful, engaging learning activities will go a long way to attract parents to enroll their children in TVET programs.

TVET Infrastructure Innovation

TVET infrastructure innovation takes place at two levels, namely, the design of the TVET campuses and the setup of training facilities within these campuses. The traditional approach in developing TVET campuses is premised on functional needs, focusing on the number and size of training workshops/laboratories to conduct the TVET courses in a typical school setting.

ITE chose to rethink and boldly transform its previous 10 smaller campuses into three mega TVET campuses; guided by an overarching aim to create a fun and engaging learning environment, an education wonderland for TVET learning. ITE's Workplace@Campus is conceived as a home away from home for students, a conducive place to spark the creativity of students, academic staff, and external training partners—drawing them to collaborate and cocreate relevant TVET learning programs to meet the skilled labor needs of the economy.

Prior considerations in the campus design included the training philosophy of ITE, its desired education outcomes, student management and development strategies, learning and teaching workflow, interfacing with the community, and partnership with industry. These are to address adequately the functional needs of the campus.

In tandem with its training philosophy and desired education outcomes, the design of the ITE campuses has evolved over the years and adopted a number of breakthrough concepts along the way:

- *From traditional school environment to comprehensive mega campus design*. Each mega campus presented the look and feel of a postsecondary/tertiary learning environment with vast opportunities for cross-disciplinary learning and real-world project work within the mega campus itself, projecting a positive public image for TVET.
- *From "single-purpose" training facilities to "integrated" learning space*. Rapid changes due to technology advancement and economic restructuring necessitate a flexible approach in the demarcation of learning space, and, where feasible, an extended application of the "shared-facility" concept. Such consideration will mitigate the unavoidable cost escalation arising from the need to accommodate new courses and the curtailing/phasing out of obsolete courses, and will improve space utilization.
- *From conventional workshops and laboratories to authentic learning facilities*. These closely model actual workplace settings where students learn to perform tasks in an environment mirroring what professionals do in the real world of work. Here they also pick up soft skills to function effectively as skilled workers in a specific profession, in preparation for internships and work-study programs. The facilities also double up to meet the shortage of internship places during an economic downturn, providing students with learning experiences beyond the traditional boundaries, and empowering them to explore job redesign and job enlargement at the workplace subsequently.

- *From technology training to "Hands-on, Minds-on & Hearts-on"™ education.* ITE campuses also come equipped with modern student amenities and recreational facilities for the holistic development of their students, raising their self-confidence through exploring and exercising their unique talents and interests as well as promoting friendship and networking with other students from both within and outside their course of study.
- *From a "closed" learning environment to an "open" campus design.* Coupled with a strategic location of key learning facilities, each campus effectively operates a 365-day open house concept for the general public to tour the grounds and gain a more accurate and positive impression of TVET.

Innovative training facilities and pedagogies adopted at ITE campuses have stirred the interest and imagination of students and employers.

Authentic learning does not happen naturally. It takes strong teamwork—from the careful crafting of industry-relevant curricula closely involving industry partners to the painstaking build-up of a conducive and authentic environment with best-in-class facilities, and, ultimately, to immersing students in real-work practices on and beyond the campus. The setup of innovative, authentic learning facilities is only the start; the next step is to equip our teachers with the capability to bring out the best learning outcome.

TVET Pedagogy Innovation

ITE offers some 100 full-time courses in six broad areas, viz., engineering, business and services, info-communication technology, media and design, hospitality, and applied and health sciences. Its teachers have been industry practitioners, all trained in competency-based pedagogy, imbued with the ITE "Hands-on, Minds-on, Hearts-on"™ philosophy, and regularly required to update themselves through industry engagement and/or attachment.

There is limited research done by the TVET community globally on the effectiveness of applying different pedagogic strategies such as project-based learning or task-based learning for specific trade disciplines. As such, ITE has embarked on a pedagogic innovation project to research appropriate strategies that will accentuate active, student-centric learning leading to the capability to perform competently and independently in one's chosen profession.

Discipline-Specific Pedagogies (DSP) is a recent breakthrough in ITE to bring the traditional skills learning process closer to professional practices in industry. DSP here is defined as that set of teaching strategies that enable students to acquire the relevant knowledge, skills, and values specific to the contexts, content, and practices of their chosen professions.

Implicit in the pedagogic innovation is teacher quality, mentoring, and learning by, and within, the teaching fraternity. Small core teams of DSP champions in each ITE school apply a set of guiding principles to contextualize appropriate pedagogies that will make the learning and acquisition of particular attributes of a discipline most apt and effective. The innovative aspect of DSP focuses on how to strengthen the nexus between job skills content (*what to teach*) and pedagogy (*how to teach*) to achieve the intended learning outcomes.

Adopting DSP as the signature pedagogy for ITE education has many aims. First, it will help the teachers to distinguish the more effective pedagogies amidst a wide array that work for the learning of a particular trade/discipline. Second, it will lead to improved instructional design and assessment/evaluation processes. Third, carefully curated DSP resources piloted successfully by DSP pioneers and champions in their schools will be cascaded to relevant groups of teachers across ITE colleges, thereby assuring the quality of curriculum delivery based on a tried and tested set of pedagogies for the respective trade disciplines. Last and most importantly, DSP integrates the acquisition of technical skills (*learning to do*) with the learning of values, work dispositions, and professional ethics (*learning to be*), the latter being soft skills that are increasingly crucial for the future economy.

Figure 14.1 depicts the ITE education and pedagogic framework summarizing the key aspects of the innovative DSP:

Feedback gathered from teachers, students, and employers during and after the DSP pilot phase revealed the following learning points and benefits:

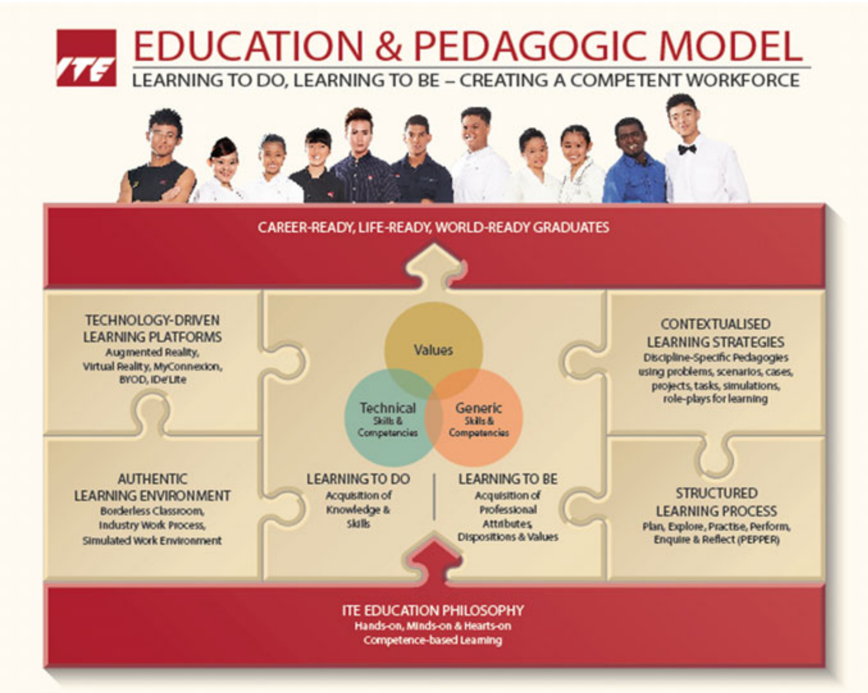

Figure 14.1 ITE education and pedagogic model

- Teachers saw their students gain a deeper understanding of the subject content when pedagogic activities were related to workplace realities and requirements.
- The students considered themselves as becoming more confident and work-ready to function effectively in their respective professions.
- Employers viewed their interns/trainees are better equipped with workplace life skills such as problem solving, communication, collaboration with others, and critical thinking.

Moving Forward

Clearly, Singapore TVET education has come a long way from its humble beginnings of basic infrastructure and predominantly teacher-led instruction to its modern and comprehensive mega-campuses that thrive as authentic learning hubs of excellence. What are the key enablers that have led to its remarkable transformation?

Once TVET's role in nation building was recognized, there has been strong and sustained national leadership support. Singapore has not spared its resources to uplift the quality of its people. Education makes up the second highest expenditure of its gross domestic product,[1] and of this amount, 16% is allocated to the postsecondary TVET sector[2] alone. This works out to an investment of $12,500 a year to train each ITE student.

Next, careful execution of TVET policies requires a strategic and coordinated planning approach for alignment at all levels—from the national, agency, and sector down to the industry level. This entails the commitment and involvement of multiple stakeholders—key public agencies including public-funded postsecondary education institutions, private employers, and trade associations/unions—to collaborate and co-create the future economy of Singapore, industry by industry and sector by sector. As a result of this systematic and coordinated approach, ITE has managed in just 2 years to bring in nearly 3,000 employers as co-training partners, and several hundred active industry partnerships for its own staff capability development and industry updates.

Finally and most importantly, besides TVET infrastructure, passionate teachers are needed to drive the transformation in TVET teaching and learning. Inspired by their early successes in DSP, these pioneers and champions in ITE have started forming professional learning circles (PLCs) to share with their peers. The recent introduction of work-study diploma programs with curriculum built around realistic work situations gives added impetus for teachers to rethink and redesign their delivery based on DSP principles to meet the aspirations of both students and the skilled workforce needs of the economy.

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[1]Ministry of Finance 2019. Analysis of revenue and expenditure—Financial Year 2019.

[2]Ministry of Education 2019. FY 2018 Expenditure Estimates. The TVET proportion includes funding of all public postsecondary institutions, viz., ITE and five polytechnics, SSG, and a few private institutions such as Lasalle College of the Arts and Nanyang Academy of Fine Arts, excluding the universities.

Conclusion

ITE has put in place basic building blocks in its TVET model. This article has elaborated on two of these, viz., infrastructure innovation and pedagogy innovation. New demands and challenges will nonetheless arise, posed by rapid technological advances; and undoubtedly, our TVET model will evolve over time. Future learning may be more efficiently done by leveraging new technologies; conventional front-loading of content may have to give way to just-in-time, just-enough, and just-for-me (personalized) learning, the latter made possible by exploiting learning analytics.

The rapid and unrelenting pace of change taking place means that TVET organizations may need to reassess their *modus operandi*—be bold to disrupt traditional TVET or else risk themselves being disrupted. Indeed, closer collaboration of TVET institutions with industry partners would be a better way forward to complement both workplace learning and work-based learning in developing work-ready, world-ready, and future-ready graduates.

Links to the presentation materials: https://events.development.asia/materials/20160919/ite-education-services. https://events.development.asia/materials/20190827/institute-technical-education-ite.

Chapter 15
Industry-Led Training and Apprenticeships: The New Zealand Model

Josh Williams

Like many vocational education systems, New Zealand's systems for workplace training and apprenticeships have evolved in response to changes in industries and also through government-led reviews and initiatives. However, the fundamentals of New Zealand's current approach have been remarkably stable since first introduced in 1992. Things may be all about to change, in light of proposed large-scale reforms of New Zealand's vocational sector.

This article sets out some of its key features and the policy choices that led to the present system. It attempts to describe some of the lessons we have learned; the things we think have worked and are working; and finally, some forward-looking considerations as New Zealand—as everywhere else—looks at how well its vocational education system is set up for the challenges of the "future of work."

In particular, I want to set out the key policy "ingredients" that have sustained our system for the last 25 years—including the functions of Industry Training Organizations (ITOs), employment structures, and qualifications policies that support our nationally recognized training system.

Issues and Challenges

New Zealand has had a long history of apprenticeship training (at least by New Zealand standards). Through the middle of the twentieth century in particular, apprenticeship was seen as a core pathway—especially for males—to enter the workforce straight from school. As the New Zealand economy was going through radical change

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through the second half of the 1980s, so too the education system was being reviewed and reconsidered in an attempt to align education with emerging economic realities.

In 1986, a Department of Labour Green Paper on Vocational Education outlined a number of the elements that would arise in industry training reforms 6 years later. Training arrangements were described as "haphazard and uncoordinated." A national certification system was called for, based on competency.

Further impetus for reform was provided in 1988 through a Ministerial Committee on Education and Training. Its report—*Learning for Life*—foresaw and promoted the notion of lifelong learning, stating that learners should engage in a comprehensive and seamless tertiary education system. That seamlessness extended into people's working lives, and the tertiary education system extended into workplaces. So while New Zealand already had a history of apprenticeships, the new thought was to connect this with the formal post-school education system.

Meanwhile, institutional vocational education was beset by concerns about supply-side capture—under a model that rewarded participation, providers would offer what students wanted to do, not what industry needed them to do. Government ministers of the time were impressed by the industry ownership and control they observed in systems like in Germany, and the emergence of competency-based frameworks such as in Scotland.

These contextual factors culminated in a core policy choice: government ceded to industry the role to set occupational standards and make the arrangements for people working in industries to achieve them. It was a demand-side solution: Industry wins if the skills are right, and industry loses if the skills are wrong, so let industry determine its needs and work with its employers on the best way to train.

The manifestation of this policy choice was the ITOs. These are industry-owned and governed entities, formed up from enterprises, that apply to the Government for recognition as the standard-setting body for an industry or set of industries. In the modern sector, most ITOs are entities in their own right—for the most part not-for-profit incorporated societies—though they have also been run as arms of industry associations.

Similar to what other countries have variously called "skills councils," "industry councils," or "sector councils," ITOs' core role is to work with industry to develop occupational standards (commonly referred to as unit standards), and develop training and assessment resources in support of their achievement.

Arranging Training

But New Zealand's ITOs have a second role, and quite a unique feature: They work with industry employers on arranging training, including the use of government subsidies to purchase training from providers, usually to complement on-the-job training. This provides a direct lever for industry to invest in provision that meets its needs, and not to invest in that which does not. An ITO can seek training subsidies through funding agencies in much the way that our public and private training providers do, however there are some key differences:

- Industry training is co-funded. Government subsidies are contingent on an ITO demonstrating, on an annual basis, that it is receiving 30% of its income directly from industry. This is a core check-and-balance in the system—an ITO proves that it is supported by its industry through industry financial contribution. Its ability to maintain government recognition and resourcing is contingent on showing this.
- Government subsidy rates for industry training are much lower than for provider-based tuition. The per-place funding for industry trainees and apprentices in New Zealand is, generally speaking, one-half to two-thirds lower than the per-place funding for education providers. This is because government is not paying for teaching, or classrooms, or operational overheads. The funding ITOs receive is to manage training, which covers the purchasing of off-job training components, but everything else too including standards setting, resource development, assessment, and quality assurance processes.

What is arranging? In effect, an ITO works with an employer and an apprentice or trainee to establish a training agreement. This training agreement is formally part of an employment agreement and sets out the program of training—on-the-job, off-job, or usually both—that will allow the trainee or apprentice to complete a national qualification: the New Zealand Qualifications Framework (NZQF).

The ITO then, through permutations of advisory services, pastoral care, and assessment services, supports both the employer and the trainee to achieve the standards and qualifications.

The second element of the "arranging" role is what it is not: It does not include, and legislatively prohibits, the direct delivery of training. It was—certainly in the design phase in the early 1990s—seen as a conflict of interest to be both the standard-setting body and the deliverer of training. Fast forwarding 27 years, this is difficult in practice to define. The rise of digital learning blurs the distinctions between teaching and learning and assessment, and what is meant by delivery. Second, across education, the importance of pastoral care and wrap-around support to learners is seen as critical to their success, irrespective of setting. Finally, it seems peculiar that both designing and delivering a program is seen as a conflict of interest when it comes to workplace learning, but not in institutional settings.

Before moving on to examples of such arrangements, it is worth making some observations about what 25 years of a "bottom-up" and industry-led system has looked like—in particular for the lessons we have learned, but also to illustrate some in-principle strengths of the system.

The first intrinsic advantage is common to all work-based learning: The trainee has been placed in the labor market already, so we have already achieved the outcome of ensuring there is a match between the learning and a labor market need—the right skills, in the right place, at the right time.

Aligned with that, an industry-led system ensures close linkages between the skills being developed and the skills being deployed—they are one and the same. A trainee may not yet be the most productive worker, and training him or her also represents a cost to the firm that may not be the long-term beneficiary of his or her skill, but the real economy sees at least some return through training a worker through a real employer, in contrast with an institutional (only) approach, which is rather more "hit and hope" in terms of whether the skill development will match its eventual application in industry, if the learner is employed in that industry at all.

A second advantage of the industry-led approach is that it allows each industry to morph and evolve its arrangements to suit itself. This applies to both the mix of training modes, and the approach to assessment. The mix of on- and off-job learning differs according to industry's wishes. For example, in New Zealand, a plumbing apprentice undertakes around 75% of the apprenticeship through block courses off-the-job. By comparison, a carpentry apprentice achieves 95% of the apprenticeship on-the-job. Still other industries—particularly those in services sectors, e.g., retail, hospitality, are 100% on-the-job.

While this may look a bit messy from the outside, it actually represents a necessary flexibility, and represents the revealed preferences of those industries about the methods and means of training that work for the industry. While each industry has developed its typical case, there is also an element where industry training in New Zealand is necessarily bespoke—in an economy where 95% of enterprises have five or fewer employees, the scope and size of any one employer necessitates a different approach to the mix of digital and on- and off-job approaches.

The connection between standard setting and arranging also creates a critically important feedback loop that benefits both activities. The day-to-day engagement with real employers through supporting trainees forms a critical input to standard setting, and what is termed skills leadership—to identify what is emerging and what is obsolescing.

Administering the traineeship or apprenticeship from the industry side also provides a demand-side "check and balance" over what vocational providers deliver and teach, to the extent that ITOs can use their purchasing power over block courses to determine this.

Standard Setting

New Zealand's approach, like many other countries, invites ITOs as standard-setting bodies to establish and register occupational standards. These are evaluated and registered by our single awarding and quality assurance body, the New Zealand Qualifications Authority. The unit standards were originally components of qualifications, when the qualifications framework was entirely standards-based. In large part now the unit standards are one of several possible approaches to assessment and provide one possible pathway to a qualification.

The lesson of history would suggest that ITOs were more rather than less prescriptive in their approach to standard setting, particularly early in their history, and particularly when there were more ITOs than there are now. However, the trend in the present day is toward newer and more flexible ways to assess and recognize skills. One example of this is microcredentials, which offer a modular and augmentable way to add and recognize skills through quality-assured credentials but not necessarily with the need or expectation to achieve full qualifications. This is seen as a fit-for-purpose approach in a fast-moving industry skills landscape, though it might also be remembered that the good old unit standard was invented for exactly these reasons and offered all those advantages, all those years ago.

The structure of the industry training and apprenticeship sector itself has also changed and evolved; throughout its history the number of ITOs has changed, and areas of industry coverage have been added and shifted around. The number of ITOs peaked at 56 just 4 years following the 1992 introduction, then settled to around 40 for most of the 2000s, then significantly consolidated in response to a government-led review of the sector between 2010 and 2014. However, most of these moves were generated by changes within industries, or to resolve areas of overlap. Since 2014, there have been 11 recognized ITOs.

A growing area for New Zealand's ITOs has been the school-to-work transition. While in the past, apprenticeship straight from school was a well-trodden pathway, this is no longer the case, with only 6% of New Zealand's school leavers having a formal ITO training agreement within 12 months of leaving school. Our average apprentice is 26 years old, with well over half of them already achieving postschool qualification, including at the degree level. In one sense this is a fine thing, since it reflects lifelong learning in action. People are continuing their engagement with the education system as part of their working life. On the other hand, it also suggests a need for better promotion of work-based options and pathways to school through broadening career information and education.

The Industry Training Federation (ITF) has worked closely with the Government over the last several years to implement a color-coded framework of "vocational pathways" that identify how learnings in traditional school subjects are recommended for further study and work possibilities in major economic sectors. The vocational pathways have also underpinned program design for several "interface" initiatives, wherein students spend part of their time learning in a tertiary provider or workplace while still enrolled at school. In the best examples, these schemes resemble the dual training approach more typically associated with countries in Western Europe. In the worst examples, these schemes are perceived as second-chance options for less academically inclined students. In the main, however, there is increasing recognition that senior-level schooling in New Zealand needs to move to a broader exploration of pathways and opportunities beyond school, and the vocational pathways are providing a useful framework to help students, teachers, and employers navigate the space and offer relevant and coherent education.

New Zealand, like many countries, is absorbed in debates about the future of work. Technology change, automation, dynamic careers, and an aging workforce necessitate a rethink of industrial age approaches to skills development. We know that in longer and multifaceted careers, people cannot solely be "preloaded" with pre-employment education. They will need to upskill over time, increasingly through their employers. At the same time, we need to ensure that training systems operate at the industry level, so that workers are portable and resilient in such dynamic labor markets. There is much to do to ensure that qualifications are modular, and maintain currency, but ultimately, if people are to make successful transitions in such a workforce, the ability to prove their skills to their next employer will remain critical.

The critical element of this is employer engagement. Employers need to be willing and supported to train people for their industry, not just for their job right now. That is a sacrifice and is perceived as a cost, even as any number of return on investment studies show the bottom-line benefits to firms of training—at least in the medium term, and certainly to the industry and economy as a whole.

ITOs therefore work hard to ensure that training materials and systems are as user friendly to employers as possible. The advantages of offering a firm a quality-assured training infrastructure need to outweigh the perceived costs of compliance and/or costs associated with training as part of the national system; otherwise an employer will not participate. The ITF has consistently argued that we should do more to support more New Zealand employers to join the system, preferably through encouragement, support, and direct incentives.

As this article is being prepared, the vocational education crystal ball is very murky, while the stakeholders of New Zealand's vocational education system await government decisions over a comprehensive reform of the vocational education and training sector.

The reforms seek a more unified and coherent system, particularly between the provider- and work-based parts of the present system. The reforms are driven by financial pressures in the public vocational providers, but also a broader sense that the vocational sector is responsible for persistent skills shortages, and/or skills mismatches, as experienced by industries and the business community.

While its high-level aims are laudable, the proposal as consulted will decouple standard setting (to be performed by new industry skills bodies) and training: The management and support of industry trainees and apprentices will become the responsibility of vocational providers, rather than industry training organizations.

While all stakeholders agree that the system can be more collaborative and coherent, many, including this author, are seriously concerned that the strengths and advantages of our industry-led system will be negatively affected. I hope I am wrong and time will tell!

Irrespective of what happens, over the last 27 years we have seen a largely stable and successful industry training system. It has been buffeted at times by various external forces, but it has much to commend as a demand-led solution to workforce skills development. Its recent improvements in participation and performance are pleasing, and through partnering with private sector firms its cost effectiveness to government is compelling. We have learned a lot along the way, and suspect other countries could benefit from looking at the New Zealand approach of the last 27 years, including its present debates.

Link to the presentation materials: https://events.development.asia/materials/20151201/new-zealand-s-industry-training-and-apprenticeship-system-public-private.

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Chapter 16
Gram Tarang: Skills Development for Priority Sectors in India

Abhinav Madan

The acute need for skill development in India, especially at the bottom of the pyramid, is well documented in various studies including the National Skill Development Corporation (NSDC) skill gap analysis. This paper attempts to offer different perspectives of the top priorities in the skill development value chain. The different stakeholders identified in the ecosystem are (i) the government as an enabler of the ecosystem; (ii) skill development organizations as the providers of skills; (iii) supply side—the student, trainee, or receiver of training; and (iv) demand side—industry as a consumer of the skilled output.

Issues and Challenges

Supply Side

Important problems beset India's education system. With a population increase of 15 million people per annum, dropout rates of 50% or more at each key hurdle of the academic system (classes I, V, X, and XII) result in only 0.82 million who will find employment in the organized sector. The remaining over 14 million youth will end up unemployed, partly employed in the unorganized sector, or self-employed as mini or microentrepreneurs. This is putting serious risk on India's demographic dividend, where the youth who are left uneducated, unskilled, and unemployed may become a liability. (Data interpreted from Economic Survey of India).

An examination of the drivers of high dropout rates in the education system yields surprising results: the predominant reason has to do with students not being interested in studies and their inability to cope. This clearly indicates a fundamental problem

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in the quality of education being imparted and a flawed design of curricula. The rote-based Indian education system is suffering from a focus on theory and lack of real-world or industry connect. Moreover, there is a general obsession with qualifications and degrees and not on skills or learning. Several studies of the unemployability of Indian graduates are testimony to this systemic failure. Other main reasons for dropout include parents not interested in the studies; financial constraints; and participation in other domestic activities. (Survey by Economic & Political Weekly).

Vocational education and skill training linked with the industry requirements is the need of the hour, and a quick comparison of gross enrollment rates in vocational education vis-à-vis other countries clearly indicates the issue at hand. More young Indians need to be enrolled into vocational education programs, which need to be designed with a view of the jobs available in industry.

A sectoral view of the Indian economy shows that 17% of the Gross Domestic Product (GDP) comes from agriculture, which employs more than 53% of the population. The service sector presently has the lion's share of GDP, and the Government's current focus areas include campaigns like "Make in India" and "Digital India," which are pushing for a greater share of GDP and employment coming from the manufacturing sector.

Demand Side and Industry Perspective

On the other end of the value chain, industry is in urgent need of skilled manpower and faces problems of high attrition. This is a key contributor to the complete lack of investment by industry in skill development as their workers shift jobs in short duration. Labor law compliance is another major issue that contributes to industry's tardiness in investing in skill development, as the trend is toward short-term contractual engagement and not long-term employment.

Government Perspective

While skill development has been a priority sector for both the national as well as state governments, several schemes have been announced, implemented, and some even closed down in the past few years. At one point, more than 25 different ministries were involved in skill development.

Three flagship schemes of the Government of India are currently focused on creating jobs, predominantly through manufacturing and technology, in the local economy and skilling our workforce in these sectors. These schemes are "Make in India," "Digital India," and "Skill India."

To give some impetus to the skill development sector, a separate ministry (Ministry of Skills Development and Entrepreneurship) was carved out for scaling up the existing vocational education and training system in India; this also houses the National Skill Development Corporation (NSDC), a public–private partnership setup to fund and promote sustainable business models in skill development in order to reduce dependence on grant-based training schemes and to encourage the private sector to innovate and try out market-linked models.

NSDC built up a large capacity to train through its partners and signed up 250 of them in a short span of five years. However, the success of these models is still to be seen, and the ministry has had to spend considerable funds on creating its own flagship scheme "Pradhan Mantri Kaushal Vikas Yojana" or Prime Minister's Skill Development Scheme. This funds training partners for imparting skill training as per the quality standards laid out by NSDC-funded sector skill councils. Sector skill councils, modeled on the Australian and English model, have also been largely ineffective in getting industry involved in the skilling process but have done a commendable job at standardizing and documenting National Occupational Standards and consolidating them into Qualification Packs for different job roles in each of the industry sectors. This has ensured some level of repeatability and reproducibility in terms of curriculum and training outcomes across this vast and diverse country.

A large quantum of funds have been invested in skill development through the Directorate General of Training or DGT (formerly Directorate General of Employment and Training housed within the Ministry of Labor, out of which the DGT was carved and realigned to the Ministry of Skill Development and Entrepreneurship). The National Council of Vocational Training (recently absorbed into a larger National Council of Vocational Education and Training) under the DGT has more than 60 years of experience in skill development and operates a mostly archaic network of Industrial Training Institutes (ITIs) across India. The DGT is also responsible for the rollout of the National Apprenticeship Promotion Scheme and Apprenticeship Protsahan Yojana, which have seen an underwhelming response from industry which views any government schemes with trepidation due to the inevitable myriad regulations and compliances involved.

Proposed Solution: Training Provider's Perspective: Centurion University—Gram Tarang Model

Labor is the most abundant asset of the poor, and effective engagement of this asset in productive activities through employment or self-employment, especially in disadvantaged areas of the world, is what the team at Centurion University and its social entrepreneurial outreach, Gram Tarang Employability Training Services (Gram Tarang means a wave of development in a village), is working toward. The strategy adopted is aimed at

- Giving the most disadvantaged sections of society in the most difficult-to-work-in areas of the country a chance to earn a sustainable livelihood, help drive equitable growth, and thereby wean them away from the clutches of extremism.
- Industry involvement in the process to assist with setting up state-of-the-art, industry standard workshops and laboratories with all relevant machines, tools, and equipment to ensure hands-on, practice-oriented, and experiential-based learning.
- Going the extra mile to support the youth beyond short-term vocational programs and helping them build career paths in industry through postplacement migration support and work integrated lifelong learning.

Gram Tarang provides these young people technical and soft skills in various sectors and trades. The generation of income and ongoing upskilling lead to wider social and economic benefits, especially through the programs focused on bringing back into the mainstream school and college dropouts who would otherwise be target recruits for the naxal (left wing extremism) cadres.

Examples of Good Practices

The typical model followed by Gram Tarang involves rural to urban migration, and counseling becomes a key component of the entire process, often as important, if not more so, than the technical training itself. This happens across three stages.

Pretraining Counseling

This process begins right in the village through mobilizers who travel with tablet PCs and videos of our training centers as well as of industries to impart a clear image into the trainees' minds of what to expect. Parents are a key part of the process as well, and they are involved at this early stage of counseling. Another key component is offering a basket of courses to the prospective trainees and explaining each course to them so that they can choose a course according to their interests, abilities, knowledge, and skills.

In-Training Counseling and Life Skills Training

A dedicated team of counselor cum life skill trainers have been put in place whose focus is to help trainees prepare for the fundamental shift they are about to see in their life ahead. It is essential to identify individual concerns rather than always address them in groups; and given that most of the students are in the age range of 18–25, they are faced with natural fears, apprehensions, and insecurities about their personal lives and professional life and the future. The in-training counseling is further enhanced through modules like health, hygiene, sanitation, AIDS awareness, change management, and how to cope with migration, industry induction, payslip understanding, Provident Fund and Employee State Insurance (PF/ESI) understanding, and financial literacy.

Pre- and Postplacement Counseling

To help the students adjust to new/big cities and new situations, preplacement counseling is given in the training center just before they travel to the workplace, and postplacement counseling continues until six months on their jobs. The key is providing proper orientation and induction about the company/industry before they go for placement/deployment, explaining to them the growth path in each industry/program, allowing them to choose the best option available to them, hand-holding them until they are well settled, and providing postplacement support.

Application of These Good Practices: Training Methodology

The direct beneficiaries are ordinary people who have been failed by the ordinary education system: school and college dropouts and others who have had limited access to any formal education.

The skill programs are practical, hands-on, and machine oriented and are delivered through tailor-made programs, including some developed in conjunction with local employers, which focus on direct placement across industries like automotive, manufacturing, fabrication, machining, retail, and hospitality. Experiential-based learning, practice-oriented pedagogy and hands-on knowledge and skills are the mantras practiced at Gram Tarang and form the fundamental design principal of any course that is offered.

A live production element is included in each course, which ensures that the trainee moves seamlessly from theory (traditional learning) to practical (applied learning) and production (action learning). Gram Tarang has also involved industry (Ashok Leyland, Godrej, Hyundai, Yamaha, Café Coffee Day, etc.) to build curricula and uses a team of trainers that focuses on developing technical, behavioral, and soft skills and imparts job-specific training to make the youth employment ready.

Implications for the Future: Career Progression, Lifelong Learning

The system of vocational training in India requires, for most courses, a minimum 10th year pass. About 50% on average clear the 10th standard examinations. Community colleges in the United States cannot deny admission to anyone who is over 18 years old and has a sound mind. It is also possible for a community college graduate to ultimately pass out from Harvard University, and this is the same in other countries with advanced vocational education systems such as Australia, Germany, etc. This is simply not possible for anyone in India. The problems faced by the average youth who migrates into the industrial areas as a blue-collar worker need urgent redress. While, in theory, there is horizontal mobility possible for ITI graduates to move to diploma and degree levels, given the socioeconomic pressure to become an earning member of the family at the earliest, most end up joining industry at whatever qualification level they finished and remaining at that level with little or no vertical progression in their organization (or similar organizations) and only marginal improvement (vis-à-vis prevalent inflation rates) in their income. At the same time, industry is suffering with high attrition rates, as the youth do not see a growth path for themselves in the organization.

The Gram Tarang–Centurion–NSDC partnership proposes to make a real change to this scenario by giving the youth an opportunity to continue their education while they are at the workplace. This will be achieved through a series of flexible associate diploma, diploma, and degree-level programs that will be delivered through our proposed centers in the industrial belts and also through various delivery models that will include regular contact classes, weekend classes, evening classes, and online and distance education. The idea is to mainstream the youth with a viable career progression both horizontally and vertically. Gram Tarang–Centurion strongly believes this to be the future of vocational education and qualifications in the country and has run several pilots of these programs in the past (TVS Sundaram Fasteners, KG Mills, Café Coffee Day, Western Refrigeration) and is now rolling the programs out in more than 45 locations across the country. The underlying learning philosophy is that of blended learning where 'on the job' workplace learning (50%) is combined with facilitated online app based learning (30%), contact classes (20%) and proctored assessments.

Conclusion: Value of a Revenue Model

Gram Tarang has a market-driven model that is both sustainable and scalable. The 1/3 × 1/3 × 1/3 revenue model it has adopted depends on training costs paid for by the three key stakeholders: individuals, government, and enterprises. The model has been recognized as a best practice and is being replicated in Assam, Meghalaya, Jharkhand, UP, AP, Tamil Nadu, Gujarat, Karnataka, Maharashtra, NCR and Punjab. The model also depends on partnerships with the government (both state and central) to ensure that fully residential placement-linked training is free of cost (including food and lodging) for the youth. Gram Tarang has trained more than 300,000 youth to date with a strong placement record of over 70% for age-eligible candidates; and it has received international acclaim from the United Nations, World Bank, and British Council and national recognition through five national-level awards: the overall best performer by NSDC, Best Skilling Center by NSDC, best placements by NSDC, and Skills Champions Award at the Federation of Indian Chambers of Commerce and Industry global skills summit, for three years running. It has also received accolades for its work in workplace retention and building career paths for students through its work-integrated programs.

Having set up 34 centers across seven states and having offices in over ten states of India, Centurion University and Gram Tarang are well on their way to achieving their mission of making 100,000 youth employable per annum by 2025.

Link to the presentation material: https://events.development.asia/materials/20160920/skills-development-priority-sectors-indian-perspective.

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Chapter 17
Challenges and Opportunities for Transforming Skills Development in Bangladesh: The Case of the Skills for Employment Investment Program

Sunhwa Lee

Bangladesh's economy has grown by more than 6.0% annually during the past decade and recorded 7.9% for the recent Fiscal Year (FY) 2018. The growth has been driven by booming Readymade Garment (RMG) exports, increasing remittances from migrant workers, and steady public investments. Between FY2005 and FY2015, export earnings tripled from $10.5 billion to $31.0 billion; remittance inflows jumped from $4.8 billion to over $15.0 billion.[1] The gross national income per capita surged to $1,751 by FY2018 from less than $600 in FY2005, achieving lower middle-income status in 2015. The country envisages to become a developing country by 2021 and a developed one by 2041.

The country has also achieved significant progress in its human and social development indicators. The average life expectancy increased from 58.2 years in 1990 to 72.3 years in 2018, and the adult literacy rate (for those aged 15 and above) rose from 35% in 1991 to 73% in 2017.[2] As of 2018, near universal enrollment was achieved at the primary level, and net enrollment at the secondary level reached 69%. Gender parity improved significantly as well, with girls' enrollment now exceeding that of boys.

Despite these achievements, low levels of education and limited skills in the workforce pose significant challenges to the country's high growth path.[3] To sustain and accelerate economic growth, Bangladesh needs to diversify its economic bases and

[1]Asian Development Bank (ADB). 2019. *Bangladesh Economic Indicators Update.* Dhaka.

[2]Bangladesh Bureau of Statistics. 2017. *Statistical Year Book Bangladesh 2016*. Dhaka.

[3]Government of Bangladesh, Planning Commission. 2012. *Perspective Plan of Bangladesh 2010–2021*. Dhaka.

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move up the value chain in the global market. To realize this vision, the government has prioritized investments in human capital to build a competent, productive workforce and initiated a series of education and skills development reforms.

This article discusses the challenges faced by Bangladesh with its increasingly large workforce and highlights one of the government's flagship initiatives to tackle them, *the Skills for Employment Investment Program (SEIP).* The SEIP introduced large-scale partnerships with the private sector to scale up the country's skilling capacity and impart job-ready skills to its youth, which in turn would enhance the employability and productivity of young workforce. The article describes SEIP's unique practices and discusses implications for future in the coming age of the Fourth Industrial Revolution or Industry 4.0.

Issues and Challenges

Bangladesh's high growth is often highlighted by its booming RMG industry, the share of which in total exports surged from mere 40% in 1990 to 80% by 2015.[4] Much of its success is owed to low-cost production and surplus of low-skilled labor. The growth of RMG industry underpinned the growth of jobs in the manufacturing sector, especially for women. It is estimated that women's employment grew by 4.4% annually due to demand from urban industrial employment, well over twice the rate of growth in the overall working-age population.[5] Yet, the majority of the labor force are still engaged in agriculture and allied sectors (41%), while about 20% are employed in the industry sector and 39% in the services sector. It is argued that the structural transformation during the past decade has moved mostly unskilled labor from rural and peri-urban areas to textiles and garments, but these unskilled workers have acquired few skills during the process.[6] As a result, low labor productivity is a continuing challenge for Bangladesh, compared with other neighboring countries such as India and Sri Lanka.[7]

Low levels of education and skills in the workforce put significant constraints on labor productivity in Bangladesh. More than half of the labor force have at most primary education or no education at all; only about one-third have completed secondary education, and less than 10% have a higher secondary education. In addition, less than 4% of the working-age population has received any technical or vocational training.[8] To place the country into the accelerated growth path, it needs to be transformed from low-productivity and low-wage development to high-productivity and high-growth models. The country also needs to diversify its economic bases, going beyond the garment sector. To achieve this vision, its growing workforce

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[4]Bangladesh Bureau of Statistics. Various years. National Accounts Statistics. Dhaka.

[5]World Bank. 2018. *Bangladesh: Skills for Tomorrow's Jobs.* Washington, DC.

[6]ADB. 2016. *Bangladesh Looking Beyond Garments: Employment Diagnostic Study*. Manila.

[7]World Bank. 2018. *op. cit.*

[8]Bangladesh Bureau of Statistics. 2018. *Labor Force Survey 2016–2017.* Dhaka.

needs to be equipped with education and skills that can improve their productivity and meet the emerging skill needs, especially in the face of industry 4.0 requiring increasingly higher levels of technical and cognitive skills.

Technical and Vocational Education and Training (TVET) plays a critical role in developing a competent workforce with relevant technical skills and knowledge. However, the TVET system in Bangladesh as of the early 2010s was fragmented and inadequate in both quality and quantity. Skills training was delivered by more than 20 ministries, along with a number of nongovernmental organizations, which provided short-term basic training, vocational secondary school certificate, vocational higher secondary certificate, and postsecondary diploma levels. The main public providers included the Department of Technical Education under the Ministry of Education; the Bureau of Manpower, Employment, and Training under the Ministry of Expatriate Welfare and Overseas Employment; the Ministry of Industries; and the Ministry of Youth and Sports. In the early 2010s, fewer than 500,000 people were trained in TVET overall, and job placement was less than 40%. With weak linkages between the TVET system and industries, most training courses could not supply the skills demanded by the job market.

With increases in the total population (from 138 million in 2005 to 163 million in 2018), the working-age population is expanding fast from 87 million in 2011 to 119 million by 2026, producing nearly two million potential new entrants to the labor force every year. Preparing them to become a productive workforce with quality education and skills poses formidable challenges in the existing TVET system. Yet, a large young workforce—if well equipped with productive skills—is vital to drive the country's future economic growth and capitalize on the "demographic dividend."

Proposed Solutions

The government has embarked on major educational and training reforms since 2010 to build a strong workforce that will ensure the demographic dividend for a dynamic economy. The National Education Policy, approved by Parliament in 2010, emphasized the overall importance of education and training. Significant investments by the government and development partners have resulted in sharp increases in primary and secondary school enrollments. For technical and vocational skills training, the National Skills Development Policy (NSDP) of 2011 has steered major institutional and policy reforms to create a highly skilled workforce across diverse industry sectors. In particular, the NSDP called for a more demand-oriented approach to TVET provision with greater involvement of industries.

Anchored in the NSDP, the government has set out to transform its skills development system both quantitatively and qualitatively. With financial support from the Asian Development Bank (ADB), the SEIP was developed in 2014 based on a long-term skills development roadmap. The main objective of the SEIP is to enhance the employability and productivity of the growing young workforce with industry-relevant skills training for the country's priority sectors. By initiating large-scale private sector involvement in training, the SEIP aims to scale up the skilling of new entrants and upskilling of existing workers to meet emerging labor market demands in and outside the country.

The program initially targeted to train about 1.25 million young men and women over a 10-year period through multitranche financing facility. The focus areas are the following. First, it aims to expand the national training capacity by mobilizing the private sector (e.g., industry associations) and by revitalizing public training institutes to scale up quality skills training. The expanded provision is expected to assure that women and socially disadvantaged groups can also access the training. Second, the SEIP reorients the content of training to align with specific industry needs by fostering direct involvement of industries. Third, the quality of training is addressed by improving training infrastructure (i.e., training facilities and equipment), quality assurance mechanisms, trainers' qualifications, and assessment and certification procedures. Finally, the program supports the government's major reform initiatives: the establishment of the National Human Resource Development Fund to serve as a unified financing mechanism to sustain skills development over the medium- and long-term; and the establishment of the National Skills Development Authority to coordinate the highly fragmented training system in the public and private sectors.

The financing for this 10-year program was approved by ADB in 2014, consisting of three separate tranche loans. The total funding for three tranches is $350 million.[9] The program targets large-scale nationwide skilling efforts through public, private, and NGO training providers with a strong coordination unit. The executing and implementing agency for the program is the Finance Division of the Ministry of Finance, Government of Bangladesh. For overall project management, the Skills Development Coordination and Monitoring Unit (SDCMU) was established within the Finance Division.

Examples of Good Practices

Expansion of Skills Training through Partnerships

The government has forged large-scale partnerships with the private sector, especially industry associations, to ensure that young people acquire industry-relevant, job-ready skills. Given the government's strategic focus on diversifying economic bases, six sectors were selected for training for the initial tranche 1 project: (i) readymade garments and knitwear, (ii) textiles, (iii) leather goods and footwear, (iv) information technology, (v) construction, and (vi) shipbuilding. The tranche 2 project since 2017 expanded its scope into additional sectors that included hospitality and tourism, agro-processing, and nursing and caregiving. Nationally recognized industry associations were selected for training partnerships of each priority sector to organize and

[9]The tranche 1 loan ($100 million) was approved in 2014 for implementation during 2014–2019; the tranche 2 loan ($100 million) was approved in 2016 for implementation during 2017–2021; and the tranche 3 loan ($150 million) was approved in 2019 for implementation during 2020–2023.

implement training courses. As of 2019, the government had established partnerships with 13 industry associations. The SEIP has also partnered with major public training institutes across four ministries to deliver training courses associated with the priority sectors. Currently, more than 40 public training institutes are implementing the SEIP training programs.[10]

The industry associations identify and organize 3–6 month training courses to serve the needs of their own respective industries. Courses are delivered in their own training institutes, training centers attached to companies, or outsourced training centers. To ensure the quality of training courses, industry associations adopted existing national competency standards or developed new competency standards with expert support from SDCMU. As of mid-2019, about 140 training courses were being delivered nationwide through more than 600 public and private training providers.[11]

Focus on Training Outcomes

With specific sector-oriented skills training, SEIP aims to provide market-responsive, job-ready skills and to place at least 60% of trainees in jobs after training completion. The government's partnerships with industry associations are built on performance-based contracts, in which milestone payments are tied to training results: (i) enrollment, (ii) completion of training and certification, and (iii) at least 60% job placement within three months of training completion. Industry associations are paid based on performance in each of these milestones, according to a unit cost per trainee, which varies across training courses. This emphasis on achieving training results, especially job placement, encourages the industry associations to identify training courses that are in demand from their businesses to absorb trainees upon training completion.

In performance-based contracts, monitoring and verifying the performance of training providers is crucial. The SDCMU developed an online Training Management System (TMS) to track and monitor real-time progress in training delivery, with mandatory data inputs on individual trainees from training providers. Such data inputs are prerequisites before making any payments to the industry associations. Data inputs in the TMS records also go through verification procedures by SDCMU before making payments.

As of mid-2019, SEIP had enrolled more than 300,000 trainees, of whom about 270,000 had received a certificate and nearly 200,000 were placed in jobs, achieving over 60% job placement rate. Of the total enrollees, about 30% were females. A tracer study for a cohort of graduates in 2016–2017 shows that the majority of those who found a job after training—about 78%—were still employed at the end of 2018.

[10]The government agencies partnering for SEIP training include the Ministry of Education, Ministry of Expatriate Welfare and Overseas Employment, Ministry of Industries, and Ministry of Youth and Sports. In addition, Palli Karma-Sahayak Foundation—an umbrella organization for nongovernmental organizations—and Bangladesh Bank, Small and Medium Enterprise Department deliver SEIP training courses, with focus on self-employment opportunities.

[11]The courses range from basic to mid-level skills courses in the priority sectors, such as machine operators and quality control (for garments and knitwear); yarn manufacturing and wet processing (for textiles); welding and plumbing (for construction); web-design and mobile applications (for information technology); and metal fabrication and welding (for shipbuilding).

Job placement success tends to vary across the industries. Those industries that have set up training centers attached to companies expectedly have a higher job placement rate, as most courses are directly aligned with what is needed in these companies. For instance, textile and leather goods companies have set up training centers within their companies and absorb trainees in their own companies or other related companies. In the case of the agro-processing industry association, they adopted a model of "recruit, train, and deploy," which led to near 100% job placement. These are the companies that previously hired workers without proper training and relied mostly on on-the-job training. With SEIP, companies now offer more structured training sessions, particularly to new labor force entrants. Employers acknowledge that job-ready workers have become more productive, and production processes have become more efficient. The trained workers are also paid a higher starting wage than those who have not undergone training.

Mid-level Managerial Training

At the earlier phase, SEIP training focused mostly on entry-level skills and some mid-level skills (e.g., sewing machine operators, quality assurance workers). Yet, both the government and industries became increasingly concerned about the "mid-level management gap." Many export-oriented industries—such as RMG, textiles, and leather goods—face difficulty in finding capable supervisors and managers who have both production and business management skills; hence, many rely on managers from overseas, such as India, the Philippines, Sri Lanka, and Viet Nam. This leads to a situation where significant amounts of hard-earned foreign currency by migrant workers are sent back to abroad: as of 2016, foreign managers in Bangladesh were reported to have remitted $4 billion annually to their home countries. The SEIP tranche 2 project designed an intervention to cultivate quality mid-level business managers. Customized training programs—called "executive development program"—were developed for four industries (i.e., knitwear, leather goods, RMG, and textiles) through close collaboration between universities and industries. Partner universities were selected for each of the industries.[12] The partner universities conducted an extensive assessment of training needs in each industry among mid- to higher-level business managers to set up a postgraduate diploma or certificate program. The curriculum consists of three modules for a nine-month long program: (i) generic business management courses such as human resource management, leadership, and business communication skills; (ii) industry-specific courses such as industrial engineering, production management and merchandising, and product development and designs; and (iii) industry attachment or internship program. The participants are drawn from both industries and university graduates. The courses are run on the weekends or outside of regular working hours. As of mid-2019, more than 700 people had completed the training programs.

[12]The partner universities are Bangladesh University of Textiles, BRAC University, East West University, Institute of Business Administration at the Dhaka University.

Challenges and Implications for the Future

The SEIP has been successful in expanding national training capacity and offering quality training to young men and women entering the labor market. The SEIP's partnership with industry associations, wherein industries are directly involved in identifying training courses, imparting basic and mid-level job-ready skills, and facilitating employment, has been key to the success. With the advent of Industry 4.0, technological advances offer opportunities to spur productivity and amplify economic development, while at the same time bringing new challenges in skilling the workforce.

In Bangladesh, garments and other light manufacturing industries have traditionally relied on labor-intensive and mass production models. Adoption of technologies such as automated production lines, high-speed sewing machines, and computerized designing and manufacturing can enhance productivity and make production processes more responsive to global trends in the apparel industry. Yet, adoption of technologies in production processes needs to be accompanied with further investment in human capital, especially in higher technical skills. It requires efforts from both industries and training providers to properly diagnose new emerging skill sets in changing industrial contexts. Some industries in Bangladesh, like large textile companies, have already adopted a large-scale automation process, where fewer numbers of workers perform routine and nonroutine tasks. These companies increasingly rely on highly technology-based production processes, requiring workers to be equipped with advanced cognitive and technical skills. The national training system, as well as company-based training, should be sufficiently agile and responsive to newly emerging skills demands.

Many workers will find out that their skill sets are no longer adequate for new emerging tasks involving advanced skills such as computer programming and problem-solving abilities. The workers need to relearn and acquire new skills, which may include not only technical skills but also higher-order cognitive skills (e.g., critical thinking, analytic thinking, and problem-solving skills). This calls for an expansion of opportunities for relearning and retraining of the existing workforce so that they continue to be productive for the changing nature of work. Such reskilling opportunities are particularly critical for women and those from disadvantaged backgrounds in Bangladesh, who have been engaged in low-skilled routine jobs that are more prone to displacement with adoption of technologies.

The increasing demand for higher-level cognitive and technical skills, combined with soft skills, suggests that the workforce should be equipped with strong foundation competencies including digital skills. Strong foundational skills will enable them to learn new skills effectively and adapt to the changing work environment. It has been argued that routine jobs are likely to be absorbed into automation, while nonroutine jobs requiring critical thinking and creativity are likely to increase in the coming years.[13] Still, rapid technological advances and new business models make

[13] ADB. 2018. *Asian Development Bank Outlook 2018: How Technology Affects Jobs.* Manila.

it increasingly unpredictable for the nature of upcoming jobs and their skills requirements. For both existing workers and future labor entrants, strong foundation and soft skills will be essential for relearning and retraining themselves while flexibly adapting to evolving work environments.

Conclusion

The SEIP in Bangladesh initiated large-scale skilling opportunities for young men and women and helped to fill the gap for a semiskilled and skilled workforce in the country's priority industries. Since 2015, it has enhanced employment and income-earning opportunities for more than 300,000 men and women. To tackle potential challenges arising from technological advances, both the government and industries need to further harness partnerships for the development of a highly skilled workforce. The nation's workforce development strategies also need to foster opportunities to continuously train or retrain and take advantage of newly created jobs.

Link to the presentation: https://events.development.asia/materials/20151201/bangladesh-skills-employment-investment-program-opportunity-transform-skills.

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Chapter 18
TVET System Reform and Development in the PRC

Asako Maruyama

Since its foundation on 1 October 1949, the People's Republic of China (PRC) has continuously been developing its TVET system in conjunction with changes in the economy and society. To meet the growing demand for a skilled workforce boosted by fast economic growth, it first promoted the establishment of senior secondary TVET schools in the late 1970s and 1980s. In the 1990s, in response to the need for higher level skills, it started to expand tertiary TVET colleges. In 2018, the scale of the TVET system in the PRC was nearly comparable to that of the academic education system, with 10,299 senior secondary TVET schools enrolling over 17.4 million students, and 1418 tertiary TVET colleges enrolling over 11.3 million students.

At present, the national-level initiative in TVET system development and reform is exercised by the Inter-Ministerial Joint Meeting on TVET under the State Council, while TVET policy formulation and administration is the responsibility of the Ministry of Education and the Ministry of Human Resources and Social Security. At the local levels, education and human resources and social security departments and bureaus are responsible for local policy development and implementation, as well as daily TVET administration, including financing and human resource management for public TVET institutions.

Since the late 1990s, the PRC has adopted a number of laws, policies, and plans at the national level to accelerate the development and reform of its TVET system. Major policy directions for the decade 2010–2020 were set out first in a State Council's special report in 2009 to address six major problems in the TVET system:

- The TVET system had not grown fast enough to develop a skilled workforce in quantity and quality and drive socioeconomic development particularly because senior secondary TVET was not accessible nor affordable for junior secondary graduates.

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- Coordination and articulation between secondary and tertiary TVET and between TVET and general education were lacking.
- The quality of TVET was low due to shortages of qualified TVET teachers in general and to rapid expansion of tertiary TVET.
- TVET programs and curricula were poorly designed to develop the skills required by employers.
- Legal and policy frameworks and institutional arrangements for TVET at the national level, as well as mechanisms for daily TVET administration at local levels, were inadequate.
- Funding was insufficient to develop quality TVET facilities (Hao 2012).

The State Council's report was followed by a series of key TVET system reform and development plans.

PRC's TVET System Reform and Development in 2010–2020

In 2010, the PRC adopted the National Long- and Medium-Term Outline Plan of Education Reform and Development (2010–2020). The Outline Plan aimed to establish, by 2020, a modern, multilevel, balanced TVET system that responds to labor market needs as well as people's demand for quality TVET. This goal would be achieved by (i) institutionalizing cooperation between TVET institutions and employers to improve TVET facilities, provide work-based learning opportunities for students, and offer work placements for TVET teachers; (ii) expanding TVET in rural areas to better serve agriculture, rural areas, and farmers; and (iii) making TVET more attractive through the exemption of tuition fees for senior secondary TVET and the provision of financial aid for students from poor and disadvantaged backgrounds, the award of dual certificates for TVET graduates,[1] and the alignment of TVET curricula with occupational standards. These measures were reflected in the 12th Five-Year Plan (2011–2015) and implemented through a national pilot project carried out at 56 pilot sites nationwide (Hao 2012).

During the early stages of TVET system reform and development, the PRC attached high priority to enhancing senior secondary TVET. A case in point was the Action Plan for Secondary TVET Reform and Innovation (2010–2012), which aimed to improve the basic capacity of senior secondary TVET. Under the Action Plan 10 projects supporting senior secondary TVET were launched to better serve the needs of industrial restructuring and upgrading, agricultural modernization, and new rural development initiatives; enhance school-enterprise cooperation and joint ventures; promote resource sharing and regional cooperation between advanced eastern provinces and underdeveloped western provinces; introduce ICT and improve

[1] "Dual certificates" for TVET graduates constitute a completion certificate or diploma and skills certificate(s).

school management; develop school principals and "dual qualification" teachers[2]; and drive program and curriculum reform and innovation (Hao 2012).

The next phase was marked by more comprehensive approaches to reforming and developing the TVET system. The vision for a "modern TVET system" was presented under the Modern TVET System Development Plan (2014–2020), referring to a world-class TVET system adapted to the PRC's context that would drive needed national and local socioeconomic development; promote integrated industry and TVET development; articulate senior secondary and tertiary TVET; provide pathways between TVET and general education; and support lifelong learning, career, and skills development. The Plan introduced a variety of measures to develop a modern TVET system, including: strategically planning and rationalizing the provision of TVET and aligning TVET standards, programs, and curricula with local industry needs; enhancing TVET at both the senior secondary and tertiary levels, strengthening the articulation between senior secondary and tertiary TVET, and providing pathways to further TVET (undergraduate-level TVET) and general education; establishing quality assurance for TVET; improving systems for developing dual qualification teachers; expanding the use of information technology platforms and international cooperation in TVET; and involving industry and employers in governance of TVET institutions, particularly tertiary TVET colleges. These measures were incorporated into the 13th Five-Year Plan (2016–2020) and elaborated more in ensuing plans.

The focus in subsequent stages was shifted onto tertiary TVET. In particular, the Action Plan for Tertiary TVET Reform and Innovation (2015–2018) prioritized the following three areas: (i) quality improvements by introducing advanced standards, programs, and materials through international cooperation; establishing systems for professional development of teachers and recruitment of part-time industry teachers; creating pathways to undergraduate- and postgraduate-level TVET programs and qualifications; using technologies to expand quality TVET resources and support ubiquitous, mobile, and personalized learning; and strengthening students' core competencies; (ii) development of credit-based, flexible, and diversified tertiary TVET and continuing education programs to be offered both at public and nonpublic TVET institutions, and using public–private partnership approaches; and (iii) capacity enhancements of specialized tertiary TVET colleges and universities to develop a pool of technical skills for priority industries in cooperation with industry, employers, and international organizations.

As discussed further below, the State Council released the National Implementation Plan for TVET Reform in January 2019 to address remaining challenges in developing a modern TVET system. Although challenges remain, the decade of reform (2010–2020) in the PRC has contributed to the development of stronger local TVET systems, especially in advanced eastern provinces, relying on local governments' supporting measures to systematically involve and coordinate with industry and employers and using technologies in the provision of TVET.

[2]A "dual qualification" teacher refers to a teacher who has both a teaching license and an occupational skills certificate relevant to the subject or subjects taught.

Good Practices in TVET: Local Examples from the PRC

International evidence suggests that systematically involving and coordinating with industry and employers in the provision of TVET is essential to develop a strong TVET system. Specifically, the following characteristics underpin a strong TVET system: (i) the mix and content of TVET programs and qualifications and progression paths through initial to higher level qualifications, are determined together with industry and employers, considering the need for lifelong learning and career development, and with due attention to those who are disadvantaged in the labor market; (ii) work-based learning with proper quality assurance, assessments, and certification/credits is systematically integrated into all TVET programs, and mechanisms exist for encouraging industry practitioners to teach part-time or enter TVET teaching in mid-career; (iii) TVET programs, curriculum, and assessments are organized based on competency and skills standards set by industry and employers, and qualifications meet labor market needs and are aligned with a national qualifications system or framework which allows flexibility toward local needs; and (iv) supporting policies, practices, and institutions are established to involve and coordinate with different stakeholders in the provision of TVET and career guidance, as well as monitoring and evaluation of TVET programs and systems, and funding (OECD 2015).

Through implementation of the plans discussed above, and of more specific policies and programs at the national and local levels, some local TVET systems in the PRC have come to bear some of the characteristics of a strong system. Examples below, which are by no means exhaustive, show how some local governments have been attempting to build stronger TVET systems that meet the needs of local industry and communities.

Joint Determination and Development of TVET Programs with Industry and Employers

"One town, one product, one major" model, Guangdong Province: In 2009, Zhongshan Polytechnic, a tertiary TVET college in Zhongshan Prefecture, established a school in Guzhen town that specializes in the lighting design program (started at the Polytechnic in 2006) with the support of the Guzhen town government[3] and local business association. The program at the specialized school was developed in partnership with large local lighting firms and small- and medium-sized enterprises in Guzhen town. The local business association, together with the town bureau of human resources and social security, coordinates skills demand and development. This model has been replicated in other towns with schools specializing in different programs (Yang 2018; Liu 2019).

[3] One of 18 towns in Zhongshan Prefecture.

TVET-industry cooperation and coordination platforms, Guangdong and Guangxi Zhuang Autonomous Region: To coordinate student enrollment, program offering, work-based learning, employment, and training and technical services for enterprises, Guangdong Province established 66 regional and industrial vocational education groups, involving more than 300 TVET institutions, 200 industry associations, and 4000 enterprises, along with relevant local government entities. Specialized TVET institutions were also set up through these groups (Liu 2019). Likewise, Guangxi Zhuang Autonomous Region formed 16 provincial industry TVET steering committees, led by relevant government entities and comprising tertiary TVET colleges, senior secondary TVET schools, industry associations, and enterprises, with a view to develop both TVET and industry. For example, the Electronic Information Industry TVET Steering Committee, led by the Guangxi Industry and Information Technology Commission, developed industry standards for skills, operating environment, and safety; conducted skills demand analysis; and advised TVET institutions on student enrollment, program offering, work-based learning, and employment.

Promotion of Work-Based Learning and Recruitment of Industry Practitioners

Financial incentives for employers to provide work-based learning opportunities, Guangdong, Jiangsu, and Shandong Provinces: Bao'an District of Shenzhen City (Guangdong) provides a subsidy for enterprises (CNY300 per student per month) that accept interns from senior secondary TVET schools. Taicang City of Suzhou Prefecture (Jiangsu) offers subsidies to enterprises that have established dual training centers (CNY2 million), and that develop new dual training programs addressing the needs of local industries (CNY100,000 annually for 3 years).[4] By contrast, Shandong Province has established a cost compensation mechanism for enterprises that provide work-based learning opportunities for students (Liu 2019).

Recruitment of industry practitioners for TVET, Guangdong and Jiangsu Provinces: Guangdong Province reformed the TVET teacher recruitment policy to allow TVET institutions to create positions such as industry teachers (mentors) and high-skilled leaders and to recruit industry practitioners by applying different assessment methods. The Jiangsu provincial education, and human resources and social security departments jointly recruited in 2018 more than 160 industry practitioners from enterprises as industry professors who participated in the development of programs and provided guidance for teachers and students on up-to-date industry practices and technological innovations at tertiary TVET colleges. The

[4]"Dual training" refers to a training modality that combines theoretical instruction provided by the TVET institution and practical training provided by the enterprise. Dual training centers are the places where enterprises provide practical training as part of dual training programs.

departments also provided subsidies and financial aid for more than 400 industry practitioners (high-skilled professionals, engineering managers, crafts persons) recruited as part-time teachers at tertiary TVET colleges (Liu 2019).

Development of dual qualification teachers, Guangxi Zhuang Autonomous Region: Guangxi Zhuang Autonomous Region established provincial dual qualification teacher assessment and certification frameworks that incorporate up-to-date industry standards, qualifications, and certifications in 2017. Guangxi also developed a dual qualification assessment and certification management information system (accessible on mobile devices and computers), generating data on TVET teachers' qualifications that can be used to tailor training programs to the needs of individual teachers.

Skills Standards, Qualifications Framework, and Quality Assurance

Skills standards and local qualifications framework, Guangdong Province: Guangdong Province has supported, with funds of more than CNY20 million since 2013, 74 standard development projects for advanced manufacturing, modern service, and strategic emerging industries, involving senior secondary TVET schools, tertiary TVET colleges, universities, enterprises, industry associations, and industry experts (Liu 2019). In 2017, Guangxi developed the first local qualifications framework in the PRC, modeled on Hong Kong, China's qualifications framework.

Learning management platform, Guangxi Zhuang Autonomous Region: Guangxi Electrical Polytechnics, a pilot institution for the national digital campus program in 2015, collaborates with Tsinghua University to develop a learning management platform for students, teachers, and classrooms as part of internal quality assurance systems. The platform supports the evaluation of teachers and teaching both in the classroom and in blended learning; provides real-time feedback on teaching and learning; and supports collaboration and communication between teachers, and between students and teachers, and individualized learning for students.

Challenges and Future of TVET System Reform and Development in the PRC

Since the State Council's special report on the reform and development of TVET in 2009, the PRC has successfully expanded access to TVET, upgraded TVET facilities, and promoted cooperation between TVET institutions and employers through the implementation of a series of plans and policies. Some local governments have also succeeded in strengthening their TVET systems. However, the six major problems identified in the report largely persist to date.

The pool of higher skills for key industries remains small. Articulation and pathways between secondary and tertiary TVET, and between TVET and general education, have not fundamentally improved, although some reforms of TVET college entrance examination and admission systems are ongoing. While improving, TVET teachers who have industry knowledge and experience are still in shortage. Despite the employment rates of graduates exceeding 90% both at the senior secondary and tertiary levels, the quality and relevance need further improvements. Dropout rates in senior secondary TVET remain high, and both TVET graduates and employers have the perception that TVET graduates do not have the skills required for work. Legal, policy, and regulatory frameworks and institutional arrangements for systematically involving and coordinating with industry and employers in the provision of TVET and for promoting lifelong learning remain incomplete both at the national and local levels.

To address these challenges, the State Council adopted the National Implementation Plan for TVET Reform in January 2019. By 2022, the Plan aims, among others, to enhance the basic capacity of tertiary TVET colleges; transform general higher education institutions into application-oriented universities (undergraduate-level TVET); build a TVET standards system that is compatible with international advanced systems; further strengthen cooperation among TVET, industry, and employers in the provision and quality assurance of TVET; increase the hours of work-based learning and the proportion of dual qualification teachers; and pilot a "1 + X" certification system.[5] A number of specific policies, regulations, and programs have been adopted to support the implementation of the Plan.

Lessons from TVET System Reform and Development in the PRC

The PRC's TVET system is grand and diverse, with each local government left to develop its own TVET system to meet the needs of local industry and communities, within overarching national legal, policy, and regulatory frameworks. The sheer scale and diversity of the TVET system makes it challenging to glean lessons from the PRC's experience. Nonetheless, there are several commendable characteristics that can be highlighted regarding the PRC's efforts to develop and reform the TVET system. These include:

- Successful expansion of access to senior secondary TVET through the exemption of tuition and other fees and the provision of financial aid for students from poor and disadvantaged backgrounds

[5] A "1 + X" certification system allows each TVET graduate to obtain an academic certificate and a number of occupational skills or competency certificates. The system is to work in conjunction with the establishment of a credit system for TVET and continuing education.

- Development of a multilevel TVET system comprising senior secondary TVET (certificate), tertiary TVET (diploma), undergraduate and graduate-level TVET (degree), and continuing TVET (diploma and non-diploma)
- Strengthening of the TVET teaching force by increasing dual qualification teachers and recruiting industry practitioners
- Promotion of the use of ICT to improve the quality of TVET
- Formulation of national policies and regulations for reforming and developing the TVET system based on pilot initiatives and local-level innovative practices
- Continuous and consistent efforts to develop and reform the TVET system through supporting laws, policies, plans, and practices since the late 1990s, building on the country's political, economic, and social stability.

Links to the presentation materials: https://events.development.asia/materials/20190828/key-features-adb-supported-tvet-projects-peoples-republic-china. https://events.development.asia/materials/20190828/enterprises-involved-tvet-chinese-experience.

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Part IV
Higher Education to Promote Higher Level Skills

Chapter 19
Higher Education Innovations: Hong Kong, China; the Republic of Korea; and Indonesia

Gerard Postiglione

Higher education plays a critical role not only in human capital development and nation building, but also in innovation systems. A lot of countries have recognized the pivotal role of universities and higher education institutions in achieving a knowledge-based economy. Anticipating emerging opportunities brought by globalization and technological advancements, many universities all over the world scramble to produce competitive graduates that will be able to thrive both in the national and the global labor markets.

Issues and Challenges

Rapid technological development brought about by the Fourth Industrial Revolution is changing the landscape of skills and employment around the world. This puts more pressure on educational institutions to quickly adapt and formulate innovative strategies to cope with disruptions and possible threats posed by these technological advancements. Further, with the rise of scientific breakthroughs and technological developments, it has been suggested that a country has at least one world-class research university to benefit from these developments.[1]

However, world-class universities have different emphases and approaches, as well as procedures and mechanisms. There is no universal ideal model or formula

[1] ADB. 2014. Innovative Strategies in Higher Education for Accelerated Human Resource Development in South Asia. Asian Development Bank. Manila; Philip G. Altbach and Jamil Salmi. 2011. The Road to Academic Excellence: The Making of World-Class Research Universities. IBRD/World Bank. Washington DC.

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to achieve such status, given that successful universities and/or institutions developed under different contexts in which leaders and decision-makers took advantage of emerging opportunities. Simply copying models used in other countries may also be counterproductive and ineffective. Instead, experiences from countries with successful higher education institutions may provide lessons and partial instruction.[2]

Proposed Solutions

To be more competitive and innovation-driven, high-quality universities need (i) competent faculty; (ii) good research, curricula, and pedagogy; (iii) good students; (iv) sufficient funding; and (v) adequate facilities.[3] Developing countries particularly need to place high importance on building talent (whether from inside or outside of the country). Recruiting and retaining leading academics is a key catalyst. The internationalization of universities can help attract top-caliber faculty to diversify university capacity and contribute to institutional upgrading and the strengthening of graduate studies and research.

Another important strategy is productive collaborations with other universities, especially those in developed countries. International collaborations provide the venue for student and faculty mobility, as well as for sharing of resources and ideas.[4] Such partnerships include establishing dual-degree programs, collaborating in research projects, and engaging with global knowledge networks.

Examples of Good Practices

Developing a World-Class University: The Case of the Hong Kong University of Science and Technology

Hong Kong, China has several of the world's top 50 universities and more in the world's top 100 according to the Times Higher Education's ranking. In the 1980s, Hong Kong, China, along with the Republic of Korea (ROK), Singapore, and Taipei,China were called the Four Dragons of Asia because of their common cultural heritage, open economies, and rapid growth. In the 1990s, the governments of the ROK, Singapore, and Taipei,China began to upgrade their economies by investing in value-added high-tech manufacturing. Hong Kong, China's laissez fair philosophy

[2]Cheng, Ying; Wang, Qi; Cai Liu, Nian. (eds.) 2014. How World-Class Universities Affect Global Higher Education Influences and Responses. Sense Publishers. Rotterdam.

[3]Park, Sung Joo. 2016. How to Innovate Higher Education in Developing Countries?. Presented at the 2016 ADB International Skills Forum.

[4]Wang, Qi; Cheng, Ying; Cai Liu, Nian. (eds.). 2013. Building World-Class Universities: Different Approaches to a Shared Goal, 1–10.2013. Sense Publishers. Rotterdam.

of economic development provided infrastructure but less investment for high-tech manufacturing. That infrastructure included the Hong Kong Research Grants Council (RGC), opened in 1988, to provide large-scale competitive research grants to universities. It coincided closely with the establishment of Hong Kong University of Science and Technology (HKUST) in 1991.[5]

1. As government support for research became enlarged with the creation of HKUST, funding to each university in Hong Kong, China was still disbursed on a competitive basis by the Universities Grants Committee (UGC), a nonstatutory body that advises the Government on the funding and strategic development of higher education. Resources allocated to the creation of HKUST as a new university were not to the disadvantage of allocations to other universities. The UGC recommendations to government reflect an effort to ensure complementarity among universities while strengthening their respective research capacities. The RGC also provides competitive grants to encourage interuniversity collaborative research directed at key challenges.

As a new university, HKUST was well-funded with a strong focus on science and technology and a competitive business education program, capitalizing on its location in a commercial city. The university entered Asia's top 10 university rankings within 10 years of its establishment. It currently ranks 30th in the world, 2nd among universities less than 50 years old, 3rd among all Asian universities, and 12th in the world on employability of graduates. Nearly 99 % of its graduates get employed upon graduation. HKUST also ranked 1st in executive MBA programs for the last 8 years.

HKUST maintains its world-class status with a high degree of institutional autonomy and academic freedom. From the start, it has been able to strategically capitalize on opportunities and advantageous conditions. With a vision to be "unique and not duplicate," HKUST has distinguished itself from other mainstream universities by finding a niche and building collaborations across disciplines and institutions. It places equal importance on research and high-quality teaching. It has no undergraduate degree in the social sciences or humanities. Yet, it requires all of its students in science, technology, and business studies to take social science and humanities courses as a way to drive innovative thinking. The university adopts a unique entrepreneurial research culture that promotes transfer and commercialization of technologies.[6] HKUST has notably invested in recruiting outstanding local and international faculty, scholars, and scientists. Particularly, it has recruited heavily from Chinese academics who studied and worked at world-class universities

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[5]Postiglione, G. A. 2011. The Rise of Research Universities: The Hong Kong University of Science and Technology. In Altbach, P. G. and Salmi, J., *The road to academic excellence: the making of world-class research universities* (pp. 63–100). Retrieved from http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099079956815/547670-1317659123740/Chapter3.pdf; Postiglione, G. A. 2013. Anchoring globalization in Hong Kong's research universities: Network agents, institutional arrangements, and brain circulation. *Studies in Higher Education*, *38*(3), 345–366.

[6]Ibid.

overseas. This not only ensures quality teaching, but also helps build transnational collaborations and attract international research funding.

HKUST's lessons learned and its keys to success can be summarized as follows: (i) pay attention to global trends and regional opportunities; (ii) move from global linkages to innovative interdependencies; (iii) forge collaborations with industry that are sustainable; (iv) leverage innovative regional exchanges; (v) nurture entrepreneurial talent; (vi) know the region, its universities, government, and the possibilities; (vii) embrace the competition and collaborate; (viii) position within the system as a catalyst; (ix) consider the medium of instruction; (x) be innovative in governance; (xi) hire the best human resources; (xii) set the conditions for a dynamic working environment; (xiii) attract research funding and donations; and (xiv) build a model that maximizes the transfer and commercialization of knowledge.

Universities for the Digital Age: The Case of the State University of New York Korea and KAIST Business School

The ROK has been a key player in the digital revolution since the 1980s, when it was at the forefront of the telecommunications industry. The country has become a rising star in technological advancements, surpassing other developed countries. As a result, the gross national income per capita in the ROK increased through the years. Recognizing the role of education, science and technology, and innovation in its rapid economic growth, the ROK has placed importance on these sectors to pursue industrialization and transition into a knowledge-based economy.

The Korean Government invited the State University of New York (SUNY) to establish a global campus in an effort to pursue academe-government-industry collaboration.[7] Strategically situated in the Incheon Free Economic Zone (IFEZ) and the ROK's smart city, Songdo, SUNY Korea is the first joint global and American university in the country. The campus' establishment was funded by the ROK, particularly by the central Government and the Incheon City metropolitan government. Aside from government support, SUNY Korea also forged collaborations with global companies and institutions in terms of internship and employment opportunities. The Incheon Global Campus has since expanded to 64 campuses around the world. Through these "extended campuses," Korean students get the same course content from partner universities around the world.

Another successful and internationally renowned research university established by the Korean Government together with American policymakers is Korea Advanced Institute of Science and Technology (KAIST). Likewise, KAIST makes a concerted effort to pursue internationalization through dual-degree programs and research collaborations with international universities. It also has strong university-industry

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[7]Kao, I., Shamash, Y. A., and Kim, C. 2013, June. Establishing an American Global Campus in SUNY Korea: Challenges and Excitement in Preparing Global Engineers Paper presented at 2013 ASEE International Forum, Atlanta, Georgia. https://peer.asee.org/17228.

linkages to promote technology transfer and foster cutting-edge ventures. Moreover, KAIST values the importance of competent talent to maintain excellence in the university—as a strategy, they actively recruit foreign faculty, and invite talented retirees from academe and industry to teach. To fully embrace their thrust of being an international organization and attract more international students, around 85 % of KAIST's courses are taught in English.[8]

University Strategic Partnerships: Institut Teknologi Bandung Indonesia

The Institut Teknologi Bandung (ITB), Indonesia's top university, was founded in 1920. It has 25,000 students and more than 1000 faculty and staffs. The different faculties are divided into four clusters: (i) Science; (ii) Engineering; (iii) Arts and Design; and (iv) Business and Management. ITB ranks 331st in the 2017 Quacquarelli Symonds World University Rankings, and 62nd in Asia.

ITB actively partners with several universities, research institutes, industry, government, and communities. It has notably collaborated with more than 350 foreign universities and research institutes from more than 40 countries. ITB maintains these global linkages to (i) promote mobility of faculty and students (ii) attract internationally diverse students, (iii) improve the curriculum through collaborative teaching and collaborative research networks, (iv) promote innovation, (v) enhance industry exposure, and (vi) raise its international profile and reputation. Some partnerships are internally driven, which means faculties and departments initiate the move. Others are externally driven when overseas partners seek ITB's participation or a mix of both external and internal efforts.

It is also worthy to note that ITB has more than 300 industry partners. Around 25 % of ITB's operational budget comes from industry contributions. By acknowledging that companies have different areas of interests for investments, ITB engages in various kinds of partnerships. For example, with the Institute for Innovation and Entrepreneurship Development (IIED) to institutionalize innovation and an entrepreneurial spirit in the university, ITB has managed to create 70 start-ups and 6 spin-off companies.

As ITB continues to pursue excellence, it reaps multiple benefits from partnerships. Through partnerships, it has been able not only to learn and share knowledge and expertise, but also to benchmark standards. The experience has highlighted the importance of considering both medium- and long-term interests from both parties when engaging in such collaborations. Partners need time to get to know each other, and universities should be prepared for possible internal changes that periodically

[8]Times Higher Education. 2016. Korea's Internationalization Challenge: An interview with the president of the Korea Advanced Institute of Science and Technology. Retrieved from https://www.insidehighered.com/news/2016/04/21/interview-president-korea-advanced-institute-science-and-technology.

occur in leadership, staffing, funding arrangements, and institutional strategy. Partnerships should have a clear focus and realistic targets/commitments. Lastly, in pursuing prospective collaborations, it is important to allocate time and resources to research potential partners.

The Swiss Model of Partnership in Higher Education: ETH Zurich

Switzerland invests in international collaborations through its Education, Research, and Innovation (ERI) strategy. This includes the Swiss National Science Foundation (SNSF), which provides funding for joint research projects, scientific exchange visits, and workshops/conferences in collaboration. with others (e.g., Argentina; Brazil; Hong Kong, China; India; Japan; People's Republic of China; the Republic of Korea; the Russian Federation; South Africa; and Taipei,China). Scholarships for PhD and postdoctoral studies are also available through the Swiss Government Excellence Programme. The State Secretariat for Education, Research and Innovation (SERI) also funds bilateral programs that invite Swiss universities and research institutions to partner with institutions from other economies. These bilateral programs are managed by the selected Swiss universities, which are called "leading houses." For instance, ETH Zurich is the leading house for the bilateral science and technology cooperation program of Switzerland with Hong Kong, China; Japan; the People's Republic of China; the Republic of Korea; Taipei,China; and members of the Association of Southeast Asian Nations.

ETH Zurich is an autonomous and well-funded university that was founded in 1855 to be the driving force of industrialization in Switzerland. It is highly reputable and internationally recognized, as the university consistently ranks among the top 5 in Europe and in the top 10 globally. ETH Zurich's bilateral programs consist of (i) *Bridging Grants or Seed Money Projects* for joint projects; (ii) *Mobility Grants* for doctoral and postdoctoral candidates; (iii) *Innovation Programs*, such as 3-month Asia Industry Internships, Innovation Partnership Grants (joint activity between Swiss academic partners and innovation partners in Asia), and Asia Entrepreneurship Training (training for start-ups with Asia-experienced entrepreneurs); and (iv) *Strategic Topics and Exploratory Funding* (e.g., strategic planning workshops, topical conferences, or funding to respond to emerging opportunities).

To foster an entrepreneurial spirit, ETH put in place various mechanisms to assist students and researchers at all stages of development (research, proof of concept, prototype, product development, and product). At the research stage, the university has put up the Spark Award to recognize the best patents. As proof of ETH's concept of product development, there is an ieLab (Innovation and Entrepreneurship Laboratory) that provides networking opportunities for entrepreneurs and venture capitalists to support young researchers and bring their technology to the market. At the product stage, there is ETH's spin-off, which has launched 25 start-ups. These start-ups have an amazing 90 % survival rate after 5 years.

Application of These Good Practices

The good practices outlined in this brief paper may not always be easily replicated. Good practices are developed at particular moments in time and within particular local contexts. Yet, they provide thoughtful lessons about how experimentation with key elements can result in successful adaptations to achieve success. The common features of these good practices are undeniable. They include investing in competent talent, placing an emphasis on international collaborations, and fostering government-academe-industry linkages. Most importantly, these models are successful because they remain nimble enough to quickly capitalize on emerging opportunities and conditions, while finding their niches and formulating innovative practices.

Implications for the Future

As the rise of frontier technologies and the Fourth Industrial Revolution is expected to profoundly reshape the demand for skills of the labor market, education systems are compelled to produce lifelong learners who have the flexibility and learning ability to quickly adapt to rapid technological progress.[9] This entails equipping students with twenty-first-century skills (a combination of foundational literacies, competencies, and character qualities) that fostering their capacity to innovate. Continuing, lifelong, and adult education also need to be strengthened in order to provide opportunities for reskilling and/or upskilling in anticipation of changes in the employment landscape.

Higher education curricula will have to develop not only technical acumen/mastery, but also intercultural and socioeconomic skills among learners.[10] A World Bank study suggests that, aside from educational attainment, having both cognitive skills and noncognitive skills (e.g., social intelligence and creativity) will be fundamental in avoiding automation-prone occupations.[11] Government-academe-industry linkages will also be crucial to help the education system to quickly receive labor market information and respond to the emerging skills needs of the economy.

[9]United Nations Department of Economic and Social Affairs (UNDESA). 2017. The impact of the technological revolution on labor markets and income distribution. Retrieved from https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/2017_Aug_Frontier-Issues-1.pdf.

[10]Penprase B. E. 2018. The Fourth Industrial Revolution and Higher Education. In: Gleason N. (ed.) Higher Education in the Era of the Fourth Industrial Revolution. Palgrave Macmillan, Singapore.

[11]Bentaouet Kattan, R.; Macdonald, K. A. D.; Patrinos, H. A. 2018. *Automation and labor market outcomes: the pivotal role of high-quality education (English).* Policy Research working paper; no. WPS 8474. Washington, DC: World Bank Group. Retrieved from http://documents.worldbank.org/curated/en/356581528983322638/Automation-and-labor-market-outcomes-the-pivotal-role-of-high-quality-education.

Conclusion

With the advent of the Fourth Industrial Revolution, universities and higher education institutions are the key players in preparing a labor force and for having a significant impact on social and economic progress. There is a need to scale up innovative and collaborative practices that sustain the excellence and relevance of higher education, as these will strengthen educational institutions and prepare learners for the workplace of the future.

Link to presentation material: https://events.development.asia/materials/20171212/hong-kong-university-science-and-technology.

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Chapter 20
Collaborative Innovation Between Shenzhen Municipal Government and Tsinghua University

Feiyu Kang

Global megatrends, such as the rise of frontier technologies, dramatic growth of information, sociopolitical landscape changes, and demographic trends, create a continuous need for transition. The increasing complexity of this phenomenon brings calls for ecosystem orchestration, which requires collaboration. The People's Republic of China (PRC), in particular, has been heavily investing in Artificial Intelligence (AI) and innovation to reduce gaps in basic research breakthroughs and high-end product development, and to further leverage its position as a manufacturing powerhouse.[1]

The PRC Government's commitment to support AI and Research and Development (R&D) is articulated in its current five-year National Development Plan (2016–2020) as well in its National Medium- and Long-Term Plan for the Development of Science and Technology (2006–2020).[2] The country has been pouring huge investments into R&D and is endeavoring to boost innovation.

Issues and Challenges

However, despite huge efforts and investments, the PRC faces challenges and roadblocks hindering its pursuit to become an innovation leader globally. It has faced deficits in terms of ensuring that its education system is prepared for an automation-driven economy, especially in fulfilling the rising need for skilled labor in smart manufacturing.[3]

[1]He, Y. 2017, June. *How China is Preparing for an AI-powered Future,* Wilson Briefs 2017.

[2]Ibid.

[3]Ibid.

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While the PRC has one of the largest pools of scientific and technological talents globally,[4] the country has very few leading AI scientists capable of producing world-leading research. Unlike more developed and innovative nations such as Germany, the PRC's training system is not yet well-aligned with the latest needs of markets and with technological trends. The PRC has also not yet successfully cultivated a dynamic culture of innovation and is experiencing challenges in attracting and maximizing its talents. Under its current system, scientific and technological engineers do not enjoy any real benefits from being innovative.[5]

The PRC also needs to catch up with more developed countries in some core technologies, as it remains dependent on other countries for key and innovative components of its manufacturing output (e.g., high-performance circuits and infrastructure software).[6] Similarly, it has a limited number of truly innovative and globally competitive companies. Most Chinese Small and Medium-sized Enterprises (SMEs) have been focusing their innovation efforts on generic products at the bottom of the value chain.

Proposed Solutions

Nevertheless, the PRC's innovation ecosystem has grown and improved steadily in recent years as the country is tapping the potential of higher education and research institutes for cultivating innovation, as evidenced by increased spending on and government support for basic research and independent projects.[7] The country is also rapidly developing hi-tech parks, and independent innovation demonstration zones are growing fast. Data from 2016 show that 130 such parks and zones, which are less than 1 % of the PRC's territory, account for nearly 40 % of R&D investment by all the country's enterprises, as well as 32.8 % of revenue from sales of new products.[8]

The Chinese innovation ecosystem is also geared toward market-oriented technological innovations and commercialization of technology.[9] More forward-looking companies have established engineering centers. Technology innovation partnerships among business and universities in the PRC are also becoming more diverse and business-driven. As such, funding support for entrepreneurship and innovation has also been growing and diversifying. To manage the momentum, the PRC Government has also set up regulatory mechanisms to protect intellectual property rights.

[4]World Economic Forum. 2016. China's Innovation Ecosystem. Retrieved from http://www3.weforum.org/docs/WEF_GAC_On_China_Innovation_WhitePaper_2016.pdf.

[5]Ibid.

[6]Ibid.

[7]Ibid.

[8]Ibid.

[9]Ibid.

It is noteworthy that, traditionally, there has been a disconnect between academic and industrial research. To address this, Chinese universities are increasingly pursuing exciting joint projects with enterprises. Such projects and endeavors include setting up technology enterprises, technology parks, and incubator programs. These universities have also been engaging entrepreneurs and organizations with local resources.[10]

Good Practices

Shenzhen Innovation Ecosystem

The PRC's AI innovation ecosystem, in particular, has been burgeoning as the nation's major technology hubs support researchers, entrepreneurs, and investors. In 2016, three cities dominated the AI sector: Beijing, home to 242 AI companies; Shanghai with 112 AI companies; and Shenzhen with 93 AI companies.[11]

Shenzhen in Guangdong Province, PRC, is a very vibrant and enabling environment for start-ups pursuing technological innovations. Located near Hong Kong, China, the city of Shenzhen has two of the top 50 global AI start-ups: iCarbonX, an AI-biotech start-up that uses algorithms to analyze genomic, physiological, and behavioral data to provide customized health advice; and UBTECH Robotics, the first company in the PRC to commercialize humanoid robots that can interact with human tools and environments. Shenzhen is also a major manufacturing region for industrial robots, producing more than $11.4 billion worth of robots in 2016.[12]

As the first National Innovation City and the first Special Economic Zone (SEZ) established in the country, Shenzhen has benefited from government policies supporting market openness, entrepreneurship, and R&D collaboration between universities and firms. Initially a fishing village, Shenzhen had no academic institutions. The PRC Government anticipated that the lack of higher education and research institutions would hinder the industrial development of Shenzhen, so it invited leading universities to set up campuses and/or research bases in the city.[13]

The Shenzhen municipal government also notably established a University Virtual Campus (UVC) concept in 2000 to increase cooperation with existing university partners and encourage more higher education and research institutions to set up in Shenzhen. They provided incentives (e.g., free office space and infrastructure for

[10]Ibid.

[11]He, Y. 2017, June. *How China is Preparing for an AI-powered Future,* Wilson Briefs 2017. Retrieved from https://www.wilsoncenter.org/sites/default/files/how_china_is_preparing_for_ai_powered_future.pdf.

[12]Ibid.

[13]Chen, K. and Kenney, M. 2007. Universities/Research Institutes and Regional Innovation Systems: The Cases of Beijing and Shenzhen. *World Development*, 35(6), pp. 1056–1074. Retrieved from https://pdfs.semanticscholar.org/15e0/43a1635dd0a85dac6df73590f8af708385b3.pdf.

2 years, subsidized amenities) to universities and research institutions that would establish branches at the UVC.[14] The incentive mechanism was so attractive that within 5 years, 43 universities and research institutions, including five universities in Hong Kong, China, and one university in France (Centrale Lyonais), put up branches at Shenzhen's UVC.[15] Aside from being a successful leading education hub, Shenzhen has also become successful in producing research and enabling academe-industry linkages. In just 4 years, more than 120 high-tech enterprises were established by the universities and more than 100 research projects from the universities were transferred to industry.[16]

Tsinghua-UC Berkeley Shenzhen Institute

The Graduate School at Shenzhen, Tsinghua University (GSSTU) was jointly founded by Tsinghua University and the Shenzhen municipal government in 2001 to cultivate top-level professionals and to carry out scientific and technological innovations. Directly affiliated with Tsinghua University in Beijing, GSSTU plays an important role in Tsinghua's commitment to achieve international prominence.

In 2014, Tsinghua University signed a memorandum of understanding with the University of California, Berkeley for the establishment of the Berkeley-Tsinghua Alliance for Transformational Technology Research and Education in Shenzhen. The Tsinghua-UC Berkeley Shenzhen Institute (TBSI) is a joint research and educational collaboration among UC Berkeley, Tsinghua University, and the Shenzhen municipal government to promote research collaboration and graduate student education. TBSI provides a unique global platform for transformational, translational, and transdisciplinary research and education for future world leaders in science and technology. The program's objective is to prepare global leaders to address societal challenges through immersion programs in the PRC and the United States.[17]

TBSI's research platforms are organized into three transdisciplinary centers to foster critical fields of research that address societal needs and global challenges: (i) Environmental Science and New Energy Technology, (ii) Information Technology and Data Science, and (iii) Precision Medicine and Healthcare. TBSI also offers a 2.5-year dual-degree Master of Engineering program, which is cotaught and takes place in both UC Berkeley and Tsinghua University (Phase 1 starts at Shenzhen, Phase 2 at UC Berkeley, and Phase 3 at Tsinghua University).[18]

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[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] UC Berkeley. (n.d.). Tsinghua-Berkeley Shenzhen Institute. Retrieved from https://tbsi.berkeley.edu/.

[18] Ibid.

Tsinghua University aims to use the positive experiences from TBSI to establish a Tsinghua Global Campus at Shenzhen, with the goal of tripling the size of Tsinghua Shenzhen Campus by 2025. The Global Campus is envisioned to build world-class transformative research, education, and innovation partnerships to nurture transformational technology and social science research that addresses global challenges, builds new capabilities, and co-creates markets and ecosystems.

Application of These Good Practices

The success of the Shenzhen Innovation Ecosystem and TBSI highlights the importance of taking advantage of favorable market conditions by timely aligning government policies and tapping strategic partnerships toward achieving development goals. The PRC Government's incentives and enabling innovation ecosystem were effective in attracting foreign talents and convincing renowned institutions to partner with its universities. International collaborations such as TBSI enhance the PRC innovation system, as they capacitate local talents and advance research through knowledge transfer/exchange and funding opportunities. These partnerships, through dual-exchange programs and transnational education, are also notably successful in terms of enabling local universities to upgrade their programs' curricula and cultivate advanced and higher level skills among their students.

University-research-industry linkages have also generally proven to be successful in achieving innovation-driven endeavors in the PRC. This is evidenced by the large number of firms and start-ups from such linkages that have grown into large businesses. Key PRC technology firms such as Lenovo, Tongfang, and Founder started as university-research-industry projects.[19] However, it is important to note that their successes are due to close relationships between universities and industries. Such partnerships also strategically embark on business-driven technological innovations and commercialization of technology, unlike conventional collaborations that involve mostly knowledge exchange and funding.

As the PRC's policies and innovation ecosystem have been widely successful in tapping the capabilities of its researchers, universities, and industries, developing countries may find the university-industry-linkage model useful. While most countries consider some separation between universities as healthy, the PRC model holds good potential in the context of gearing economies to be more knowledge-based and innovation-driven. This approach, however, would entail proactive and enabling government policies as well as strong willingness from universities and businesses to engage in joint ventures.

[19]Chen, K. and Kenney, M. 2007. *op. cit*.

Implication for the Future

The pace of technological advancements is anticipated to rapidly change the needs of the labor market and education systems globally. Many countries, especially the PRC, have been preparing for such developments by heavily investing in endeavors that will enable them to become leaders in science, technology, and innovation. Universities, in particular, have been tapped as critical players in this race.

To keep up with dynamic changes in research and curricula, education systems need to ensure that teachers are well equipped to cope. Learning methodologies are expected to adapt quickly to rapid technological progress and ensure responsiveness to the needs of the labor market, and educators need to have adequate competencies to teach these. Emerging fields and disciplines brought by technological advancements will also require higher level skills and create new demand for curricular offerings/programs. This will also require more efforts in adult education, retooling, and/or upskilling, given the expected effects of disruptive technologies on jobs (i.e., automation, demand for new jobs). For countries to fully benefit from internationalization and university-industry endeavors, their education systems also need to be able to timely address these needs.

Conclusion

With the onset of the Fourth Industrial Revolution, universities have a critical role in the creation of knowledge-based and innovation-driven economies. As such, innovative and collaborative practices that sustain the excellence and relevance of universities will be important to compete globally. Furthermore, education systems need to prepare both teachers and learners and ensure that they have the right competencies to thrive in a very dynamic labor and skills landscape. To achieve these, governments need to be proactive in creating an ecosystem that will encourage industry and academe to embark on breakthrough education and R&D ventures.

Link to presentation material: https://events.development.asia/materials/20171212/collaborative-innovation-between-shenzhen-city-government-and-tsinghua-university.

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Chapter 21
Regional Approaches to Improving Education in the Pacific and the Role of the University of the South Pacific

Chimi Thonden

Regional cooperation can offer much to the small dispersed island economies of the Pacific. The region contains some of the earliest regional organizations in Asia and the Pacific, with the fore-runner of the Secretariat of the Pacific Community established in 1947, the first meeting of leaders of the (now) Pacific Islands Forum in 1971, and the founding of the University of the South Pacific (USP) in 1968.

The USP one of two regional universities in the world, the other being in the Caribbean region. The USP jointly owned by the governments of the following 12 member countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Samoa. Campuses are located in all member countries, and the main campus is in Laucala, Fiji. The Alafua Campus in Samoa holds the School of Agriculture and Food Technology, and the Emalus Campus in Vanuatu holds the School of Law. The USP is governed by its own Council, which includes representatives of the member country governments, academic staff, students, community and business leaders, the Pacific Islands Forum Secretariat, the Secretariat of the Pacific Community, the American Council of Education, the Privy Council, Australia, and New Zealand.

The USP also operates 11 regional campuses based in Pacific island countries (PICs), which benefit from curricula, lecturers, administrative services, and support from the Fiji main campus. The network of campuses services a vast region of 33 million square kilometers of the Pacific Ocean, an area greater than three times the size of Europe. However, the total landmass area served corresponds to the country of Denmark. Populations of member countries range from Tokelau with 1500 people to Fiji with more than 900,000 people. (The total population of the USP region is approximately 1.3 million people.)

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Expanding Access to Tertiary Education Through Enhanced Regional Campuses

ADB's support to the USP began in 2009 with Regional Technical Assistance (RETA) 7282: Creation of the Pacific Information Super Highway, with the USP Network designed to support preparation of a multitranche financing facility loan to the USP. The $19 million loan represented ADB's first and only nonsovereign regional education loan. The project supports the USP in expanding access to higher education in its 12 member PICs by improving physical environments and learning programs. The investment program focuses on (i) expanding regional campuses and in Kiribati and Solomon Islands, (ii) enhancing Information and Communication Technology (ICT)-based distance learning programs, (iii) improving student services, and (iv) strengthening USP governance and management capacity.[1] Improved access to quality higher education at the USP will contribute to human resource and skills development in the Pacific and will promote inclusive growth enabled by higher productivity and diversification of the region's economy.

In the Pacific, the gross enrollment ratio for higher education ranges from 10% in Fiji to 2–5% in most other Pacific countries. Low enrollment is attributable to several factors including limited physical campus capacities, limited program coverage, and the perception of the quality of higher education programs available in the Pacific as insufficient. This has resulted in student desires to attend higher education outside the region, such as in Australia and New Zealand. This is largely unaffordable for the vast majority of students, especially those from low-income households, and only 5% of students seeking an overseas education can obtain government scholarships or private sponsorship. The governments of Kiribati and Solomon Islands view the value of in-country training as a better option to retaining students in their nations for tertiary education. The new expanded Kiribati campus, completed in 2015, already provides increased access to more than 3000 students doing preparatory, foundation, certificate, diploma, and degree studies at the USP. Similar works are soon to be underway for the Solomon Islands campus.

Under the umbrella of one university, regional cooperation and sharing of country-level lessons and good practice experiences are valuable to improving the quality of tertiary education across the region. The regional model of the university allows for greater efficiencies in small constrained economies, where resources may be more effectively spent on other priorities such as basic education. The contributing governments and higher education leaders believe that regional cooperation and cross-border collaboration are effective strategies for strengthening higher education in the region, as they are also owners of the USP.

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[1] ADB. 2012. *Report and Recommendation of the President to the Board of Directors*: Multitranche Financing Facility: Higher Education in the Pacific Investment Program. Manila.

Facilitating Pacific Regional Education Initiatives

USP also holds key regional roles in Human Resource Development (HRD) and in Information, Communications and Technology (ICT) as Chair of the Council of Regional Organizations of the Pacific (CROP) agency for HRD and for ICT. The USP's chair role on the CROP agency for HRD positions it well to facilitate the newly approved Pacific Regional Education Framework (PACREF). The Pacific Heads of Education Systems (PHES) developed, under the auspices of the Pacific Islands Forum and with the support of the Asian Development Bank (ADB) and Global Partnership for Education grant financing, the PACREF 2018–2030 program. Launched in October 2018, the PACREF outlines the region's education and training priorities and strategies, which stress a collaborative, Pacific-based approach to establishing a world-class human capital base.

Despite significant progress toward ensuring universal access to primary education, the quality of basic education remains a large challenge in the Pacific region. The results of the 2018 Pacific Islands Literacy and Numeracy Assessment (PILNA) revealed that in literacy, 47% of Year 4 students did not meet the expected minimum proficiency level in PILNA 2018, and 37% of Year 6 students did not achieve it. In numeracy, 17% of students did not meet the minimum expected proficiency level both in Year 4 and Year 6.[2] These results indicate that education systems need to continue to address the needs of the region's lowest-performing students in order for young people to acquire the basic skills and foundations critical for further education and work.

Several factors constrain efforts to improve the quality of education in the Pacific. These include economic, geographic, and political issues that may hamper access to technology, resources, and policy support. Social and cultural constraints such as gender inequality, accessibility considerations for persons with disabilities, and the need to account for the rich language diversity in the Pacific affect access to education. Other challenges include weak teacher and principal preparation, exacerbated by high staff turnover, affect delivery of education services, poor coordination of complementary activities that hampers opportunities for further learning and enrichment, and gaps in data collection and analysis which limit monitoring, evaluation, and learning supposed to guide the development of policy and program interventions to improve the education sector and its outcomes. In recognition of these challenges, Pacific countries have affirmed their commitments to development goals and have fostered partnerships with development partners and neighboring countries through regional institutions and high-level forums. Responding to rising local and global demand for a qualified workforce, governments have started to integrate national education planning and budgeting, implement national policies for early childhood education, and push for curriculum reforms. Various improvement initiatives have also been undertaken at the school level. Governments also recognize that regional solutions can significantly enhance efforts to improve the quality of education largely because they create economies of scale that may not be possible when a country

[2]Pacific Island Literacy and Numeracy 2018 report.

acts on its own. This enables more efficient use of scarce resources and encourages regional, as well as national institutions to coordinate and collaborate more closely, and, in the process, learn from one another.

The Pacific Regional Education Framework[3]

The PACREF has three phases which allow education ministers to conduct in-depth periodic reviews and allows for the time to obtain external financing. Phase 1 is being carried out in 2019–2022. Each phase is a 3-year rolling implementation process that requires annual updating that will help decision-makers to monitor available resources closely, as well as to ensure smooth transition between phases. Four regional agencies (the Educational Quality Assessment Program of the Pacific Community; the United Nations Educational, Scientific and Cultural Organization; the United Nations Children's Fund; and the University of the South Pacific through its School of Education and its Institute of Education) will support the program. Oversight functions will be shared among the following: (i) a PACREF Facilitating Unit under the Office of the University of the South Pacific Vice-Chancellor—to facilitate program operations of the four regional agencies as well as logistical and secretariat support; (ii) the Human Resources Development Working Group under the Council of Regional Organizations in the Pacific to coordinate implementation with the Facilitating Unit; (iii) a five-member steering committee composed of PHES members serving on a rotational basis—to represent the PHES on PACREF matters between PHES meetings; (iv) the PHES themselves—to ensure that the program addresses their respective countries' education needs and is being implemented smoothly at the country level; and (v) the education ministers of the Pacific Islands Forum member countries to meet every 2 years beginning in November 2020 to assess the PACREF's effectiveness and confirm the objectives and direction of the succeeding phases of the program.

There are four key policy areas in the PACREF, each with its own outcomes and strategies.

High-quality Learning at All Levels of Education

The PACREF seeks to develop inclusive, responsive curricula and programs that reflect Pacific values and culture, feature both cognitive and noncognitive development, and promote gender equality and innovation. Phase 1 involves the following activities: (i) production of tools that can be adapted to the national context for developing a curriculum with a Pacific identity and strengthening teacher competencies through standardized, regularly assessed, and continuous professional development opportunities; (ii) development of quality assurance frameworks at the

[3]Discussion of the PACREF and its components is based on ADB. July 2019. Pacific Economic Monitor, Policy Briefs: *A regional approach to strengthening education in the Pacific*. Manila. https://www.adb.org/sites/default/files/publication/514206/pem-july-2019.pdf.

regional and national levels that cover external validation for qualifications and programs; (iii) establishment of quality learning environments at all levels through the appropriate pedagogy, new technologies, and enabling facilities and student care services; and (iv) improvement of learners' information management systems for monitoring student performance and better inform future education interventions. Later phases of PACREF will cover specialist programs for language acquisition, ICT-enabled learning, identifying and mitigating barriers to education, and ensuring that tertiary programs offer "future-focused" learning opportunities that meet labor market demand.

Multiple, Accessible Learning Pathways and Modalities to Meet All Learners' Needs

The PACREF will help create an enabling policy environment for school-level decision-making and flexibility to facilitate learning. It will support the adaptation of regional tools that can be to the national context to help improve the governance, financing, program development, and quality assurance of early childhood care and education. The program will also ensure seamless pathways between education levels and beyond, complemented by full participation of preschoolers and the most vulnerable learners (e.g., out-of-school and at-risk youths, girls, persons with disabilities, and remote communities). Phase 1 of the PACREF will help national education systems to mitigate the risks to transitions in education, as well as develop and implement technical and vocational education and training and other inclusive, alternative pathways for formal education and skills development.

Learners Achieving Full Potential at All Levels

The PACREF aims to improve learning outcomes at all levels, namely, proficiency in literacy and numeracy (particularly at the primary level) and participation and success rates. It will support access to early intervention programs; teacher training to improve literacy and numeracy instruction; and continuous, system-wide use of assessment for learning which is expected to help achieve these outcomes. Further, the PACREF will develop and implement programs to build life skills that take into account the Pacific context, while helping learners respond to twenty-first century challenges and opportunities. This will include capacity building in information and digital literacy, programs for career education and workplace readiness, and resource development to support programs that nurture noncognitive skills. Under this policy area, the program will engage social agencies and collaborate with relevant partners to establish child protection policies. It will also examine adult literacy to guide decision-making and policy development in this area.

Competent and Qualified Teachers and School Managers

The PACREF envisions schools staffed by teachers and school managers with the appropriate skills and certifications, the confidence of their communities, and access to a range of continued professional learning opportunities. Phase 1 will focus on improving understanding at all levels of education of teachers' professional standards and development, and regional application of performance management systems;

and on strengthening preservice training and developing mechanisms to validate training programs across countries. It will support the development of regional standards, that will be complemented by opportunities for development, to help school managers better work with teachers toward meeting students' needs. Succeeding phases of the PACREF implementation will work on improving teachers' working conditions and remuneration, as well as establishing a code of ethics for teachers and school managers. It will support engagement and collaboration between the education system and community stakeholders, including teacher unions, and work to attract and retain quality teachers by marketing and advocating for the teaching profession. Partnerships with interested national education systems, and relevant development partners and regional agencies will be centered on these priority areas to help maintain proper focus of interventions and avoid redundant efforts.

By adopting a regional approach in close collaboration with national, regional, and multilateral partners, the PACREF 2018–2030 program seeks to deliver sustainable, high-quality education resources that can help improve learning outcomes in all Pacific countries. It responds to the Pacific governors' call at the 50th Annual Meeting of the ADB Board of Governors for more Pacific-based solutions and learning between developing member countries to address global education challenges.

ADB's support of the PACREF will help improve regional mechanisms for monitoring, evaluating, and designing education initiatives; enhance accessibility through e-learning; and support the exploration of options to further promote knowledge development and sharing in the Pacific. It will also provide a platform for policy dialogue, and a possible channel for additional resources in support of regional education initiatives.

Promoting Open Distance and Flexible Learning for Quality Teaching and Learning

There has been growing recognition of the importance of self-directed, resource-based learning as a key driver of twenty-first-century human capabilities. Provision of e-learning resources, particularly more Pacific-contextualized teaching and learning resources, including adaptation of open education resources, can help leapfrog the Pacific region into adopting technology as key to inclusive growth and development. An ADB report recommended establishing a regional center to develop e-learning resources and provide curatorial services with appropriate human resources and technical facilities in the Pacific.[4] The center can develop, collect, and coordinate the interchange of e-resources among the Pacific countries, and it should be organized regionally to leverage economies of scale and support national e-learning resource repositories.[5] ADB will (i) support development of and adaptation of critically needed high-quality open education learning resources focused on Science, Technology,

[4] ADB. 2018. *ICT for Better Education in the Pacific*. Manila.

[5] ADB. 2018. *Technical Assistance to the Region: Strengthening Education in the Pacific Region.*

Engineering, and Mathematics (STEM) subjects and literacy and numeracy spanning Kindergarten–Grade 12; (ii) develop and embed an intelligent tutoring system supported by AI research and innovations, in the e-learning resource design; and (iii) embed intelligent systems in the Learning Management System (LMS) platform to help teachers better manage student learning processes and outcomes.

With funding from the e-Asia Korea Knowledge Partnership Fund and High Level Technology Fund, ADB will work through the USP's Center for Flexible Learning (CFL) to house the development of quality e-learning resources in Fiji, which will be easily accessed and usable from all the Pacific countries' ministries of education. The USP again is well-positioned to play this role through the CFL and through the USP's role as CROP agency for ICT. The system will periodically replicate the repository data on all USP regional campuses. To maximize impact, the project will necessarily involve training teachers through teacher education programs, including the Fiji-based USP School of Education (SOE), which has a regional mandate, on strengthening teacher competencies in using and integrating ICT to support quality learning. The CFL will serve as the locus of repository and e-learning resources development under the project. The project will leverage previous ADB ICT regional infrastructure support to the USP to host the repository and can be supported to develop, curate, and distribute e-learning resources for the K-Grade 12 level. It will also leverage and complement New Zealand government support for the development of a regional platform and science e-resources. Currently, the USPnet serves only the university level of resources—in the future the repository may be expanded to host skill development and other related e-learning resources. The pilot will initially engage the USP CFL, the Fiji National University (the primary teacher education provider of teachers in Fiji), the USP SOE (to reach all regional campuses), and identified Fiji pilot schools and centers.

Conclusion

The deep educational challenges in the Pacific require the countries, institutions, and development partners to work together collaboratively to more effectively address the perennial challenges to improve countries' human capital bases. Over time, it is believed that the value of regional cooperation will be bear fruit, and that such approaches will help the region become more resilient and able to address the Pacific education challenges in a manner consistent with the Pacific interests.

Link to the presentation material: https://events.development.asia/materials/20171213/university-south-pacific-21st-century-partnerships-skills.

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Chapter 22
Stimulating Entrepreneurship Activity at SUNY Korea, from Scratch

Chihmao Hsieh

The Republic of Korea (ROK) is a country well-known for fostering innovation. From 2016 to 2019, the ROK has ranked #1 in the Bloomberg Innovation Index (Jamrisko et al. 2019), which scores economies using factors that include research and development spending and concentration of high-tech public companies. Yet, the country historically has not been a leader in fostering high-quality innovational entrepreneurship ecosystems. Statistics show that Small and Medium-sized Enterprises (SMEs) employ almost 90% of the country's workers, but those SMEs hold only around 23% of the country's market capitalization (Ogura 2015; Korean Ministry 2019). While the speed of entrepreneurial decision-making is certainly slowed down by the bureaucracy and hierarchy typically found in Korean organizational culture, the education system has also been scrutinized. Policy-making and academic research alike point to the shortcomings of the education system's sheer reliance on rote memorization when it comes to developing critical and creative thinking skills required for innovational entrepreneurship (McGuire 2007; Jeon 2015). In that sense, the educational environment and entrepreneurship education environment in the ROK differ significantly from those in many Western environments.

This article addresses *SUNY Korea*, a recently founded international campus for Stony Brook University, and focuses specifically on the recent launch, progress, challenges, and concrete actionable "lessons learned" at its Center for Global Entrepreneurship (CGE). While the CGE is only a few years old at the time of this writing, its small staff has already accumulated experiences that can help inform those who wish to replicate this kind of organization elsewhere, especially in Asia.

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Background

The State University of New York, or SUNY, is the largest comprehensive system of universities, colleges, and community colleges in the United States, with a total enrollment in 2019 of 415,572 students, plus 2,313,953 adult education students, spanning 64 campuses across the state.[1] Although the broader university system was established in 1948, its four flagship universities were founded in different years: Albany (1844), Binghamton (1946), Buffalo (1846), and Stony Brook (1957).

In 2007, Stony Brook University (SBU) signed a memorandum of understanding with the Incheon Free Economic Zone, and in May 2009, the SUNY board of trustees granted Stony Brook administration the authority to conduct negotiations with the ROK government to build a partnership campus in the country. Stony Brook would join other universities in the so-called Incheon Global Campus (IGC), to offer a diverse learning environment while at the same time stimulating the economy of the ROK. In July 2011, Stony Brook University announced that the Ministry of Education, Science and Technology in the ROK had approved the establishment of SUNY Korea as part of Songdo International Business District in Incheon, and that the campus was expected to begin academic programs in March 2012. Since launching in that month, SUNY Korea in 2019 offers seven undergraduate majors, five from SBU and two from SUNY's Fashion Institute of Technology (FIT).[2] As of Spring, 2019, SUNY Korea has 1,044 students, with 237 hailing from 56 foreign (i.e., non-Korean) nationalities.

All instruction at SUNY Korea is in English. While many American and British universities have launched international campuses in Asia, very few use SUNY Korea's kind of educational model: All SUNY Korea students are required to spend 1 year living and studying at the SBU home campus in New York. This residency requirement exposes them to American social and educational culture, as well as the community network there.

The Center for Global Entrepreneurship at SUNY Korea

In 2016, SUNY Korea launched a Business Management Department, and the following year its CGE was launched. The mission of the Center is to offer all SUNY Korea students and faculty a "networking point" with both the global and local entrepreneurship communities, as well as a set of in-house programs ranging from ideation hackathons to workshops on sales/negotiation and business modeling

[1] The State of New York website (https://www.suny.edu/about/fast-facts/).

[2] The SBU majors are mechanical engineering, business management, applied mathematics and statistics, technology and society, and computer science. The FIT majors are fashion design and fashion business management.

to mentorship opportunities. The primary metric for the Center is the incubation of student start-up companies at SUNY Korea.[3]

Since launching in August 2017, the CGE at SUNY Stony Brook's Korea campus has launched a variety of programming[4]:

(i) The *Global Growth Supporters* program, where teams of non-Korean faculty and undergraduate students offer consulting services to Korean start-ups interested in "going global;"
(ii) The *Foreign University-linked Start-up Support* program, where faculty and entrepreneurs give workshops and pitch training to funded start-ups;
(iii) Start-up Weekend (in partnership with Techstars). The November 2017 theme was "Educational Technology." The June 2018 theme was "Fashion Innovation." The June 2019 theme was "Sustainable Fashion Innovation;"
(iv) Business "Beautiful Mind Speaker" Series, where guest speakers give talks about industry and leadership experiences;
(v) MOES, or "Monthly Ongoing Entrepreneurship Symposium," wherein SUNY Korea students pitch their ideas to each other during monthly closed-door luncheons;
(vi) Internship matching program connecting SUNY Korea students to work at local start-ups; and
(vii) A 3-day Business Idea Camp for all IGC students in November 2018 designed and delivered with an $18,000 government grant.

Some of the programming (notably [i] and [ii] above) has been developed in conjunction with the Incheon Global Start-up Campus (IGSC). Located on the basement level underneath the IGC, the IGSC is part of the Incheon TechnoPark (subsidized by the Incheon Metropolitan Government) and incubates more than 40 professional start-ups.

Major Issues and Challenges at the CGE

Although the CGE has made progress in the earliest stages, there have been several significant cultural challenges. The first challenge has come from a broader cultural stigma or overall apathy toward entrepreneurship.[5] As the Wall Street Journal reported in 2013, "Part of the challenge in … Korea is tackling the heavy stigma of business failure. Working in a safe, prestigious job for a large corporation or the government has long been considered a desirable career route. Business failure is particularly feared because bankruptcy laws focus on ensuring that creditors are paid, meaning that personal and business assets can be stripped away at struggling companies" (Nam 2013). Although that news article was written 6 years ago, staff

[3] https://www.chsieh.com/.

[4] *Ibid*.

[5] These accounts are from the CGE's founding director, also this article's author.

at the CGE still perceive this undercurrent of stigma. SUNY Korea students are not particularly attracted to a life spent in entrepreneurship, and neither are their parents especially encouraging them to follow that path. Compounding the issue is that SUNY Korea's tuition matches SBU's tuition at roughly $25,000 per year, and so students' parents are looking for a return on their educational investment.

Furthermore, many Korean students arrive at SUNY Korea still stuck in a rushed Korean pedagogical model and educational system driven by "making the grade" in anticipation of university admission; via rote memorization instead of concept acquisition; in hierarchical, one-way instructional designs (Jeon 2015). Thus, the typical student has not been exposed to critical thinking, creativity, and critical debate or discussion.

At the institutional level, SUNY Korea's small size is both a strength and a weakness. While its small size offers students and faculty more room for academic interaction, there is seemingly just not enough critical mass of student entrepreneurship spirit to continually inspire students. Consider statistics—albeit from the United Kingdom—showing that only 4.7% of recent graduates are self-employed or freelance, with only 0.6% having actually started their own business (Phillips 2018). Large universities with a student population of 20,000 students often announce entrepreneurship success stories. At such institutions, a 5% entrepreneurship participation rate would yield 1,000 entrepreneurial students, and at (say) four students per nascent entrepreneurship team, the equivalent of 250 teams. Hypothetically, if 3% of those teams reached any significant level of success (i.e., generating enough revenue to support the team's salaries), then 7 or 8 success stories could emerge and inspire others in the university community. Even assuming away "economies of scale" attributable to the geometrically increasing number of student interactions at larger universities, at just around 1,000 students the odds of fostering enough teams at SUNY Korea to produce even one such success story become challenging.

Practices and Solutions

In September 2017, for the launch of the CGE, a multistage ideation competition was created for SUNY Korea students. Every month the CGE would accept submissions for venture ideas from individual students, and selected ideas would be invited to be pitched to students and a faculty-based "jury." At semester's end, the top three or four ideas would be selected by the faculty jury from all the ideas presented during the semester for a finals competition. Throughout the course of the semester, the cash prize for the winning idea was announced at $500. While there was interest and participation among the international (i.e., non-Korean) students, such cash prizes were apparently not enough to incentivize the Korean students.

However, student interest and participation exploded in the entrepreneurship programming when professors were identified as willing to offer their students extra credit for taking part. Very few faculty members, however, were willing to offer this deal to their students, apparently due to worries that such extra-curricular activities would eat into their students' commitment to class and time devoted to their homework assignments.

Between October 2017 and June 2019, the CGE offered three 54-h hackathon-style events in collaboration with Start-up Weekend. The first one, in October 2017, had an EdTech theme and was university-wide but also attracted students from the other universities on the IGC. The ones in June 2018 and June 2019 were held in partnership with FIT Fashion Management professors, with themes related to Fashion Innovation. Partnering with Fashion Management professors, Start-up Weekend became mandatory for their students as a part of their final semester project.

Success was also found in relying on a professor's course to support hackathons and "Start-up Weekends." Using classes to generate participation was found to be especially useful in high power-distance conditions. Professors were asked whether they would be willing to use a weekend hackathon to substitute for their semester-long project. Some professors resisted, usually because they were unfamiliar with the value of entrepreneurship programming. Thus they were slowly brought on board by first asking them to help judge the student team pitches and presentations. More often than not, they became impressed enough to want their classes to join in the future.

Compared with other parts of the world, the Korean *entrepreneurship education* ecosystem is not as well-supported by (or reliant upon) corporate funding or individual donors. Instead, financial support tends to come from government entities such as ministries. Government offices have been approached on whether they would partner at events, in terms of getting the chance to announce the theme in exchange for sponsoring door prizes or meal costs. For example, the June 2019 Start-up Weekend on "Sustainable Fashion Innovation" was funded in part by the Korea Culture Information Service Agency (KCISA). As part of the funding agreement, KCISA contributed $1,000 to cover food and door prizes, and after seeing the success of the event, agreed to contribute more funding in the future.

At the beginning of 2019, the CGE launched another program initiative with strong success. Mini-grants called "IGNITE" (standing for Inspiring Goals Now In Technology and Entrepreneurship) were created to help expose students to national competitions and the exposure that reflects current trends. For the first set of IGNITE mini-grants, the CGE at SUNY Korea welcomed computer science students from SUNY Korea to apply to compete at a hackathon sponsored by Google Campus Seoul. Sixteen applicants competed fiercely for the four mini-grants, and there were four winners of the 2019 grant. The CGE covered their event ticket costs and their 2-night Airbnb accommodations a few blocks away from Google Campus Seoul. A second set of IGNITE mini-grants were used to send 25 enthusiastic students on a field trip to attend the Seoul Motor Show. Although small in size and incremental in effect, these mini-grants have been shown to garner strong interest from students (SUNY Korea 2019).

Finally, there has been value in contacting local business incubators or start-up hubs and coordinating for them free "student consulting." New directors at university entrepreneurship centers in Asia may need to utilize some small funds to help make the experience more fun for students (e.g., funding for shared meals).

Moving Forward

There are a variety of additional strategies being planned or explored to build the entrepreneurship spirit at SUNY Korea. First, the CGE anticipates exploring the possibility of reaching out to parents of SUNY Korea students, in hopes of convincing them to support their children in experimenting with entrepreneurship during university. As mentioned earlier, a stigma can be noted against business failure and attempts at entrepreneurship. Much of that stigma and the student dreams of working for a *chaebol* conglomerate appear to originate from parental mindsets. These parents could be contacted by university professors or administrators. Unfortunately, because SUNY Korea is the international campus of SBU, it follows SBU's institutional framework and there are privacy acts (i.e., Family Educational Rights and Privacy Act) serving to block direct contact with them. Instead of contacting parents directly, the CGE may instead attempt to contact parents via notes to their children.

Another issue that CGE staff have recently identified is that SUNY Korea students do not have the friendship network that can help them identify co-founders. One might attribute this partly to the emergence of popular communication technologies such as Instagram or TikTok. Cooperation or collaboration may not come naturally when Korean students are raised in an ultracompetitive educational system. Finally, while many other Korean universities make use of a "big brother/little brother" cultural system (i.e., *sonbae*/*hubae*), SUNY Korea has no such system. The CGE, in collaboration with the Business Management department, is testing the introduction of activities to better bond students within each incoming graduating class. By helping students to bond within their cohort immediately after arriving on campus, seeds can be planted to help students' social professional networks to grow.

Unsurprisingly, not all students are cut out to become entrepreneurs, and thus not everybody should be forced to choose to become an entrepreneur. At SUNY Korea, the CGE is thus shifting from a mode of trying to reach all students with its programming to a mode of reaching only those students who (already) show an attitude and motivation toward entrepreneurship. In the coming semesters and years, based on the success of hackathon formats, the CGE would like to create "All-Star Start-up Weekends." At the beginning of each semester, an announcement could be made to invite business and mechanical engineering students to apply competitively for limited spots to take part. The competitive application process would require students to submit a copy of their transcripts, as well as a 1-page motivation statement. The best 4–6 students from various departments would be selected by the chairs of those departments. During a weekend around week #4 of the semester, a 2-day or 2.5-day event would be held. At the start of this event, each selected student would be required to make a 1-min pitch about an entrepreneurial opportunity: the consumer or industrial problem/pain/need, and the basic nature of the solution (12 ideas total).

These 12 students would form three teams to tackle a problem/pain/need of their own choice. Ideally, industry mentors would be available to coach the students, but the CGE has had difficulty attracting volunteer mentors outside of the university. On the last evening of the competition, teams would pitch to a jury.

Now in its third year, the CGE has slowly built up programming that has left impressions on a handful of students, and in the fall of 2019, some SUNY Korea students are creating their own university-sanctioned Entrepreneurship Start-up Club. CGE staff thanked the students for exhibiting the intrinsic motivation required to form this kind of club, and will be financially supporting their membership activities. In many ways, students may be best motivated and inspired by other students (and not necessarily professors or staff), and so the development of such a student club is not viewed as infringing or unwelcomed by the CGE. The CGE has met with the club's founding members and discovered that SUNY Korea students are incentivized not by cash prizes but rather by unique and exclusive VIP-type experiences generally inaccessible by the public. For example, many students were intrigued by the Google Campus Seoul competition because entry into the Google facility there is monitored and controlled, even though rental of that space was offered for free to instructors. However, CGE staff have learned that SUNY Korea students are looking for unique prize "experiences" such as the ones up for bid at hotel rewards points auctions (e.g., "meet-and-greets" with celebrities), and hope to learn more about such changing student tastes.

Conclusion

This article offers an account of some progress and lessons learned from a new entrepreneurship center at the recently founded international campus of the first American university to open in the ROK. The challenges in promoting student entrepreneurship can be steep when a small student population has not had much experience or training in critical thinking during previous studies. Students at the university profiled here have tended to exhibit more competitive spirit about grades than entrepreneurial spirit or passion, and moving forward, some next steps have been identified and will be trialed, assessed, and iterated. Overall, while SUNY Korea's Center for Global Entrepreneurship has experienced some starts and stops in its first few years, it aims to continue developing and gathering support for entrepreneurial activity on campus.

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Part V
Transformational Edtech

Chapter 23
An Overview of Innovations in Online Learning

Marito Garcia

Learning today has extended much further, beyond the classroom. With the rise of the Internet and mobile phone technology, more education and learning occur online—on laptop computers, tablets, and mobile phones. In 2019, for example, more than 3.9 billion people globally had access to the Internet, out of the world's total population of 7.6 billion, of whom about 3.4 billion were active users of social media such as Facebook and Twitter. These technology developments have dramatically increased access to learning materials and are changing the landscape of education.

This overview article describes the emerging trends in e-learning and blended learning, captures key emerging good practices worldwide, and considers their role in schools and at work, in continuing education, and in workforce skills development.

The most obvious feature of online-based courses is the availability to everyone with Internet access. Individuals are free to join, interact, and reflect based on their learning needs, with students joining with great frequency. Enrollments tend to be high. In the very early case of a class on 'introduction to artificial intelligence' (a noncredit course offered free to anyone) at Stanford University in 2011, 160,000 students enrolled. Utilizing a course Web home and a customized learning management system, the course included lectures, homework, and assessment. While many

[1] Class Central (2018).

Better retention occurs when mobile learning is presented as a stand-alone delivery method or as part of a blended learning program. For example, one global pharmaceutical company achieved a 53 percent improvement in knowledge retention among staff members by using mobile learning to introduce a new product (Werner & da Gama 2011) – Benefits of Mobile Learning, 2015, Lynda.com, LinkedIn Learning.

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online students did not finish the course, some performed as well on the assignments and examinations as did those taking the traditional campus-based course. By 2018, more than 101 million users had participated in Massive Open Online Courses (MOOCS) in over 190 countries on major platforms such as Coursera, EdX, Udacity, and FutureLearn.[1]

Challenges in Education Addressed by Online Courses

Traditional colleges and universities are facing a number of issues, including increasing tuition, reduced state support for public institutions, declining endowments, decreasing enrollments, and increasing competition from for-profit institutions. In developing countries, postsecondary education is unaffordable for the majority of the population, and access especially for the poorest is a huge issue.

New online courses can attract millions of participants from around the world, with students openly sharing their expertise and knowledge with each other, while also managing their own learning paths.

Blended learning describes the way e-learning is being combined with traditional classroom methods to create a new hybrid teaching methodology. A course created following a blended learning model uses classroom time for activities that benefit most learners from direct interaction. Traditional education tends to place an emphasis on delivering materials by way of lectures; while in a blended learning model, lectures can be videoed and prepared ahead of time so students can watch at their own time of choosing. Classroom time is then spent doing exercises that emphasize the application of the curriculum, or to solve problems. The new technology allows for individual assessments, and thus learning is personalized.

Promising Online Learning Technologies: Key Trends Worldwide

The Rise of Massive Open Online Courses (MOOCs)

A MOOC is a type of online course aimed at large-scale participation and open access via the web. Early applications of online learning emerged from the availability of content from open education resources (OERs). Though the design of and participation in online courses may be similar to college or university courses, MOOCs typically do not offer credits awarded to paying students at schools. However, assessment of learning may be done for certification.

A MOOC is a model for delivering learning content online to anyone who wants to take a course. Anyone can enroll, and there are no preconditions for participation. It is an interactive, step-by-step course aimed at reaching virtually unlimited numbers of participants, worldwide. The initial courses had enrollments as large as 100,000 students at a time for a course, available worldwide. MOOCs started as free courses but have now become a ‘freemium’, where some are free and others are for a fee. The first MOOCs were essentially college courses put online: they were approximately 10 weeks long and had weekly or biweekly assignment deadlines, with a final exam. Like a college course, they followed a semester pattern and were offered once or twice a year.

While MOOCs started around 2008, the rapid increase in enrollments began around 2012 with the offering of platforms by Silicon Valley-based platforms Coursera and Udacity, EdX in Massachusetts, and FutureLearn in the United Kingdom (UK). Working with high-quality academic institutions worldwide, including Stanford University, the Massachusetts Institute of Technology (MIT), and thousands of others, these platforms expanded and reached a significant number of users in all countries. Registered users of the largest platform today, Coursera, rose from a few hundred thousand in 2012 to around 40 million in 2018, as it increased its collegiate courses offerings to more than 2,100 from partner universities and institutions across 29 countries. Beyond the United States and Europe, MOOCs have spread worldwide. *IndonesiaX*, for instance, was created for Indonesian students so that courses from the best universities in the world could be delivered in local language as well, taking advantage of the fact that Indonesia is one of the world’s largest users of the Internet (Pandjaitan 2017). The People’s Republic of China (PRC) has also moved quickly since 2013, and (in fact) the development of online courses has put the PRC next to the United States in terms of the growth of users and platforms (Tang 2015).

The originators of MOOCs expected the large uptake of courses to come from the student (high school and college) market. To their surprise, the early users were significantly different. For example, Coursera’s review showed that the principal users were not students in their late teens to early 20s, but rather users in their mid-20s-50s, and 80% already had bachelor’s degrees or were professionals and mid-career workers. These learners were basically enrichment-learners, technical skill builders, and career-changers who needed new skills to advance their careers.

The growth in the first 3 years of MOOCs worldwide was explosive—by 2016, a total of 58 million students, with over 700 universities as partners worldwide, and 6,850 collegiate courses being offered through platforms. These spanned the globe in terms of more than 190 countries, with one-third of all enrollment being from the United States/Canada, another third from the developed economies (such as Europe), and another third from emerging economies (Brazil, PRC, India, and countries in Southeast Asia).

The Pivot of Online Learning to Specialization, Digital Credentialing, and Accreditation

Between 2012 and 2015, online learning dramatically increased, driven by large exponential growth in Coursera, EdX, and other platforms, and was thus initially heralded as a revolution in access to tertiary education. However, early results indicate that, while enrollment was very high, the percentage of those who complete the courses was less than 15%, and the initial assessment of the users of Coursera shows that users were not college-age students but mostly those who already had bachelor's degrees (Chen et al. 2015).

As a consequence, the main platform providers started to pivot around 2014 and 2015 and repackaged their offerings. Courses began to be offered on a continuous basis and were not defined by schedule dates and thus were more spread through the calendar year. The bunching of students/users into large numbers is now more spread out throughout the year, with lesser number of users per course cohort. In response to market demand, online providers began to offer new kinds of specializations in addition to random courses. Each specialization usually comprises a collection of three or more courses packaged as a specialization, a microdegree, or a nanodegree in specialized skills demanded by new occupations and jobs in the labor market.

Coursera, for instance, offers a specialization in data science, with 10 courses bundled and delivered in partnership with professors from Johns Hopkins University; a specialization in project management principles with the University of California, Irvine; a 6-course specialization in digital marketing through the University of Illinois at Urbana-Champagne; and a 6-course specialization in full-stack web development with the Hong Kong University of Science and Technology. At completion, the users are awarded a specialization certificate for these programs for a fee. And, in keeping with these trends, these new forms of skills acquired online are now codified as digital badges which have become part of an individual learner's portfolio which employers recognize. Consequently, the individual learners credentials in the form of digital badges are appearing in individual LinkedIn profiles. More recently, these digital credentials have earned increase in trust by employers, the government, and the public arising from new digitalization using blockchain where issuers are transparently identified and cryptographically protected.

The EdX platform similarly offered a micromasters program with a collection of courses organized as a specialized job stream, and credit-eligible courses recognized by industry. Examples of these include a micromasters program in cybersecurity with the Rochester Institute of Technology, a supply chain management micromasters credential with MIT, and an international law micromasters program with Catholic University of Louvain in Belgium.

Udacity was among the first platforms to pivot toward specializations or job skill streams in collaboration with large private industry, beginning with the technology firms in Silicon Valley.

Rapid Growth of e-Learning Markets and Investments Worldwide

The emergence of Massive Open Online Courses (MOOCs) was accompanied by the rise of the generic e-learning market and has grown even more dramatically over the last 10 years. The e-learning market caters to various end-users—including skills development and self-improvement markets--which target the corporate learning market, consumer skills market, and the education market. Thus, new content platforms such as Udemy, and other key players including LinkedIn Learning, Pearson Education, Macmillan Learning, and Skillsoft, have been growing at a rapid pace.

Microlearning: Just-In-Time Knowledge and Explosion of Mobile Learning
The latest trend in e-learning is microlearning which is a bite-sized learning nugget intended to meet a specific learning outcome in 4–7 min or shorter to encourage course completion and promote better retention of the learning material. Ideal for learners with low attention span, it is easily accessible via mobile devices, providing just-in-time performance support.

Microlearning arose from the rapid rate of technological innovations, which required an adaptive workforce who can learn quickly and on the go. Studies at Deloitte (2016) indicate that 70% of modern learners rely on search engines like Google, and thus the workforce today, especially the millennials, are naturally learning online already for their job or school needs. Mobile microlearning platforms such as Gnowbe, Axonify, Grovo and others have short courses packaged to address specific just-in-time knowledge needs, have become the trend.

Gerudio (Australia/United States) supports coding boot camps in Australia, India, the Philippines, and the United States and creates software development projects using blockchain technology (Raman Nambiar 2017). A coding boot camp is a super-intensive style of learning programming and is highly project based. Students learn from people coming out from industry and acting as facilitators, and thus students learn the latest technology available.

Use of Online Learning Technologies at the Kindergarten to Grade 12 (K–12) School Level
At the school level (K–12) online learning technologies have been successfully piloted and implemented in many parts of Asia. For instance, to increase student motivation and break the cycle of rote learning, BYJU in India developed a personalized learning app for K–12 students. Studies show that students achieve greater academic progress in schools using personalized learning strategies. An estimated 16 million students are learning this way. To verify content quality, experts in their respective fields collaborated to structure the pedagogy of each subject. Gamified content is used to promote student engagement and encourage increased hours of learning. Increased student engagement has also encouraged greater student efforts, which leads to more hours of learning using the app.

In mathematics learning, *MathCloud's* neural adaptive learning programs are based on an understanding of how the brain recognizes and processes information. Studies have revealed positive impacts in student achievement in ADB's pilot programs.[2] In Sri Lanka, student achievement improved by 0.4 standard deviation, and reinforced learning using Khan Academy video tutorials helped increase students' standardized test scores by 0.21 standard deviation above the mean.

Deploying Online Learning to Offline Communities
An estimated 4.5 billion people are currently left out, having no access to the Internet. This also means no access to learning opportunities or access to the benefits

[2]Asian Development Bank. Completion Report. Learning from e-learning: Testing Intelligent Learning Systems in South Asian Countries 2018.

of a thriving digital economy. Learning Equality was created in 2012 as a social impact initiative, committed to digitally bridging the gap in education by providing open educational resources around the globe through low-bandwidth and offline channels.[3] Evaluation studies have revealed positive outcomes in student learning in low-resource communities where Learning Equality's technology was used. In Guatemala, an independent evaluation found that student mathematics performance using Khan Academy content increased an average of 10 points in math scores compared with the traditional program.[4]

Implications for Asia and the Pacific

Rather than replacing existing bricks and mortar classrooms, e-learning has so far been used to supplement and enhance current learning and education even in the countries where these started, notably in the United States and Europe. For some of the younger workers, especially the millennial generation (21–34 years old), e-learning has become the modality of choice to improve their careers. There are a lot more ways to go before a wider penetration of e-learning could be realistically achieved in education in Asia and the Pacific especially for the K–12 and higher education segments.

Moving forward, some pathways are discussed below, to leverage available technologies to achieve improved learning outcomes, gain better skills, and support the overall economic development of the region.

Multilateral and ADB Support for e-Learning Initiatives in Asia and the Pacific

Countries in the Asian Region like the PRC, India, Indonesia, the Republic of Korea, and the Philippines have mainstreamed or incorporated e-learning in their programs and curricula. International multilateral support for these initiatives is critical in initiating wider use of e-learning in schools. For example, ADB can include components in its current and future portfolio of education and skills development projects to test the new methods. The initiation of new e-learning approaches can be scaled up after successful pilot testing, with adequate technical support and resources provided to help schools and administrators.

Addressing the Broadband Issue to Reach More e-Learning Users

A major constraint in developing countries is poor connectivity and the cost of data. Online learning uses video and interactive programming, and this requires more bandwidth, which means additional cost to the users. The increased use of wi-fi technology and making it more available, especially in schools and other strategic locations, can help alleviate the problem.

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[3] https://www.vodafone.com/content/dam/vodafone/connectededucation/vodafone_connected_education.pdf.

[4] https://learningequality.org/media/FUNSEPA_Final_Evaluation_Report_27May2016.pdf.

Piloting and Scaling-Up Promising Interventions: Understanding Impacts in Various Country Environments
As a new technology, there is a need to understand the impact of specific e-learning interventions before launching these into a wider program. The way these programs impact on learning varies dramatically from one environment to the next, largely because there are program requisites that are addressed differently across countries. Countries in the region need to carry out evaluations through the help of international assistance from such as ADB and bilateral partner agencies.

Localizing e-Learning Courses
Context-and country-specific adaptation of courses is essential to create locally relevant content. IndonesiaX.org is a platform for e-learning initiated in Jakarta, and has localized courses for the Indonesian environment. This is one avenue for responding to national need without necessarily using courses originating from the developed world. It was initiated in Indonesia using Indonesian instructors and loaded unto the EdX online platform. Its initial success in generating interest within the country will provide new avenues to begin e-learning, which was found to be helpful in gaining educational access, particularly for geographically dispersed countries and island economies. Several countries such as the PRC, India, Pakistan, and the Philippines have begun organizing e-learning platforms, which are gaining traction. In the Philippines, for example, online programs were developed that improve Technical and Vocational Education and Training (TVET) skills and address the needs of the high-demand business process outsourcing market, which is one of the growing sectors in the economy.

Innovations in e-learning and blended learning provide new opportunities for the Asia and Pacific region as countries modernize their education, training, and skills development sectors. There is an unmistakable need to incorporate these new technologies in the drive for universal access, and in enhancing the quality and relevance of education and training in these countries.

Link to presentation material: https://events.development.asia/materials/20160919/overview-innovations-elearning-and-blended-learning.

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Chapter 24
Bringing TVET up to Speed: Regional Overview of ICT-Enhanced Practices in TVET

Margarita Pavlova

Information and Communications Technology (ICT) has become a megatrend, and is one of the transformative global forces that define the future of the world, with a far-reaching impact in different fields (including education); and it leads social-political, economic processes and demographic trends (Frost & Sullivan 2011; OECD 2013; PwC 2014). The reality defined by this megatrend includes increasing access to information, a dramatic growth in information itself, and a diversity of applications and languages in use. Research studies show that Internet activity and the use of mobile broadband have been rising exponentially worldwide (e.g., OECD 2011, 2013).

Based on an Organisation for Economic Co-operation and Development (OECD) study (OECD 2013), ICT is used as a generic skill by everyone in elementary occupations to managerial positions. As a result, it should be included as a generic foundation skill in training programs. As a specialization, ICT is expected to be a leading industry by 2020 (Frost & Sullivan 2011); computer equipment operators, industrial robot controllers, and multimedia developers will be in great demand. Top emerging industries, such as virtual commerce and cloud computing, will require higher level ICT skills.

In Technical and Vocational Education and Training (TVET), ICT can be a generic skill, a specialization, a pedagogical tool, an access solution, and a management tool.[1] Countries recognized this when they accepted the Qingdao Declaration in May 2015 (UNESCO 2015), wherein approaches to ICT were identified as well as how these can directly assist the unleashing of the full potential of ICT in terms of improving the quality of TVET. In the Declaration, ICT is envisioned as a catalyst that will

[1] Herd and Richardson (2015).

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strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more efficient service provision to achieve the sustainable development goal of Inclusive and Equitable Quality Education and Lifelong Learning by 2030.

Issues and Challenges

While ICT has immense potential to drive competitiveness and economic growth, it also comes with challenges. Rapid ICT advancements will inevitably reshape the needs of economies, especially those that are primarily knowledge-based. This would require increased investment in TVET systems, and the promotion of lifelong learning to meet an increased demand for retooling, skills upgrading, and/or continuing professional development. In this regard, education and training systems are compelled to be flexible enough to adjust and improve approaches currently used to deliver and organize TVET and the emphasis we put on the development of particular skills.

However, some Asian countries continue to encounter problems with respect to access to electricity, computers, Internet connectivity, and the capacity of teachers to integrate ICT in teaching (UNESCO UIS 2014). There are also insufficient data on ICT infrastructure in most countries that may be needed to address these challenges on a national or regional scale. If these accessibility issues are not suitably addressed by policymakers, ICT may cause a digital divide or widen the gap between the rich and poor (ITU 2015). Furthermore, while increased connectivity presents many opportunities, it also involves challenges in terms of developing the critical capacity of students to use ICT for learning, and in ensuring the quality and accuracy of information available on the web.

According to Subrahmanyam (2015), there has been positive but uneven progress in the Asia and Pacific region in terms of integrating ICT in TVET.[2] More private sector partners have been engaged in TVET planning and delivery. Emphasis on fostering innovation-related skills in TVET curriculum development has also been pursued. Training that integrates digital methods and technologies in curricula has been increasingly offered as well. Moreover, numerous countries have also shown notable promise in (i) implementing ICT-related TVET programs (Bhutan, Lao People's Democratic Republic, Palau, Tuvalu), (ii) institutionalizing policies to promote ICT in TVET (Indonesia, Iran, New Zealand, Thailand), (iii) using ICT to improve TVET access and equity (Fiji, India, the Philippines), and (iv) utilizing ICT as a self-help tool for continual skills upgrading (Singapore).[3]

Nonetheless, countries in the Asia and Pacific region continue to encounter obstacles such as limited finance for TVET (especially in South Asia and the Pacific), a lack of trained staff with relevant knowledge and expertise, and inadequate information

[2] Subrahmanyam (2015).

[3] *Ibid*.

technology and other technology-related infrastructure (especially in the Pacific).[4] A digital divide in the use of ICT in TVET, and differences in skills sets among countries, have also been observed. Scaling up the use of ICT-enhanced innovative pedagogies remains a challenge.

Proposed Solutions[5]

Forging beneficial partnerships among stakeholders, increasing investment, and strengthening governance in TVET may overcome obstacles that hinder the enhancement of TVET systems. Broader and closer partnerships need to be established with the private sector to ensure relevance of TVET and boost its quality. Also, there may be a need to increase the inclusion of young people and parents in both TVET systems and processes to ensure their effectiveness and improve education outcomes.

Countries also need to bolster TVET's role in the national agenda, particularly in the areas of social change (promoting intergenerational equity and inclusion), economic development (inclusive growth), adapting to change (lifelong learning through TVET), and innovation (leveraging the potential of ICT through TVET). At the regional level, the recognition of qualifications (including the validation of formal, informal and nonformal learning) also needs to be supported to safeguard pathways to education and employment in the context of regional integration. The examples below illustrate successful cases of ICT based learning in TVET that have been facilitated by companies (ICT learning product providers). They present different models developed through partnerships that focus on quality, low cost, and accessibility.

Examples of Good Practices

Funzi

Funzi is a free mobile app designed by a Finnish start-up company that provides accessible and high-quality learning via a mobile device. Through mobile learning, it seeks to create opportunities for people who are not employed, not in university, and who do not have access to learning tools and quality education, but are willing to learn. Funzi courses focus on the areas of livelihood, health and wellness, migration, and global citizenship.

Aside from being free, the advantages of Funzi are its accessibility and cost-efficiency, because it may be easily used on a device most people already have—a mobile phone. For example, Funzi has been used in Syria and Nigeria to deliver learning and enhance employability at a cost of $10 for each job. In South Africa, Funzi helped deliver courses on entrepreneurship. As long as the phone has a browser,

[4]Pavlova (2015).

[5]Subrahmanyam 2015. *op. cit*.

Funzi is able to facilitate learning in three ways: mobile learning, blended learning, and the training of trainers.

As it adopts a Software as a Service model, *Funzi does not produce content*. Instead, it forges partnerships with entities that produce learning content themselves. It seeks a content partner, a local partner who knows the community, and a commercial partner with mutual interests to facilitate learning within that community (e.g., nongovernment organizations, public organizations, or global brands with a social mission).[6] Then Funzi transforms the learning content to become fun, engaging, and practical. Its services include *course production from existing materials*, course delivery, and targeted user acquisition through digital marketing, as well as real-time reporting and certification of the newly acquired skills.[7] Given that Funzi thrives in such partnerships, the company strives to collaborate with key stakeholders in every area in which it operates.

In Africa, the company is running the largest mobile entrepreneurship course, which started out with localized content for Swahili-speaking areas (i.e., Kenya, Rwanda, and Tanzania). Funzi also runs an entrepreneurial training program in community centers (with 230 individuals and 32 company participants) in South Africa. In Europe, Funzi provides mobile services to help asylum seekers in the European Union. Its learning package, "About Finland," consists of five courses relating to Finland, language and communication skills, everyday life, and legal rights. Further, Funzi has an Arabic version of its African entrepreneurship course that is used for integration services for immigrants who speak Arabic.[8]

Funzi has a simple, scalable, and verified business model, which can be launched in 1–4 weeks (from project start to service launch). It has been successful in providing access to learning, as evidenced by 5.5 million all-time users from Africa, Asia, and the Middle East. Twenty-five percent of Funzi's active users return the next day, and 40% return the next month. It also has 20–40% completion rates in weekly topics. It is notable that 95% of feedback sent by users on Funzi is positive.

Coursera

Coursera is a global leader in online education, which envisions a world where anyone, anywhere can transform his or her life by accessing the world's best learning experience. It offers more than 2,500 courses that come from over 160 partner university organizations. Coursera has more than 28 million learners around the world taking over 2,500 courses.

Using a combination of market and learner data, content vertical expertise, and skill mapping models, Coursera creates learning programs that transform skills training at scale. As a platform, it has three different parts: the consumer part, wherein anyone can access Coursera and learn; an enterprise part, wherein Coursera works with governments in upskilling employees and companies; and a degree section, wherein Coursera works in the higher education market for a fee.

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[6] Pohjavirta (2018).

[7] Funzi. Services. Retrieved from https://www.funzi.fi/services.

[8] Pohjavirta (2018).

Some of the largest companies in the world (such as AT&T) are using Coursera to upskill their employees through high-quality learning. Coursera has also embarked on helping countries through its "Coursera for Government and Organizations" initiative, which focuses on deep skilling to provide critical competencies among government officials and partners in national-scale training of citizens in job-relevant skills across countries. For instance, Singapore Civil Service College (CSC), which trains government officials across Singaporean ministries, collaborated with Coursera in curating a curriculum of data science specializations, and in developing and implementing a cohort training model. With more than 600 officials trained each year and a 78% course completion rate, Coursera has made an incredible impact for CSC. The Singaporean Government also partnered with Coursera for its SkillsFuture[9] program, wherein 607 courses and 82 specialization tracks of the platform may be accessed by every citizen (age 25 + and above) through a S$500 subsidy from the government.

In Egypt, Coursera collaborated with the government and a third party organization in implementing the Next Technology Leaders (NTL) program, which prepares young, qualified Egyptian preprofessionals for jobs in technology and entrepreneurship. Aside from being one of NTL's partners in providing up-to-date massive open online courses (MOOCs), Coursera helped develop a blended learning experience. NTL notably yielded a 92% completion rate among its learners.

In the Philippines, Coursera partnered with the Department of Science and Technology to offer courses on emerging field specializations, such as data science and artificial intelligence. Other partner countries/governments are Kazakhstan, Malaysia, Mongolia, Pakistan, and United States.[10]

Coursera has notably shown a positive impact on its users, including a new functionality, and/or increased confidence.

Extramarks Education

Extramarks is an educational technology provider that operates in Southeast Asia, Africa, the Middle East, and India, where there are numerous challenges such as connectivity, affordability, teacher/student ratio, and quality of classrooms. By tailoring instruction to each student's unique needs and interests, while safeguarding sound pedagogy, Extramarks has brought about a fundamental shift to learning through the intelligent adaptive learning approach.[11] This learning model utilizes technology to facilitate comprehension and retention, based on the unique needs of the learner. It envisions a solution to what is happening in the classroom and in any learning space. Connectivity helps Extramarks achieve good results at low cost—$10 per learner a year.

The goal of Extramarks is to produce a cognitive model through data analysis and to provide personalized learning to every child. The model looks into the strengths

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[9] SkillsFuture is a national movement that provides Singaporeans with opportunities to develop their fullest potential throughout life, regardless of their starting points.

[10] Taber, R. 2017, January 22. Announcing Coursera for Government & Nonprofits. Retrieved from Coursera Website: https://blog.coursera.org/announcing-coursera-governments-nonprofits/.

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of the learner and considers the capability of the teacher in terms of providing the required and appropriate learning intervention. Through user information that comes in, teachers are able to holistically assess their classes and make small changes in the classroom. At the same time, students will get some intelligent feedback on their learning status that enables them to adapt their natural style of learning. Extramarks is using data from some 9 million learners across the world and about 9,000 schools to continuously enhance the model and produce better results.

Nonetheless, remain a big challenge for the Extramarks model. In an era of mobility and global citizenship, there is an emerging need to capture and easily share such data as the number of hours spent by users, how long it takes to answer a question, as well as capturing data about students who transfer for the purposes of enhancing learning systems. Extramarks is strongly advocating for some sort of standardization for data collection across the world so this outcome becomes possible.

Application of These to Promote Good Practices

The three successful ICT learning models discussed above have thrived because they maintain strong and beneficial partnerships with government, academe, and industry. Their cost-efficiency and ease of access have also made their business models scalable. Ultimately, these practices have resulted in impressive learning outcomes, because they all focus on enhancing and innovating pedagogical methods, while also addressing the needs of their target learners (based on context, culture, language, etc.). A strong focus on the improved livelihood of learners is also an important aspect of these models.

The operation of these particular innovative companies, which effectively develop ICT resources and deliver skills training in different settings, is extremely valuable. However, in addition, a coherent and systematic approach toward integrating ICT in TVET is essential. Key success factors for this integration are enabling national policy and/or support from government; effective ICT infrastructure and high-speed Internet; effective and accessible ICT resources, including software and pedagogy; commitment from institutional managers, individuals, and teachers; professional development for teachers; support of “champions” or advocates; and research on ICT practices (Pavlova 2018).

Implications for the Future

Rapid technological developments, and the Fourth Industrial Revolution, are expected to profoundly alter the needs of the global economy, especially in the skills and employment landscape. As a result, education and training systems are under pressure to prepare learners for the future world of work and to ensure that they have the necessary skills. ICT-enhanced learning provides an opportunity to develop a whole spectrum of skills from very specialized high-level skills through such courses as artificial intelligence, data science, technology, and entrepreneurship, to life skills and employability skills for marginalized groups, and to generic skills such as twenty-first century skills (a combination of foundational literacies, competencies, and character qualities), as well as flexibility and the capacity to innovate, which are essential at every level. Aside from the need to prepare young people for employment, ICT-based learning can also meet the demand for adult education, retooling, and/or upskilling—in which the TVET sector plays a very critical role.

Conclusion

As ICT-related developments are a megatrend in the Asia and Pacific region, there is an important need to make sure TVET does not lag behind. When developing practices and policies on integrating ICT in TVET, countries need to consider labor market and social orientations, as well as accessibility issues, to prevent a potential digital divide. Stakeholders also need to be mindful of the interface between technologies and pedagogies, as good practices show that cost-efficiency matters (accessibility of resources, quality of learning content, and ease of use for both learners and teachers) are key factors in achieving successful and improved education outcomes for all groups of learners. Finally, maximizing opportunities from government-academe-industry linkages is critical for the establishment of relevant and effective ICT-driven TVET interventions.

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Chapter 25
Funzi Uses the Power of Mobile to Give Everyone Cost-Effective Access to Quality Learning

Aape Pohjavirta

Much of what is being discussed and written about in education today is often comes across as complicated and difficult to understand. Yet the task ahead is simple: how to make everyone on the planet learn skills that give them a sustainable livelihood and a happy life without going beyond the available resource limits of our planet. And yet, as simple as the task at hand may seem to be, it is the biggest challenge humanity has ever faced: how to change the behavior of billions of individuals in just a couple of decades if the existing education system during the few thousand years it has existed has not even succeeded in teaching everyone to read?

This article examines some of the causes of the challenges that face us today. It gives examples why existing methods will not help us fast enough, and paints a clear way forward that combines the best sides of existing educational content and systems, and new technologies.

The future can be bright because for the first time in the history of humanity it is possible to give everyone access to quality learning at a fraction of the cost of traditional education. It is possible to give everyone access to the life of their dreams. This article is a true story about a better, happy tomorrow for our planet. And you, dear reader, are the main character in that story, because your actions will decide if we reach Agenda 2030 or not.

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How Do We Teach for a World that Never Has Been?

Today's education systems were born to serve the needs of the societies, traditions, and rulers in which they are located. In the past, the part of the population that was educated was small, and the primary task was to transmit skills and knowledge to the next generation, making certain that nothing was "lost in translation." Different types of education systems were developed. The religions developed their own methods to educate their servants in dedicated locations such as monasteries; craftsmen in Europe developed a mentor–apprenticeship model, managed by guilds, that enabled the standardized training of more professional craftsmen to serve the needs of the growing population in the cities. However, the majority of the population remained completely uneducated. The Industrial Revolution changed that.

To be able to take advantage of the full potential of the enormous economic growth enabled by the Industrial Revolution, a new component was required: trained humans. The machines that fueled the growth of economies everywhere had to be operated by humans who could read and understand instructions. The solution for that was to build factories for education: an education system that reached as large a part of the population as possible and delivered to them the skills required to lead their daily lives, operate machines, and follow rules. While the majority of the learners exiting the education system served only a certain purpose such as operating a machine, those who were more capable received a higher level of education, becoming responsible for not only maintaining but also developing the system.

The global education system of today, with its Programme for International Student Assessment (PISA) tests and Ivy League universities, is as good as such an education system will ever become. It is like "Magnificent Mallard," the fastest steam locomotive in the world—impressive and wonderful, but it belongs to the past. The ubiquity of digital software and mobile technologies have created a new set of rules, a new world order that is unlike anything we have seen before. To equip humanity with the skills needed to succeed in that new world requires a total transformation of the education system.

What is Transformation? and How Fast Is It?

Transformation is one of the many buzzwords we are so used to seeing everywhere that we oftentimes forget what it actually means. I mean, it is easy to say that the global education system must be transformed and then sit down and wait for something to happen. But what does "transformation" actually mean?

According to the Oxford Dictionary of Biology (and I choose this meaning as it must be the closest because education must be a living object and not a fixed mathematical function), it means: "A metamorphosis during the life cycle of an animal," with metamorphosis being "A change of the form or nature of a thing or person into a completely different one."

So now we know that we have about 15 years to create a completely different education system.[1]

The Power of Digital Technology

Most of the industries in the world have undergone a transformation during the last few decades. That new world order, driven by digital software, automation, and mobile technologies, has changed how the world works. Old structures have been forgotten, and new, better ones have emerged. The new world is obeying the mantra of "don't make things better, make better things."

Digitalization had a global impact since the late 1980s. The music industry may be taken as an example (CDs, DVDs, iPods), and finally, streaming services changed the consumer-facing part of the industry. And digitalization also had a great impact on the processes within the industry. So, digitalization was driven by both consumers and the industry itself: Everything became more efficient and enjoyable, the quality became higher, and music became more accessible. Digital was good for everyone! First, step by step, the production of music became 100% digital. Then the playlists that the radio stations used were created, distributed, and delivered digitally. Then came iPods, Spotify, and finally today, in 2019, practically the whole music industry is digital.

The same applies to the movie industry. And, all other types of media: television, radio, newspapers—everything is digital. In all of these industries, digitalization has been driven by both the industry players as well as consumers.

The Weakness of Digital Approaches in Education

The annual global spending on education is more than six trillion dollars. That is an insane amount of money. And the craziest thing about that money is how little is spent on (i) Transformation and (ii) Digital. Industries that are undergoing a transformation typically spend 10–15% of their expenditure on research and development in order to remain competitive. The education sector does not. Nor does it invest heavily in digital. And why is that?

One of the biggest reasons for the low level of digitalization in education is the lack of private sector activities and initiatives. The digital development in other industries was accelerated, and in many cases driven, by global industry players who created their own technologies privately while jointly creating technical standards with their competitors. The education industry does not have such global drivers, because no

[1]The author used the duration of a learner's studies from start to finish as the life cycle of an animal: ~15 years.

global players exist in the industry. Even the biggest players are regional players. And that is not big enough to drive a global transformation.

The Mobile Revolution

The fastest and most impactful of all digital revolutions has been the mobile revolution—starting in the 1980s with the first portable devices, becoming digital in the 1990s, and then becoming a platform for services—first with SMS, then WAP, MMS, mobile apps, and finally the mobile Internet. Today mobile *is* the Internet. Tomorrow everything will be mobile.

One of the primary drivers of the mobile revolution is trust. You trust your device. You trust the services you use. Science shows that if you do not trust a service you do not use it. Period. Science also shows that your behavior on your mobile, your trusted device, is driven by the 16 basic desires Steven Reiss identified. This means that, in order for a user to use and continue using mobile services, the services need to address the intrinsic motivation of the users.

Mobile games and music services are great examples of mobile services that have succeeded in attracting users and created completely new behavioral patterns: Once you start using Spotify, going back to listening only to the records you have bought in the past sounds like a stupid idea—as stupid as for a city to choose steam locomotives as their primary method of public transport.

The Future of Learning is in Your Pocket

Many of the technologies that led to the mobile revolution were invented in Finland, where respect for education and learning is deeply embedded in Finnish society (Ruohotie and Maclean 2006). That is part of the background to why a few years ago a group of mobile industry veterans founded a company to develop a mobile service that would give everyone with mobile device access to quality learning.

The group's goal was to create a service that is proven to produce good learning outcomes among all learner types with any kind of content. And that service would have to work on all connected devices, not only new smartphones but also low tech. And the service would need to be scalable enough to serve the whole world.

That is what Funzi is today. It is a mobile service that combines a pedagogy proven to deliver great learning outcomes with a technology that runs on billions of mobile devices smoothly, even on slow networks, without installing any apps.

Yes, It Does Work

In the fifteenth century, after the invention of the printing press, the newly emerged printing industry spent all of its energy for decades doing one thing only: printing artifacts called incunables, only to prove to the world that the new technology could produce exactly the same kind of artifacts as craftsmen already did manually. It took more than 50 years for the world to understand that the strength of the printing press was in the things that craftsmen could not do.

Mobile learning as a term was coined by Alan Kay in the late 1960s. In 1999, John Traxler became the world's first professor of mobile learning, and in the past few decades, thousands of small-scale pilots and projects have been realized. They are the incunables of mobile learning, created to prove that mobile can produce the same results as traditional education.

But for the global education industry to transform itself over the next 15 years, that is not what the world needs; the world needs something better, new. The way the world learns needs to be reinvented. And that is what Funzi does.

The typical reaction to Funzi's claims of impact and scalability is a shake of the head. Industry experts and decision-makers simply do not believe that this could be true. They have yet to comprehend that mobile does everything the classic media does, and much more—not just in communication, music, or games but also in learning.

Mobile enables us, humans, to learn whatever we want, wherever and whenever we want. Mobile enables our learning to merge with the context, to become important for ourselves and our societies. Mobile gives the wings of our minds. Mobile learning gives everyone an equal opportunity to learn. It is the greatest equalizer in the history of humanity. And it is our last chance to maintain humane life on our planet, to reach the Sustainable Development Goals (SDGs) before it is too late.

I dare to state this because we can prove that Funzi works. It is loved by its users and it produces good sustainable learning outcomes. We do not want to make empty claims, and that is why we have validated our claim with multiple data sets.

The easy method to verify this is by looking at the usage patterns of the service. The great retention numbers show that users love the service and come back: More than 58% of active users return even in the second month. The average length of the sessions—almost 12 min—proves that the users actually study, and finally, the net promoter score from our feedback is >90.

In addition to data analysis we conduct active user research: The feedback for Funzi services typically lies between very good and excellent. And to put this all into a globally valid perspective, an academic entity has researched the impact of Funzi (by the United Nations Development Programme in Syria) using the Kirkpatrick model, wherein the answers clearly indicate that respondents found the courses relevant and applicable, expectations were clear, and they have already started seeing positive results from taking the course.

The respondents' answers also indicate that the course was very convenient for them to take on mobile, and more than half the respondents indicated that taking the courses positively impacted mission accomplishment and their personal confidence.

Only 4% of respondents in Course 1 and <2% in Course 2 believed that they would not be able to apply what they learned.

These results from a crisis- and war-torn Syria prove that Funzi mobile learning is not an incunable. It is a service with the potential to transform how the world learns—today.

Practical Examples

Case 1: Viet Nam

In Viet Nam, we are currently working with an education and training company from a leading Vietnamese conglomerate that has many subsidiary companies focusing on real estate development, retail, and services ranging from healthcare to education.

Our customer was looking for an effective digital learning solution to deliver science, technology, engineering, and mathematics (STEM) and entrepreneurship education to high school students. With the aim of reaching 500,000 students by 2020, traditional education methods would be costly and time-consuming. Mobile is an integral part of our everyday lives, and thus an excellent channel for learning. With Funzi mobile learning service, teachers can be certain that the students have learned the content, monitor their progress in real time, use an online reporting dashboard, as well as easily identify the topics students find most challenging to go through in more depth in class. Funzi also works as an online "library" that students can refer to, and access time and time again.

The initial pilot round is targeting 800 high school students from the top 20 schools around Viet Nam. The courses were launched in early March 2019 with the goal to help students acquire the skills they need to tackle pressing environmental challenges.

Case 2: Uganda

The program on entrepreneurship training for women in information and communications technology (ICT) is sponsored by the Netherlands Trust Fund IV (NTF IV) Uganda. It is implemented by the International Trade Centre (ITC) with the aim of creating a supportive environment for tech start-ups and enterprises in Uganda. ITC has coordinated the implementation and operation of the program hand-in-hand with its partner on-site, Zimba Women, an association aiming at empowering Ugandan women through technology.

Finding new and innovative tools for hubs training women entrepreneurs in Uganda and elsewhere in Africa, specifically women in ICT, is a major challenge. The project utilized the Funzi Founder 101 Hub, a blended learning program that consists of participants studying a mobile course and attending on-site sessions facilitated by Zimba Women. During the 6-week program, each week participants studied one-course module as mobile learning, after which they attended an on-site training session that deepened the learning. Through practical tasks and activities, the onsite sessions took participants further in improving their own business ideas or their already existing businesses. The program focused on building entrepreneurial skills and a growth mindset in order to be a successful entrepreneur.

Seventy-one percent of those who started the online course completed the program. The results and participant feedback show that blended learning is convenient and effective: a mobile course and on-site sessions are a great combination for bite-sized learning and the practical application of entrepreneurial skills and development of a growth mindset. The on-site component also provides support and peer learning, as well as strengthening participants' networks. Of the participants completing the program, 76% gave feedback, 74% of questionnaire respondents considered that the program absolutely made them better equipped to start or grow their business, and an additional 16% considered it likely.

Case 3: Iraq

The Funzi Founder 101 course has been used in Iraq to promote entrepreneurship as a career choice. The use of mobiles and mobile technologies can drive the creation of entrepreneurial opportunities and a culture of innovation. Between June 2016 and June 2017, about 3.5 million Iraqis became aware of the Funzi Founder 101. About 350,000 visited the Funzi service and about 40,000 Iraqis became active Funzi learners (of whom roughly 50% were female).

Conclusion

There is no doubt that technological developments have transformed the world, and the way in which people learn, work, and utilize their leisure time. Coupled with the characteristics of the Fourth Industrial Revolution, technological developments have resulted in a paradigm shift in human societies. This is true for all societies and economies regardless of whether they are developed, developing, or in transition.

However, regrettably, education and schooling systems have generally lagged well behind in adequately harnessing the new information and communication technologies. This is a matter of concern that needs to be corrected in order to help improve the quality, relevance, and geographical reach of teaching and learning.

Funzi, a company from Finland, provides an excellent role model for other private sector companies as to how good learning access and outcomes can be achieved for anyone who has access to mobile devices.

Links to the presentation materials: https://events.development.asia/materials/20171214/technology-and-elearning. https://events.development.asia/materials/20171214/funzi-mobile-learning-everyone. https://events.development.asia/materials/20171214/funzi-mobile-learning-everyone.

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Chapter 26
Udemy: Blended and e-Learning for Transforming Teaching and Learning

Richard Qiu

At *Udemy*, we are reimagining what it means to be a student and what it means to be a teacher. An online marketplace is an entirely new approach to lifelong learning, one that lets the enormous pool of everyday experts produce entirely new content to meet the demands of that huge pool of potential students around the world.

Rather than relying on the way we have always done things, this approach actually draws on the shifting forces in our world—advances in technology, improving bandwidth, commerce across borders, a cultural embrace of sharing, and an acknowledgment that education needs to evolve to keep up with the demands of our economy—to enable the upward mobility that people are searching for.

The best teachers have the power to change lives. Reflecting on most impactful educators in one's own life, the list likely includes classroom teachers, coaches, mentors, managers, and friends. To unleash the power of online learning, we need to open teaching to all cultures and localized contexts.

Issues and Challenges: The Potential for Impact

At the same time that unemployment is high, across various geographies and industries, many companies have positions for which they are unable to find qualified applicants. In the People's Republic of China, 74% of employers have said that they have positions they cannot fill. In Brazil, that number is 63%, and in the Russian Federation, it is 57%. Youth unemployment in all of these countries is above 15%. The problem is not entirely about job creation but also about job preparedness. Even once employed, graduates and employers have learned the hard way that a degree

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does not mean job preparedness. Only 42% of employers believed that new graduates are ready for work, while 72% of educational institutions felt their students were entering the workforce prepared (Herzog 2014).

Compounding this problem is the fact that, because industries are changing rapidly as technology drives them, workers must continue training to stay relevant. As a hiring specialist put it in a recent Thomas Friedman article, "In the new economy, 'you have to prove yourself. A degree document is no longer a proxy for the competency employers need.' Too many of the 'skills you need in the workplace today are not being taught by colleges'" (Friedman 2013). To put this in perspective, in the United States in 1900 only 17% of all jobs required knowledge workers, whereas more than 60% do today. As developing economies mature, the needs for training and education change.

The pace of change in the workplace shows no signs of abating. In fact, studies show that 65% of today's grade-school children may end up doing work that has not even been invented yet. That is a little terrifying, especially if the only skills you have are based on the classes you signed up for at age 18. The skills you learn in university may be enough to get your first job, maybe even your second job. But they will not be enough to keep getting better jobs for 40-plus years.

Imagine that you graduated from university 10 years ago with a degree in marketing. Today, you might be competing against millennial for roles that require running Facebook ads or advertising on Instagram, things that did not even exist 10 years ago. But as we all know, "I never learned that" will not get you a promotion or a new job. It will not even help you keep the one you have. Gone are the days when you got a job straight out of university and spent decades working your way up through the ranks at the same employer. Last year, the median job tenure for workers aged 20–24 was shorter than 16 months. For those aged 25–34, it was 3 years, according to the United States Bureau of Labor Statistics, still far short of the 5.5-year median tenure for all workers aged 25 and older.

What happens when, a couple of years into our careers, we discover we need additional skills to help with the job we actually have, or the job we are trying to get? We do not have a time machine to help us go back and take the right courses in university, assuming those courses even existed back then.

It is not like it is easy to go back to university; that is a huge, expensive investment. For most people, it is also not what they need. They need media training, or experience building web pages, or whatever the equivalent focused-but-incredibly-important skill is for their job.

Proposed Solutions

If online learning can have a real impact on significant global issues of unemployment and workforce development, the future must be one in which courses teach what matters at a local level. With such diversity in demographics and driving industries, content must be responsive to individual countries' challenges.

To be clear, this need to train workers for the specific localized industry is not an unrecognized need: Training centers and workforce development programs exist around the world. However, the traditional train-the-trainer models are reliant upon costly in-person seminars, limited by the number of instructors, capacity, cost, and student's ability to travel. The potential impact of online learning is significant.

As online learning evolves, it is worth asking of online courses: Will this help someone change their income, stay in their existing job, or find a new job? Will it help them find jobs in the industries that matter to their communities? What are the endemic skillsets and critical experiences from the older working generations that should be shared with the younger members of the workforce?

Why the *Udemy Marketplace Model* Works

At *Udemy*, we believe the marketplace model has the power to transform education, because our students and instructors are both intrinsically and extrinsically motivated.

Much has been written about low course completion rates for online courses. This does not take into account the question, how many people entered the course hoping to finish? What was the motivation to enroll? Did they in fact reach their learning objectives? When we asked students who were more than halfway through a course the question, "Has Udemy helped you achieve your learning goals?", 92% of the participants answered yes.

Course engagement largely tracks the intention of enrolling. When we surveyed our students, we found that 90% came to learn practical knowledge, 30% of users surveyed came to build something (e.g., a website, an app), 25% came with the intention of developing skills to shift careers or prepare for an examination, 25% came to hone their skills, and 10% came for help with a start-up or business. This motivational data make clear what students were willing to pay for.

As a result, our students are both intrinsically and extrinsically motivated. Some take courses to get a raise, while others take courses because they had an interest in creating a website for their personal usage.

Like students, our instructors are also motivated intrinsically and extrinsically. When we surveyed our instructors, we found that most were motivated by the desire to teach and share their knowledge. But creating a course takes time and effort, and we have seen that extrinsic motivation—the prospect of being able to charge a nominal amount for their course—has also driven course creation.

How the *Udemy Marketplace* Works

With students able to solicit instructors from whom they want to learn and to rate the quality of the courses they have taken, the marketplace matures to meet student demand. For instructors, besides being able to share knowledge, teachers are directly rewarded for quality teaching. That is, teaching can become a sustainable income source for local experts if teachers want to charge.

In this new model, the Udemy learning ecosystem is sustainable. It cannot be perpetually funded—we leverage the interests of the students to drive not only content creation but also funding for teachers to teach.

Therefore, the Udemy marketplace can be a self-sustaining model for education. As students discover new courses, their instructors make money. Those instructors make new courses; others see those results and develop their own; the course list grows; more students join; and on and on until…well, there is no until. These network effects mean that this education ecosystem continues to grow across countries, subjects, languages, and a huge range of lifelong learners.

Implications for the Future

Going Global

We are tackling the global education puzzle at Udemy, guided by the notion that learning improves lives. We create an even playing field for educators, with a platform that makes it easy for anyone to create an online course and publish in a broader marketplace.

For our millions of students, we aim to make top-quality learning content from the world's experts significantly more affordable for anyone, anywhere. As of March 2017, we had 15 million students all over the world who were taking more than 45,000 courses and learning from 20,000 instructors. Courses were in over 80 languages.

Interest is Clear

Two-thirds of Udemy students are from outside the United States, and that percentage has grown rapidly since our inception over the past 6 months. These visitors are from more than 200 countries and territories. Native mobile applications for iOS and Android enable offline downloading so that reliable Internet connection does not become a prerequisite to effective learning.

Technology is not waiting for businesses and employees to keep up. There are too many skills, too many potential instructors, and too many hungry learners out there to put limits on who can teach and when and where they can do it. So, it is time to try something entirely different, to create new content that meets the demands of today's workers and comes from the people who are already ready and willing to teach it.

A marketplace for learning is how we solve the need for more skills in the workplace. This is how we give people a real way to ensure that they have the tools they need to keep moving further up and up and up, as far as their desire to learn and grow will take them.

Conclusion

If we want to keep up with constant change, we need to become lifelong learners. We all know that person—the one who learns Italian or computer coding "just for fun"—who is constantly pushing himself or herself to learn new skills. In the new economy, lifelong learning cannot just be for them anymore; it is going to be a thing that all of us have to do.

We are just beginning to tap the potential of online learning around the world. We continue to think about what will be next. What is the best way to deliver online learning to students around the world? Whether it is a video or something else, we hope to be at the forefront of that movement. We challenge ourselves to continue to innovate on the product to enable the best teachers around the world to reach hundreds of millions of students around the world.

Links to the presentation materials: https://events.development.asia/materials/20160921/udemy. https://events.development.asia/materials/20190827/udemy-government. https://events.development.asia/materials/20190827/innovative-approaches-digital-learning-0.

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Chapter 27
Mindtree's Experience in Global Learning Center

N. S. Parthasarathy

Mindtree is a *learning organization*. It is not just concerned with what we learn from usual sources, but more from unusual sources. Growth for Mindtree Minds (we do not call ourselves "employees") means "learning." How we see the world and respond to it is an indication of the way we learn (pedagogy). The idea of setting up a physical campus in the digital age did go through its fair share of debate. A brick-and-mortar campus helps codify the organizational culture. People must experience culture in the real as well as the digital world; both add to memorability. Hence, it was imperative to create an immersive learning experience for Mindtree Minds. This article highlights some of our experiences from this creative journey.

Issues and Challenges

An alarmingly large number of engineers joining the information technology (IT) industry do not come with the required skills to work in customer projects. Often their *weakness in fundamentals* is severe. This is pronounced in understanding systems; solving problems; the ability to articulate; and, most importantly, relating to real-world problems, which a standard University Engineering curriculum should attempt to cover. There are many possible and debatable reasons. Among these is that industry hires engineers from various disciplines when there is a demand and trains them in-house. Thousands of colleges mushroomed in the last decade as a response to this demand. What the colleges produce is not questioned as long as every student gets a job placement, which they have. The first job is expected to provide opportunities to close immediate learning deficits and deploy engineers to work at the earliest

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opportunity. In a way, the skills required in the industry are known and dealt with by the industry itself. Collaboration between industry and academia is practically nonexistent. Peer and parental pressures to always succeed and never fail during the 16 years of proctored examinations have almost deprived students of the excitement of learning. The quality of courseware, faculty, and the exposure deserved by students, coming from diverse economic and social backgrounds is not addressed adequately by anyone. Amid this debate, the fact remains that our workforce is not ready as individuals, professionals, and global citizens as they step into the IT industry.[1]

Proposed Solution

Mindtree's Approach

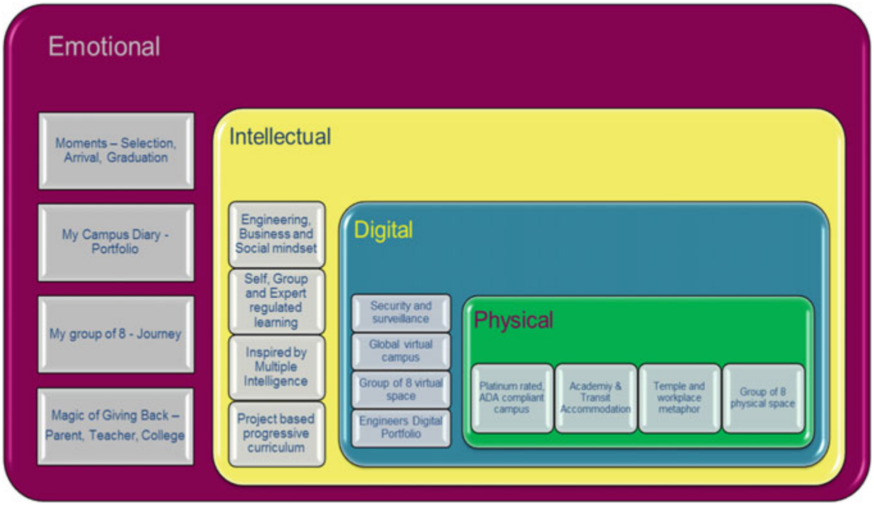
Solving the key issues highlighted above requires a very different approach toward learning and adoption of a long-term view. With the resolve to make a difference to businesses and societies, Mindtree designed its 20 acre residential Global Learning Centre to groom college graduates hired globally. Its mission, aptly directed toward the IT industry's youngest professionals, is to "Revive *Curiosity*, Ignite *Courage* and Foster *Responsibility* to become an expert and a global citizen." In three words—Curiosity, Courage, and Responsibility—are found the guiding principle behind everything that is seen, felt, and done at the *Global Learning Centre*. Curiosity is inherent in us as we discover ourselves through the work we do. While Curiosity can be a driver, it requires Courage to challenge existing belief systems and present a new point of view. Above all, a sense of collective Responsibility awakens us to a purpose beyond our own selves and unites us a global citizen.

Physical, Digital, Intellectual, and Emotional Infrastructure

A residential learning facility for the future requires the right balance among physical, digital, emotional, and intellectual infrastructure. This, combined with the right pedagogy, can create an environment for future professionals. The curriculum should focus beyond technical and soft skills on health, business, society, and sustainability, which we believe are critical missing components in grooming our next generation.[2] We made our own bricks, we did not send our wet waste outside the campus, we grew vegetables, we replenished the groundwater, and we generated our own energy to the extent possible. All of these became an integral part of campus life and curriculum.

[1]Based on *Grooming talent for the next decade: Mindtree's Approach* (brochure). https://www.mindtree.com/about/resources/grooming-talent-next-decade-mindtrees-approach.

[2]Based on *Grooming talent for the next decade: Mindtree's Approach* (brochure). https://www.mindtree.com/about/resources/grooming-talent-next-decade-mindtrees-approach.



Source: Mindtree Limited

Figure 27.1 Four layers of infrastructure

The "Four Layers of Infrastructure" as represented in Figure 27.1 integrate the design with the outcome tightly. While physical infrastructure provides the base, it has limited capability and capacity. Digital infrastructure, when meaningfully embedded into a physical space, can extend the space to infinity. Intellectual infrastructures provide many learning environments that are closely tied with the digital–physical capabilities. Such learning environments are incomplete without an emotional infrastructure that creates memorability. When engineers graduate from our Global Learning Centre, apart from the holistic learning acquired, they carry with them an indelible emotional footprint. This footprint is created through the collective experience of living and working together, learning by self, in groups, and from experts; creating meaningful software for external communities; design thinking using campus systems and processes; working with ground staff in campus maintenance; respecting professionals from diverse disciplines—turning into a professional and global citizen. We call them "engineers of tomorrow."

Pedagogy, the Way One Learns

To design an environment, where one competes with one's own abilities, where fear of failure is converted to determination, and where diversity conflict becomes a new learning opportunity, we had to dismantle four traditional pillars of learning.

(i) Replace traditional confined classrooms with all types of physical space as learning spaces that can be used for many forms of interaction.

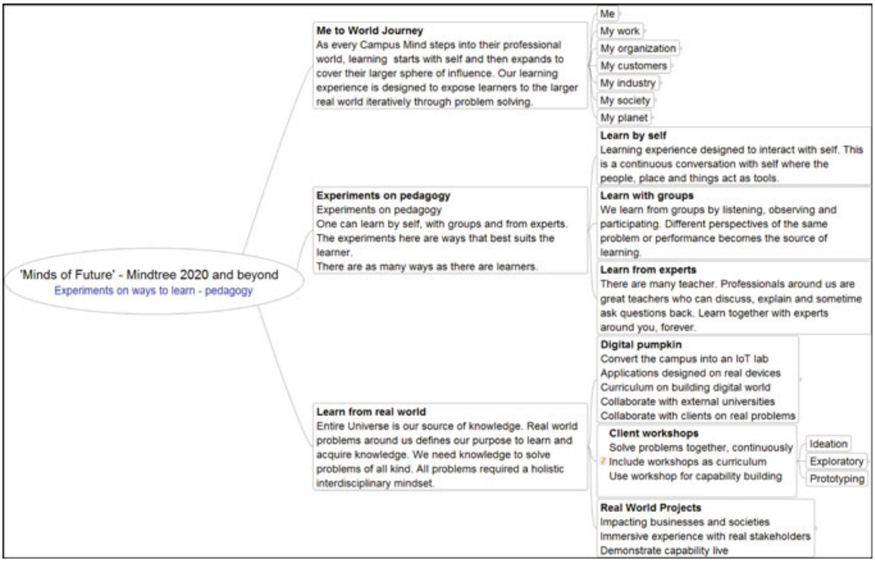
(ii) Replace teachers and faculty with technical leaders from Mindtree who can work as colleagues and guides to solve problems together.
(iii) Replace proctored assessments with continuous demonstrations, every day through learning conversations.
(iv) Adopt real-world problems and content around the world as the curriculum.

While these form the basic guiding principles to design the intellectual infrastructure, there is a continuous effort toward evolving new ways to learn. We call them experiments that will never be completed. Our Global Learning Centre will thus remain "Always Beta"—a software that is almost ready but not complete. The learning environment is unstructured within a structure with plenty of intellectual freedom for learners and experts to exercise. With no scores, marks, or grades to objectively tag a human mind to a level of competence, there is scope for learners to push their own capabilities further. There is no false competition, nor the pressure to score; instead, there is a creative pressure to explore and stretch capabilities by solving real-world problems. A capability is subset of a skill acquired that you can either demonstrate, explain, discuss, and debate, or you simply cannot do all of that.

Examples of Good Practices

As campus hires (we call them Campus Minds) begin their professional journey with their first 90 days at the Global Learning Centre, their brain expansion happens through a program called "Orchard." They arrive with "Me" as their sphere of influence and leave the campus after 90 days with a worldview that progressively adds layers of exposure that a professional would need to get started with life. This is called their "Me to World Journey," wherein the meaning of work, client, industry, society, and our planet is brought into their lives through a diverse set of engagements. Figure 27.2 maps out what we regard as being good practices in this regard.

Campus Minds come into industry at different levels of competence. Some are weak in programming languages, some in logic, and some in confidence. The goal is to find ways to rapidly skill engineers in basic programming and problem-solving. The design team at the Global Learning Centre focuses on many learning experiments such that no two batches go through the same program, improving the process of learning with observations, feedback, and debate. The experiments are mostly around designing self-realization opportunities with lots of counseling. The objective is to trigger curiosity and build self-confidence to ask questions.



Source: Mindtree Limited

Figure 27.2 Mindmap of good practices

Application of These Good Practices

Real-World Problems

We asked ourselves, why cannot learning be on real-world problems, even if it is about basic concepts? Let the curriculum be real problems and real systems. In addition to basic capability development, the engineers should work on real projects manifest on the campus, which could be on security, sustainability, hospitality, or automation. Most importantly, it must be a creative pursuit that triggers curiosity: learning by doing. Working on these real-world problems further helps learners apply what they have learned as concepts. It exposes them to the structure, processes, and systems of an engineering environment.

G8 Living and Learning

Groups with socioeconomic diversity, when made to live, learn, and work together for a period of time, can break mental barriers and bridge deficits that otherwise cannot be imparted through lectures. A diverse set of individuals from distinct cultural backgrounds come together to form a culturally heterogeneous group of approximately eight people (referred by the Harvard Business School as a Group of 8, i.e., G8). A common purpose challenges them to work in teams, helping them improve their communication and collaboration skills. A spectrum of nontechnical tracks ranging from storytelling, business feasibility, professionalism, and social interaction was brought together to create a learning environment.

Industry Connect

Understanding business is as important as knowing technology. A glimpse of what is in store at the delivery center makes a big difference on day one at work. Increased IT industry exposure, direct conversation with internal business heads and top management is a two-pronged approach to help Campus Minds connect with many stakeholders and understand what is the meaning of *work*, who our *clients* are, what is the nature of *business*, and how we impact our clients and *societies*.

Learning Platforms

To remain relevant, it is important for us to immerse ourselves in the world of disruptive technologies and ways of doing business as new channels of communication take birth. Mindtree has built a web-based learning platform (Yorbit) and on-the-go mobile (Shotclass) platforms for learners to support self-paced and self-led learning. It has dramatically changed the way engineers on the ground are self-skilling, upskilling, and cross-skilling. Every new batch of Campus Minds brings with them newer ways of learning.

Electives

What happens when interesting people are invited to spend time with Campus Minds on topics that the respective expert is passionate about? Will Campus Minds love to give a weekend to be with such interesting people or will they choose not to? In addition to courseware, we introduced electives, conducted by interesting leaders and practitioners. Topics ranged from cooking and photography to personal branding. We saw most of the Campus Minds opting for one such additional course. They are free to walk away at any point, which is a real test for the experts and hence learning for them as well. We see true engagement when passion is the reason to meet.

Implications for the Future

Being "Always Beta" is an *adaptive design*. The path to the future is designed in the action today. Just as living organisms have evolved *trying*, the Global Learning Centre applies the same rule. We must sense change every day and adapt incrementally. With time some of the practices discussed above will age and die, and new ideas will take their place. New mindsets will rule with artificial intelligence, art, ethics, social conscience, and rights of robots as the next generation areas of expertise, to name a few. New ways of working will be discovered, and new customers will arrive with a completely different set of skill expectations. Machines and humans will share work seamlessly as well as jokes. In the long run, the measure of success will be to see how many graduates eventually become a respected business, technology, and social leaders. How many will carry on the mission of "Curiosity, Courage, and Responsibility" to become global leaders?

Conclusion

In the field of engineering, as is the case with many other occupations, there is often a skills gap with regard to employees having the necessary repertoire of skills to perform efficiently and productively in the workforce. This draws on the idea that all individuals need to possess and display 'multiple intelligences' if they are to be successful in their work endeavors.

This short article explains and evaluates how, to help overcome deficiencies in this area, *Mindtree* has successfully designed and executed a program, through its Global Learning Centre, to generate learning experiences and an infrastructure which addresses and seeks to achieve an optimum balance between physical, digital, emotional, and intellectual aspect of teaching and learning. The Mindtree initiative demonstrates that it is important for educators and learners to immerse themselves in the world of disruptive technologies and various ways of doing business as new channels of communication evolve and develop.

Mindtree has dramatically changed the way engineers on the ground are self-skilling, up skilling, and cross-skilling.

Link to the presentation material: https://events.development.asia/materials/20160920/mindtree-s-experience-global-learning-centre.

Chapter 28
Teacher Professional Development at Scale in the Global South

Cher Ping Lim, Victoria Tinio, Matthew Smith, Ellen Wenting Zou, and Justin Edward Modesto III

UNESCO (2016) estimated that 68.8 million teachers need to be recruited and trained to achieve Sustainable Development Goal 4, ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all by the year 2030. The problem of a lack of qualified teachers is acute in the Global South, where countries often struggle with limited resources and significant rural–urban, regional, gender, and other gaps in the provision of quality education. The shortage of qualified teachers affects student learning engagement, reducing the effectiveness of schooling (Verspoor 2004; OECD 2005; Hanushek 2005; Rivkin et al. 2005; UNESCO 2006). To address this problem, countries in the Global South have to provide high-quality teacher professional development to all teachers, from pre-service to induction to in-service.

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Equity, Quality, and Efficiency Challenges for Teacher Professional Development

The TPD@Scale Coalition for the Global South was initiated in 2018 to promote quality, equitable, and sustainable large-scale, information and communications technology (ICT)-mediated teacher professional development (TPD) through collaboration, research, and implementation support. To provide equitable access to TPD, programs need to be fair and inclusive. Fairness refers to personal and social circumstances not being a barrier to achieving education potential, while inclusivity means that all individuals, regardless of personal and social circumstances, can achieve a minimum level of education (OECD 2005). To design high-quality TPD programs, collaborative, active learning experiences should be provided, and teachers need to be supported by constant modeling, coaching, and expert feedback over a sustained duration. Efficiency can be defined in terms of the optimization of inputs (teachers, administrators, other human resources, physical facilities, materials, instructional methods, teacher training, etc.) to produce the desired outputs (learning gains).

Addressing the Challenges with TPD@Scale

Students' academic success is highly correlated with the quality of teaching, and professional development is a key ingredient in schools and school systems for improving teaching quality (OECD 2005). Hence, providing inclusive, quality, and cost-effective TPD programs for teachers in the Global South is a particularly high priority. Despite a global need for quality teachers, most teachers in the Global South receive inadequate and often ineffective professional development that fails to develop their core competencies in teaching. In many countries, the frequency of professional development is episodic, the quality varies, the duration is limited, and ongoing support or follow-up is extremely rare (Ball and Cohen 2000; Borko 2004). Teachers in the poorest and most fragile countries and regions, who need professional development and support, often receive the least.

TPD@Scale seeks to address this need for inclusive, quality, and cost-effective TPD programs in the Global South. It taps into the potential of ICT to benefit large numbers of teachers, whether remotely, face-to-face, or both, and to expand the coverage and simultaneously ensure the depth of change necessary to support and sustain teachers' professional learning. Massive open online courses (MOOCs), open courseware, intelligent tutoring systems, learning games, and a variety of peer learning networks and collaborative communities are among the emerging technologies mediating TPD.

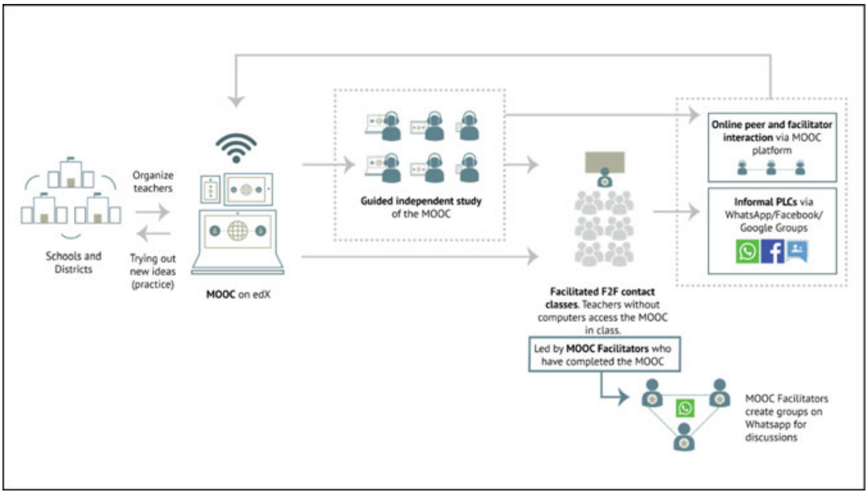
Examples of Existing Practices

In this section, we will introduce two cases and describe how ICT supports large-scale TPD programs to achieve equity, quality, and efficiency.

TESS-India

In 2012, the Open University (OU) in the United Kingdom launched the Teacher Education through School-based Support in India, or TESS-India, designed by experts from the OU and state resource group members. The program adopts a blended model, combining the learning from MOOCs and from facilitators' feedback on the peer-reviewed assignments (Figure 28.1). Each MOOC runs for approximately 4 h per week over a 6-week period. When participants successfully complete a certain number of assignments, they are awarded a Certificate of Completion. The first pilot of the MOOC, in English, was offered in May to July 2015 with almost 3000 participants.

As teachers are more used to face-to-face learning, the MOOCs are also supplemented by weekly or fortnightly contact courses. These contact courses are conducted either in district institutes of education and training, teacher education institutions, or secondary schools, led by a local facilitator who has successfully finished the MOOC. The contact class aims to serve as an alternative venue for peer-supported group study as well as to provide access to quality TPD for participants who have



Source: Lim, C.P. (2019, August). TPD@Scale Coalition for the Global South. *8th International Skills Forum: Future of Skills and Jobs in the Age of Digital Disruptions.* Presentation at the Asian Development Bank, Mandaluyong City, Philippines.

Figure 28.1 TPD@Scale model: TESS-India no internet or computer. It is found that completion rates were especially high (80%) for areas with learner support through face-to-face classes.

Besides meeting face-to-face, teachers also form informal professional learning communities using social media and messaging applications such as WhatsApp, Facebook, and Google Groups. MOOC facilitators also used WhatsApp to share experiences and resolve issues they have encountered in the contact class and in the MOOCs.

In terms of assessment of learning, concerns were expressed about the peer review mechanism where the peer review tasks were allocated randomly. Participants were often frustrated by the poor quality of peer feedback. To address this issue, the grading function was removed, and the feature focused more on the formative feedback that peers provide.

In general, connectivity is less an issue in the program, with more technological infrastructures being invested and promoted by the Government of India. The MOOCs are relatively inclusive. However, time constraints and gender-related involvement are the major obstacles to participation. For instance, more senior female teachers may have domestic duties that prevent them from participating or finishing the MOOCs more actively.

Unlike TESS-India, access to the Internet and technology is still a major barrier that hinders the implementation of quality and cost-effective TPD@Scale in the Global South. The Philippines faces such a barrier in internet connectivity. In 2015, with funding from the United States Agency for International Development USAID, the Foundation for Information Technology Education and Development initiated an intervention to develop a TPD delivery model as an alternative to the Education Department's traditional train-the-trainer cascade model (e.g., 10-day face-to-face workshop) to reach the entire teaching staff of then around 600,000 teachers in a cost-effective and timely manner. The pilot involved 240 rural, peri-urban, and urban primary schools, and reached 4040 Kindergarten to 3rd grade (K to 3) teachers of early language literacy and numeracy.

The blended TPD@Scale model of Early Language Literacy and Numeracy (ELLN) Digital (Figure 28.2) features teachers' individual offline learning through courseware requiring classroom application of concepts learned, with self-assessments.

Teachers' independent learning was supplemented by peer support through Learning Action Cells (LACs), a form of PLC mandated by the Department of Education. Groups of teachers, consisting of 2 up to a maximum of 15 individuals, meet regularly to reflect on and discuss the course content from the Compact Disc (CD), which they had studied and applied in class. These group interactions are organized by the school head and/or master teachers and led by teachers who are designated LAC facilitators. The LAC sessions are meant for teachers to share their learning in a collegial community. LAC facilitators are not meant to be experts delivering lectures and providing all the answers to solve their peers' problems.

Ninety-five percent of the participants completed some or all of the course modules by the end of the pilot. There were small but significant gains in pedagogical and content knowledge and learning, especially among rural school teachers.

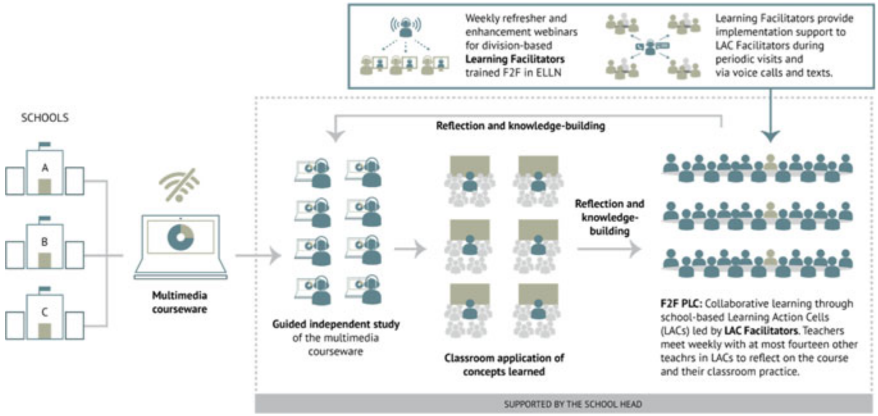


Figure 28.2 TPD@Scale model of Early Language Literacy and Numeracy (ELLN) Digital

However, there remain some challenges. According to the program evaluation, some teachers experienced difficulties in engaging with the learning materials due to time constraints and limited access to the technology and courseware; and some teachers were unable to apply what they had learned to their teaching practice because of insufficient classroom resources. Another challenge is assessment. Even if teacher knowledge has improved, it is hard to know whether the teachers' practice has been transformed and how much change has occurred, given the limited knowledge gained from the teachers' self-reported data.

The ELLN Digital model also highlights the tensions of equity, quality, and efficiency. Although the pilot was implemented with more than 4000 teachers in various contexts, all K–3 teachers will be required to take the course as part of the national rollout, beginning SY 2020–2021. The Department of Education is working to ensure teachers' access to the program without any major obstacles. Now the focus shifts to maintaining quality across a wide array of different contexts. The original ELLN Digital content was reviewed by a team of experts to ensure fidelity to the DepEd training curriculum. Access to the standard expertise in the courseware provided consistency across learners participating in the program, which was difficult to achieve under the original cascade model of ELLN. In terms of cost-effectiveness, though it was time-consuming and fairly expensive to develop the blended learning materials, the cost was one-off, and DepEd can benefit from this endeavor if the course is able to run across the whole country (now 600,000 K–3 teachers) in the next few years.

Critical Issues

In studying these models of TPD@Scale, three critical issues have emerged in the implementation of quality, accessible, and cost-effective TPD.

Learner Differentiation or Personalization. This refers to designing and implementing programs that suit or accommodate teachers or teacher groups in specific contexts. Accordingly, this can imply that teachers need to be included in the conceptualization and testing processes of the @scale model in order to appropriately and continually refine the features of the TPD program, based on their feedback. The learning experience should also provide options for adaptation. In the pursuit of equity, the program must have features that can adjust to fulfill teachers' individual needs as learners.

Learner Support. This refers to access to resources and tools post-training. Once the program has ended, the lack of validation and feedback can cause inconsistent, if not ineffective, implementation or translation of the competencies gained from the TPD. Support mostly includes mentoring and coaching, but this can also pertain to access to professional learning communities or peers who had gone through the same learning experience.

Assessment. This refers to a formal process of obtaining and analyzing data to measure learning. Quality formative and summative assessments become a challenge, if not infeasible when done for TPD programs at scale, particularly for models that are blended and do not solely rely on face-to-face classes. As an alternative, although there are some studies correlating student performance with a teacher's participation in TPD, researchers have found it difficult to directly attribute student learning outcomes to effective TPD. As with personalization, there are multiple factors and contexts to consider in designing assessment for TPD@Scale.

Such critical issues straddle the tensions of quality, equity, and efficiency. To date, there has been no large body of scholarly work thoroughly studying the issues of personalization, support, and assessment in TPD@Scale in the Global South. In response to this, a large part of the Coalition's research work is to provide technical assistance (i.e., support in the design and development of their TPD@Scale system) to governments facing these critical issues and to document (1) their scaling process and (2) their learning (e.g., challenges faced and outcomes reached based on the specific contexts).

Conclusion

From the preliminary analysis of the current practices of TPD@Scale, it is apparent that ICT has the potential to address some of the challenges of large-scale TPD in the Global South. However, many questions remain unanswered, such as, how can teachers be motivated and facilitated to learn digitally? What are the best pedagogies for MOOCs for TPD@Scale? How can evaluation design be improved to capture teacher learning and/or trace learner outcomes and attribute them to TPD@Scale interventions? How can ICT cost-effectively increase coaching opportunities for TPD@Scale? How can you address the issues of personalization, support, and assessment in a cost-effective manner and without sacrificing the quality of the learning design? A carefully planned evaluation agenda is needed to collect data to answer these questions. There is also a need for more studies of TPD for disadvantaged and marginalized groups. A comprehensive analysis based on more rigorous data from the existing practices will go a long way to ensure the achievement of equity, quality, and efficiency of TPD@Scale programs across the Global South.

Links to the presentation materials: https://events.development.asia/materials/20190828/tpdscale-coalition-global-south. https://events.development.asia/materials/20190828/philippines-case-study-elln-digital.

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Chapter 29
Coding as an Essential Skill in the Twenty-First Century

Raman Nambiar

The pace of technological innovation has been felt across all industries, and digital literacy is becoming a key central skill that is important to include in the education system to give employment seekers their best chance at securing the jobs of the future. The way in which the education system itself has been affected by technology is also equally important to consider ensuring that the education system makes the best use of technology to maximize learning opportunities.

The use of cutting-edge technology has also been adopted in areas such as qualification storage and smart contracts by utilizing blockchain and distributed ledger applications. Alternative student payment mechanisms have also been explored, allowing access to learning resources for a new segment of the population that has no access to traditional banking facilities.

Education Today

The two major areas of education—school and college/university—have seen a significant change over the past decade. Both have experienced a more general shift toward vocational skills, and a large amount of funding has been redirected toward ensuring that the content taught leads more directly to current jobs and general employment opportunities.

There has also been a shift toward self-directed learning and the "flipped classroom" where the bulk of the theoretical content is learned at home or by oneself and

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the other, more engaged learning is conducted in a face-to-face classroom environment. This has also introduced the complexity of self-paced learning, which aims to tailor the pace and content of the curriculum to an individual's ability.

These movements are still very new, and, although extensively adopted, it is far too early to gauge their subsequent success or failure.

Issues and Challenges

Online Learning

The introduction of online learning content has taken longer to adopt than initially projected. And, there are still relatively few exceptional examples of online content delivery replacing face-to-face delivery; but certainly, access to learning resources has dramatically increased. The amount of online learning content available in traditional forms and media such as video has given rise to a new breed of learning content curators who make content available for microskills ranging up to full 3–4-year courses.

Massive open online courses (MOOCs) were initially rejected by traditional universities as a poor choice of learning platform in comparison to what a university experience could offer, but this trend has also changed, with major universities now working in conjunction with MOOCs and exploring ways to blend the offerings made to potential students. Free courses have had notoriously low completion rates and no direct link to accreditation. This is being tackled in a wide variety of ways by global providers and will continue to be a challenge over the next decades as technology offers more and more possible solutions to improving the remote student experience.

Online content has also never been so easy to produce. There is a wide range of content platforms that make it easier and easier for educators to produce quality content and broadcast that content to a wider audience. This is overcoming many traditional challenges of servicing regional/remote areas, but it brings us to a basic stumbling block that in the developing countries has not been adequately addressed: information technology (IT) infrastructure. Moreover, access to fast/reliable/cost-effective Wi-Fi is still a major blockage to relying on new technology products. Without this essential ingredient, we are still missing out on a huge proportion of potential students and the way in which they are able to experience online learning.

The Tech Industry Today

A major misconception that people have about youth and technology is that the young are naturally good at technology. Extensive research has indicated that the upcoming generations are very good at consuming technology but still proportionately lacking (as in previous generations) in creating technology.

The huge array of tech products/applications available today is increasing the chances that you will remain a consumer rather than a developer. The other worrying trend is that the development of technology is so heavily skewed toward Western countries and dominated by white middle-class males. This has a lot to do with access but is also heavily influenced by our perception of creating tech products. Whether it is hardware or software there is a perception that it is only for the mathematically gifted and is a very difficult discipline to learn.

An approach being adopted to combat this perception is to encourage learners to create products and applications quickly using simplified coding templates and focus on the rapid deployment of a product rather than the theory required to build it. This builds confidence in the creator and allows for rapid feedback from users of the product/system, which can then be adopted in another prototype in quick succession. This "agile" methodology promotes a more democratic approach to development and enables concepts to be demonstrated without becoming tied down to long and narrow production environments.

It is also interesting to note that, although it is widely thought that technology is moving at a rapid pace, the reality is that it could move a lot faster. One of the major bottlenecks is the IT labor shortage, which is a well-documented and clearly global phenomenon. It has been acute in high-tech regions such as Silicon Valley in the United States for a long time, but now that technology is an integral part of the economic success of most industries, it has taken on a broader role across all industries.

Asia cannot keep up with demand, and the United States simply cannot graduate enough students to meet even the existing number of employment positions available. This does not even consider the new jobs that are emerging that we have not even planned adequately for in terms of technology skills requirements. To further exacerbate the problem, current university/college graduates often do not have the skills (both soft and technical) that employers are looking for. This means that emerging technology industries are moving slowly and not taking advantage of the global economic opportunities that are available to remain competitive. This is a basic supply–demand problem that has precipitated some innovation in the education arena in regard to technology.

Proposed Solutions

In 2011, the first coding boot camps began appearing to try and supply employers with additional technology workers. The model has been hugely successful, and now there are over 100 boot camp companies operating across the United States. They have spread globally and are becoming a very real alternative to university IT qualifications. The main difference is that they are very condensed (typically 4–6 months) and focus on problem-solving using the most modern software frameworks available. This means that students learn to rapidly prototype in the technologies that employers are using today, including multinational tech giants and small start-ups.

Coding boot camps are usually focused on 1 or 2 front end and back end languages and are aimed at deploying applications and making their graduates ready to immediately add value to a workplace environment. Obviously, there is less concentration on theory, which the universities still excel at, given that they have 3–4 years with the students as opposed to 4–6 months; but coding is largely a trial-and-error exercise wherein the bulk of the learning is absorbed on the job. There is also an argument that coding has many levels of employees: basic quality checkers and testers and also scientific architects/engineers. The level of proficiency in most non-tech companies is skewed toward the basic coders, for whom 3–4 years at university may not be the best pathway for success.

These boot camps also open the doors to the opportunity of a distributed global workforce wherein tech teams can be geographically spread, giving employers wider access to IT talent and creating great opportunities for coders in developing countries. Online learning of coding skills is also growing rapidly, as technology makes it easier to digest the learning in smaller chunks and allows for online tutors/peer reviews and open-sourced problem-solving.

Women in Tech

The gender imbalance has been widely documented across the globe. It remains a major challenge to the tech industry as we experience a very one-sided development flavor and we also miss out on a huge number of potential employees to meet some of the demands that the tech industry is experiencing. There are a number of initiatives attempting to reduce this imbalance, including the use of scholarships, better marketing, corporate partnerships, etc.

One of the major movements that will require a long period of monitoring is introducing girls to tech before their perceptions are molded and stereotypes are embedded. By introducing young women at the age of 12–14 to a range of tech initiatives, we are able to form stronger bonds between women and technology and open the doors to career paths that were previously seen as the domain of the male tech stereotype.

School Curriculum Changes/Corporate Partnerships

The introduction to technology skills is being made earlier and earlier at the school level. This focus on problem-solving and using logic and basic algebra to architect solutions is proving to be instrumental in allowing young students to understand the possibilities of technology and science, technology, engineering, and mathematics (STEM)-related education.

The concept of coding/software development is being introduced in more creative ways and linked to existing subjects as a logic component rather than a completely separate discipline. Examples also include game playing and game creation and the building on tactile applications that do not require a computer interface. This approach is also important in order to decrease the isolation of students who do not naturally gravitate toward science and mathematics and provides a pathway for young learners to build confidence in building quickly and making mistakes often without negative ramifications. This also allows for the early introduction of emerging technologies such as virtual reality/augmented reality (VR/AR), and students may use these tools in their learning and also use them to understand broader applications in industry.

The prevalence of technology in day-to-day devices including smartphones, household appliances, security sensors, lighting, etc., enables students to quickly recognize how these devices communicate and become a necessary part of working/social life. The bottleneck in this progress is the teachers themselves. Many of our existing school teachers are not comfortable with technology and coding and are unable to teach the students these skills. We need a huge movement in the professional development of teachers to take advantage of the technology appetite that our young students are experiencing.

Technology in Education

Advances in the technology itself are helping to distribute technology skills more effectively. The use of mobile phones as a teaching aid is being adopted extensively in regions like Africa, where it is difficult to access laptops but mobile adoption is high. Improvements in bandwidth and Internet speed are also assisting with broadcast tutorials, and VR/AR is making technical visualizations more readily available at much more economical rates.

Sophisticated coding suite tools that require a limited understanding of software development are also starting to gain traction, and artificial intelligence is improving to correct errors and make rapid prototyping more mainstream and available to a wider audience of users. All of these developments equate to a more expansive adoption of fundamental coding skills with more emphasis on self-directed learning and less intervention from mentors/teachers. The teachers become "guides" rather than formal instructors in this scaled-up learning environment.

Examples of Good Practice

Australia, Canada, the United Kingdom, and the United States are embedding coding skills as part of their primary school curricula. There are also global coding movements to create awareness and introduction to basic skills (e.g., code.org). Other initiatives are women in technology scholarship programs and women-focused accelerators or innovation funds. Coding boot camps are also working with universities and corporates globally to change graduate employment rates. There are also free learning resources via platforms such as EdX, Khan Academy, and Coursera. Many countries and the United Nations are moving toward making Internet access a basic human right, which will require policy shifts to adopt digital skills toolkits and prescribed digital skills benchmarks.

Implications for the Future: The Changing Job Market; New Roles/Industries

IT graduates no longer just end up in tech companies. The majority of IT graduates are now working in a broader range of industries including finance, government, retail, mining, health, etc. This changes the landscape of job opportunities but also puts more pressure on our supply of tech-savvy graduates. We are also creating a whole new array of jobs that were unpredicted and at the same time rapidly losing a huge number of jobs in “older, more mature” industries. Without proper planning, we will see a huge number of underemployed workers, particularly in developing countries, where robotics/artificial intelligence are replacing old job roles. This creates problems but also huge opportunities with perhaps a fairer distribution of talent/remuneration such that remote workers can earn higher salaries for the tasks they are performing.

Companies that are investing in technology training and basic digital literacy for their staff are seeing positive results and healthier work culture. It is also important that we recognize more mature workers that have not had exposure at school/college to technology training. These workers need to be nurtured and given the opportunity to combine their experience with the new advances in technology.

The United Nations has been a driver of change in the area of digital skills adoption and has developed a digital skills toolkit that outlines a strategy for several sectors of society including youth, the employed, and the elderly. By creating a strategy for digital skills adoption across an organization that encompasses all levels of digital literacy, it enables an organization-wide focus on the resources available and identifies gaps and mismatches in company aspirations and current skill sets. Regional hubs of shared resources for digital skills adoption are also proving to be effective in allowing for the recognition of common challenges and the pooling of solution methodologies. This includes databases of professional trainers, libraries of tools/applications, and innovation centers.

Conclusion

A number of interested parties are involved in ensuring the success of IT training and the adoption of digital literacy including employers, government, education providers, and a range of global agencies. Assistance can come in the form of funding to schools, scholarships, various corporate donations, student loans, and curriculum development projects. It is a huge task that will be successful only with a combination of public/private efforts that recognize the huge economic impacts that can be gained. We must also seek to be inclusive with respect to disadvantaged groups and minorities to fully realize the potential of our digital future.

Links to the presentation materials: https://events.development.asia/materials/20160921/digital-literacy. https://events.development.asia/materials/20171214/switch-mavens-coding-boot-camps-and-blockchain-technology-applications-education.

Part VI
Technology Platforms for Skills Gaps Bridging, Career Counseling, and Guidance

Chapter 30
Empowering Filipino Youth Through Technology and Community

Henry Motte-Muñoz

Although the Philippines has achieved sustained economic growth in recent years, national education outcomes continue to lag behind other countries in the region. Asian Development Bank (ADB) research has shown that for most children in the Philippines, secondary education will be their highest educational attainment, while a proportion of secondary education-aged children will stop or forego schooling for work (Maligalig et al. 2010). Consequently, the tertiary enrollment rate for college-age Filipino youth is only 45%, limiting employment opportunities for the rest who do not pursue higher education (Ken Research 2014).

The level of formal educational attainment is not the only barrier Filipinos face in terms of human capital. Roughly, 30% of those who have pursued or completed a college degree or higher are tagged as the "educated unemployed." Most are young Filipinos fresh from college, who are believed to be unprepared and unequipped for entry-level jobs. Often, this involves a slow school-to-work transition, where it will take a college graduate 1 year to find the first job and up to 2 years to find more permanent employment. This is attributed largely to the mismatch between skills and qualifications held by young jobseekers and those required for jobs in the labor market (Moya 2018).

Improving quality and performance outcomes for the Philippine education system is a significant, multifaceted, and long-term task. However, it is important to consider near-term factors that may be contributing to these broader issues, as well as alternative interventions that may support Filipino youth in meeting current and emerging skills and job requirements.

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Issues and Challenges

A critical matter to consider is the proportion of Filipino youth who are not entering higher education. Based on observation and research, this gap is partly influenced by three factors that create a disadvantage among students: lack of information, lack of access, and lack of guidance.

Lack of Information

Despite the availability of thousands of higher education institutions across the country, there is limited awareness of options beyond the top-ranking universities in the Philippines, which are located mainly in Manila, and those found within one's own province or region. In other countries, including the United Kingdom and the United States, centralized information systems exist to help students understand what, where, and how to pursue higher education. These are substantial and clear in terms of what courses are offered by the various schools, what job opportunities are available in line with the course selected, and basic instructions on application processes and requirements.

Lack of Access

In addition to comprehensive sources for basic school profiles, course listings, and potential academic paths to employment, students are actively looking for information on scholarships and student financing. Given economic conditions in the Philippines, it is clear that affordability is a major factor that influences education decision making and often limits options available to students. However, they typically do not know how or where to find relevant opportunities that may help alleviate costs.

Lack of Guidance

Finally, what students could benefit from adequately preparing for their future is proper guidance and advice. While the information on schools and careers can be made available using various channels and tools, this knowledge should be paired with appropriate support that can help students evaluate their choices. Students could then have a better understanding of options most suitable to them based on academic strengths, interests, or feasibility. Moreover, additional context from the employment side, including job trends, demands, or emerging societal needs can play a role in charting a path forward.

Proposed Solutions

To arrive at potential solutions, society must also consider the cultural climate surrounding youth in the Philippines. Gen Z, specifically the segment of Filipino youth born between 1995 and 2015 (aged 14–24) and comprising about 20% of the population, is native to a world that is largely digital and increasingly interconnected. Based on initial research, two approaches are proposed for addressing the issues and challenges facing youth when advancing their education and career.

Leveraging Trends in Technology to Reach Youth at a Broader Scale

According to Kantar Millward Brown Philippines, a leader in brand strategy consulting, more than half of Gen Z uses the Internet throughout the day. About 80% are seeking articles to read or videos to watch, indicating that they are hungry for information (Ng 2017). This is reflective of the broader population of the Philippines, where Internet penetration is now nearly 60%, and which ranks number one globally for time spent on social media. Moreover, We Are Social reports that mobile internet connections have improved considerably in many developing economies, and the Philippines in particular has seen an impressive jump in average mobile connection speeds (Kemp 2017).

These data point to a significant opportunity to meet Filipino youth where they are online, and specifically on social media and through mobile devices. Taking this a step further, innovative technology, through the use of data and analytics, is now enabling internet users to have more personalized experiences, opening the potential for more engaging discovery, or learning opportunities for students.

Creating an Ecosystem that Approaches Education to Employment from Various Perspectives

ADB's review of education outcomes in the Philippines reported that the Department of Education has forged partnerships with private and business sectors in implementing initiatives that have resulted in valuable contributions. Specifically, the report recommends partnerships with successful businesses to develop a technical–vocational curriculum that would give students better chances of being hired by enterprises in their communities (Maligalig et al. 2010).

This example highlights that higher learning or career readiness should be approached not only from the viewpoint of education. As students continue their pursuit of degrees or certifications, there is also a growing need for input and insight from other players who are vested in the next generation's development. Early and ongoing involvement is relevant not only for businesses but also for other public and private institutions, comprising a holistic ecosystem that holds a common interest in ensuring that Filipino students are adequately equipped to meet the challenges and demands of the future.

Examples of Good Practices

Based on the two proposed approaches, harnessing technology and multi-stakeholder involvement, three examples can be considered for successful implementation of interventions targeted toward Filipino youth.

Creation of Online Platforms Supported by Offline Engagement

Recognizing that students are seeking information mainly online, digital destinations where they can access comprehensive data on schools, courses, and careers would provide significant benefit. Using technology, information available through the Internet and other resources can be easily gathered and collated, creating a centralized database that enables convenient searching and browsing. Schools can also play an active role in this initiative by providing accurate and updated information that supports students in making informed assessments of their options. Providing information online can also be supplemented by in-person activities that would (i) build awareness around the existence of these platforms as new information sources, (ii) create connections between students and multiple stakeholders who can support them in their education-to-career path, and (iii) reach and similarly support youth who may not have easy access to the internet.

Promotion of Opportunities Addressing Affordability

As students seek scholarships and other options to finance their higher education, sharing available opportunities online can increase awareness and access for a large number of eligible students who would not have learned about them otherwise. In the Philippines, there are countless benefactors including government agencies, corporations, and foundations that aim to support scholars, and engaging them through a shared and centralized online initiative could amplify reach and attract more student candidates.

Development of Engaging Multimedia Content

Finally, issues around lack of information, access, and guidance can be addressed by creating content that meets students online and on their preferred social media channels such as YouTube, Facebook, Instagram, or Twitter. The ability to produce articles, imagery, and video that speaks to this audience can help engage and ultimately guide them on important decisions concerning education or career. Multimedia content could then be strengthened and made more credible by stakeholders who share expert advice and serve as positive influences for students and future jobseekers.

Application of Practices

In the experience of Edukasyon.ph, an online technology platform that aims to empower Filipino Gen Z youth to make better-informed choices about education, career, and life decisions, the following initiatives have been implemented.

Development of Edukasyon.ph and Execution of School Fairs Across the Philippines

Edukasyon.ph is an online platform that provides information on 13,000 schools, 20,000 courses, and 4,000 scholarships that senior high school and college students across the Philippines can choose to pursue. For more than 700 educational partners, locally and abroad the platform enables students to inquire and apply directly on the platform, online, at no cost to the students. In 2018, Edukasyon.ph acquired the website FindUniversity.ph, which similarly lists higher education institutes and available academic programs across the country. By providing choice, access, and convenience, Edukasyon.ph's online platforms are now visited by 10 million students a year. Students have actively engaged and benefited from its use, with more than 500,000 registered users, 600,000 monthly searches, and more than 85,000 monthly inquires and applications coursed through the platform. With more than 70% of students accessing the platform through mobile devices, Edukasyon.ph is adequately designed and optimized for this audience.

In recent years, Edukasyon.ph has also implemented successful offline engagements together with local government units, corporate partners, and media partners. In close collaboration with the local Department of Education divisions across the country, more than 30 school fairs nationwide have complemented the use of online platform, reaching a total student population of more than 15,000 as of 2018. At each school fair, students have gained relevant information on pursuing higher education opportunities, scholarships, and knowledge to prepare them for future employment.

Launch of Project Layag Scholarship Platform

On addressing affordability, a common barrier for students, Edukasyon.ph in partnership with De La Salle University Science Foundation launched Project Layag, a nationwide online scholarship platform that democratizes access to financial support for Filipino youth. In addition to the thousands of scholarships listed on Edukasyon.ph, this targeted initiative provides added convenience by making certain scholarships available for direct online application on the platform, at no cost to the student. Project Layag is an ongoing effort to ensure that all existing scholarship opportunities are accessible to eligible students through the website.

To date, more than 30 higher education institutions, foundations, and scholarship providers, including Insular Life Foundation and the PHINMA Foundation, have been integrated into the platform.

Implementation of Corporate-Partnered Campaigns

Involvement from reputable businesses, particularly through engaging multimedia campaigns, has also been a recent focus of Edukasyon.ph to ensure that students can access guidance on potential career paths and values that could help them succeed in the future. The campaigns are equally aligned with the partners' business objectives, allowing brand messaging to be seamlessly integrated with Edukasyon.ph content categories that are co-created with its writers.

A collaboration with [24]7, a customer experience company, examined the business process outsourcing industry by "debunking myths about call centers." Through an engaging online video campaign on Edukasyon.ph, students were able to understand the professional demands and opportunities in these roles through the lens of experienced experts in the field. For [24]7, Edukasyon.ph provided a wide-reaching platform that boosted the company's visibility as an industry leader and drove student interest around its employee recruitment initiatives.

Another campaign developed in partnership with FWD Group, an insurance provider, sought to engage Filipino youth around financial literacy with knowledge and skills to promote sensible management of personal finances. Edukasyon.ph-led blog content approached the topic through "signs of becoming an adult," advising Gen Z readers that growing up comes with important responsibilities, including banking and budgeting, managing retirement funds, and preparing for the future overall.

Implications for the Future

With the availability of online resources targeted at Filipino youth, who are increasingly turning to the Internet for answers, more can be done to inform and empower them. In the case of online platforms like Edukasyon.ph, there is a significant opportunity to raise awareness of educational options, especially as more doors are being opened each day. This can extend to technical and vocational education and training, online degrees and courses for lifelong learning, internships, or on-the-job training opportunities, as well as additional tools for student financing, including loans.

In building an ecosystem in support of fruitful education-to-career paths, there is also room for increased stakeholder participation. As industries and societies embrace interconnectivity, they must also realize that youth is an important segment to invest in, as they will be drivers of sustainability.

Finally, based on current trends, it can be expected that Gen Z will become even more digital in the next 5 years and beyond. Increased Internet penetration in the future, if not absolute, will require that all education-to-employment programs be designed as digital first, and not merely as a secondary component of learning.

Conclusion

Although there is no quick solution to improving national education outcomes in the Philippines, supplemental resources that leverage the digital youth culture and employ multi-stakeholder approaches can be valuable tools. For technology platforms, a unique benefit is the ability to track and harness data analytics and insights to better understand what is working and what else can be done to achieve meaningful results.

As existing models produce and replicate stories of success—from education to employment to sustainable careers—more students will be motivated to make the right choices for themselves, more stakeholders can be engaged to lend their support, and the more extensive impact can be created for the Filipino youth.

Link to the presentation material: https://events.development.asia/materials/20171212/edukasyonph.

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Chapter 31
Singapore's Experience in Analyzing the Labor Market Using Artificial Intelligence and Big Data Analytics

Gary Gan

The Fourth Industrial Revolution, or Industry 4.0, has brought about rapid changes in the world of work. Digital technologies such as artificial intelligence (AI) and robotics have disrupted major industries, and jobs are evolving faster than ever before.

Around 60% of today's job roles entail at least 30% of tasks that can be automated,[1] and around a quarter of today's job roles have more than 70% of automatable tasks. Even 28% of reasoning and decision-making, a traditionally human work function, is expected to be performed by machines in 2022.[2] At the rate that technology is evolving, it is difficult to determine how long one can continue to be relevant.

In earlier years, Singapore focused more on developing the education system for pre-employment education, with Singapore ranking first in terms of the World Bank's Human Capital Index. Now, there is an increasing focus on helping Singaporean workers stay competitive postemployment, through workforce transformation and lifelong learning, to help workers cope with the changing requirements in the world of work.

[1] A Future That Works: Automation, Employment, and Productivity. 2017. Retrieved February 28, 2019 from https://www.mckinsey.com/~/media/mckinsey/featured insights/Digital Disruption/Harnessing automation for a future that works/MGI-A-future-that-works-Executive-summary.ashx.

[2] The Future of Jobs Report 2018. 2018. World Economic Forum, 10–14. Retrieved February 28, 2019, from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

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Breakdown of Challenges

To keep up with technological changes, workers need to adopt both on-the-job experience and active reskilling. The change in mindsets of the workforce is evident: Globally, the number of learners taking massive open online courses (MOOCs) increased from 35 million in 2015 to 101 million in 2018.[3,4] In Singapore, the number of adult learners engaging in course offerings by the five national polytechnics also increased to 77,000 in 2017.[5]

However, challenges still exist in face of these trends. Some of the key barriers to effective workforce upgrading lie in understanding labor market trends and getting sufficient buy-in from both workers and businesses.

Real-Time Awareness of Labor Market Skills Demand

Policymakers, businesses, and individuals need to understand the rapid changes in industry skills demand in today's digital economy in order to inform their planning and decision making. Traditionally, this process involved consulting industry professionals to provide a well-researched perspective and forecast of the future. However, the difficulty of this task has grown with the rate of labor market changes.

Businesses and individual workers face information failure when planning for workforce shifts and the accompanying training initiatives. American organizations spent an average of $1,252 per employee on training and development initiatives in 2015, totaling more than $350 billion for the year.[6] Yet, 92% of executives agree that there is a skills gap in the United States workforce.[7] The lack of benefits from learning and development investments stems largely from untargeted training and the lack of a common skills language among the market, employers, and training providers.

To make sense of uncertainty, and keep up with the speed of labor market information, technologies to consolidate the latest information and identify deeper trends need to be used. A system to track the evolution of job functions and job-relevant skills needs to be implemented, and the insights generated must be simple enough for individual workers to act on them. This information will also need to be updated in

[3] By the Numbers: MOOCS in 2015. (2018, October 3). Retrieved February 28, 2019, from https://www.class-central.com/report/moocs-2015-stats/.

[4] By the Numbers: MOOCs in 2018. (2018, December 23). Retrieved February 28, 2019 from https://www.class-central.com/report/mooc-stats-2018/.

[5] Teng, A. (2017, September 11). Adult learners on the rise. Retrieved February 28, 2019, from https://www.tnp.sg/news/singapore/adult-learners-rise.

[6] Vox Creative (2017, November 28). Are you and your workforce ready for the future? Retrieved February 28, 2019, from https://www.recode.net/ad/16710572/workforce-digital-reskill-talent.

[7] The Future of Jobs Report 2018. 2018. World Economic Forum, 10–14. Retrieved February 28, 2019, from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

real time in order to be utilized viably and will have to be able to map in the contexts of both businesses and training providers.

Getting Buy-in from Enterprises and Individuals

To keep up with shifts in the labor market, that are constantly displacing workers while creating new jobs, companies have a role to play in retraining and upskilling their workers. Maintaining a workforce with future-proof skills to complement technology and automation would naturally lead to a rise in productivity and reduce the risk of becoming irrelevant to the market.

Research demonstrates that only 30% of employees in today's at-risk job roles have received any kind of professional training over the past 12 months. Companies highlighted the lack of a clear business case and bottom-line impact for reskilling and upskilling investments as a reason for deprioritizing inclusive workforce transformation.[8] Commonly used metrics to calculate training return on investment include training hours and course satisfaction level, which are not adequate to reflect what skills the company gains and how training impacts the bottom line. A metric based on skills gained, job readiness increase, and productivity increase of employees may be more valuable in presenting a clear business case for training, which could result in more training provided for employees

Individuals

Individual workers will need to proactively seek out upskilling and upgrading opportunities. Technological disruption and work automation can have different implications on high- and low-skill workers and could exacerbate the skills and employment gap between the two. Between 2002 and 2016, jobs in the United States that require low-level skills dropped from 56% to 30%.[9] Routine-based white-collared job roles such as data entry clerks and cashiers are expected to be increasingly redundant from now until 2022 due to process automation.[10] Even if only a subset of their tasks is automated, a worker who lacks the appropriate skills to adapt to new technologies and perform higher value functions would naturally see their job performance and wages suppressed. As such, central to any workforce transformation strategy is

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[8]The Future of Jobs Report 2018. 2018. World Economic Forum, 10–14. Retrieved February 28, 2019, from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

[9]The Future of Jobs Report 2018. 2018. World Economic Forum, 10–14. Retrieved February 28, 2019, from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

[10]The Future of Jobs Report 2018. 2018. World Economic Forum, 10–14. Retrieved February 28, 2019, from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

an agile and motivated workforce that is constantly engaging in upskilling to stay future-ready and relevant.

There must be an awareness of the need to reskill, and guidance to help workers understand what skills to develop as well as what roles to transition into. A methodology of identifying and breaking down a worker's skills into a common skills language would also strengthen personal development strategies. This shared taxonomy can fill in the gaps among the worker, the labor market, and training providers.

Singapore's Case Study

In a small country like Singapore, where human capital is the greatest asset, policymakers have been racing to push out initiatives to support workforce transformation. Yet Singapore still faces a large mismatch between skills and jobs in the Southeast Asian region, mostly due to the fast pace of digital transformation in the country as compared with her neighbors. As such, the rate of displacement of workers is high, with one-fifth of Singapore's full-time workforce expected to have their jobs displaced by 2028.[11]

A heartening trend is the awareness of the importance of lifelong learning among the workforce of Singapore: 83% of workers in Singapore recognized the importance of evolving and growing their skills and knowledge, along with a desire to grow their skill set as a result; 72% of workers also indicated that their biggest concern was that their knowledge and skills would become obsolete.[12]

The Government has capitalized on this trend and has made a number of efforts to promote upskilling and lifelong learning in the workforce, including the usage of AI and Big Data in building technology platforms for bridging skills gaps and for career counseling and guidance.

JobKred is a Singapore tech company that uses Big Data to access publicly available labor market information, informing its AI engine on the jobs and skills changes in the world of work. This AI is used in JobKred's workforce transformation platform to provide digital career guidance, skills gap analysis, and training recommendations to help individuals and employees gain skills that industry requires and prepare for the future of work.

[11] Technology and the future of ASEAN jobs: The impact of AI on workers in ASEAN's six largest economies. 2018. 42–48. Retrieved February 28, 2019, from https://www.cisco.com/c/dam/global/en_sg/assets/csr/pdf/technology-and-the-future-of-asean-jobs.pdf.

[12] Singapore 2017 Salary Guide. 2017. 8–9. Retrieved February 28, 2019, from https://www.kellyservices.com.sg/media/kelly-services-sg/pdf/2017singapore-salary-guide.pdf.

SkillsFuture Initiative

In 2016, the Government first introduced the SkillsFuture initiative to its citizens, bringing forth a wave of upskilling programs with it. The core of the initiative is to promote and enhance the lifelong learning experience through a formal integration of skills into the contexts of various industries.

One of its most notable initiatives is the SkillsFuture Credit, wherein Singapore citizens of age 25 and above were given S$500 of credit to invest in their personal growth. This included participation in MOOCs and continuing education and training courses at local institutes. In the first 2 years after its launch, SkillsFuture Credit saw 285,000 Singapore citizens using it to take ownership of their own career pathways.[13]

To help citizens understand their own current skills, identify their skills gaps toward their target careers, and receive training recommendations, Singapore's national skills portal, MySkillsFuture.sg, is utilizing JobKred's AI engine, which understands current skills demand and can make relevant career and skills recommendations. This helps citizens to be more directed in their skills development journey by becoming aware of what skills to obtain in their career progression, and keeps citizens relevant to the latest skills demands.

AI-Powered National Jobs Portal

To enhance the job matching process, Singapore's national jobs portal, MyCareersFuture.sg, has implemented JobKred's technologies to power the intelligence behind every job search. Since its launch in mid-2018, there have been 250,000 active users every month, with an average of 23,000 job posts each month.[14]

The portal uses a data-powered approach to match a jobseeker's skills to a suitable career. JobKred first analyzes online labor market information from various sources such as job descriptions and resume data to identify emerging job titles and the relevant skills. JobKred then uses machine learning to train an AI engine to perform the job matching process.

[13]Technology and the future of ASEAN jobs: The impact of AI on workers in ASEAN's six largest economies. 2018. 42–48. Retrieved February 28, 2019, from https://www.cisco.com/c/dam/global/en_sg/assets/csr/pdf/technology-and-the-future-of-asean-jobs.pdf.

[14]Seow, J. (2019, January 4). Better matches, more postings coming up on national job portal MyCareersFuture. Retrieved February 28, 2019, from https://www.straitstimes.com/business/economy/better-matching-more-listings-on-government-job-portal.

Digital Career Guidance and Adaptive Curriculum

Education institutes have also turned to systems fueled by data and machine learning for career counseling and guidance. More than half of Singapore's higher education institutes have worked with JobKred to provide students with a personalized experience. Traditionally, to understand a learner's skills and career aspirations, a lengthy and subjective profiling process would have to be carried out by the institutes. JobKred provides learners with labor market information at their fingertips and helps them to profile their current skills. Gaps are also identified between their skillsets and those in demand for their careers of interest.

This process of Skills Gap Analysis paves the way for individualized career guidance and learning. Counselors are able to profile students at scale and refer to labor market information when giving guidance, while curriculum planners can refer to aggregated data on both the students and careers in demand to perform informed decision-making in updating their curriculum.

JobKred is also working on an adaptive curriculum system, wherein curriculum and course recommendations to students change based on current labor market demand, to ensure that students are always presented with the right training that the market currently demands.

Helping Enterprises Transform Their Workforce

Recent initiatives have also been introduced to encourage businesses to digitalize their processes, such as the AI Singapore and SME Go Digital initiatives, and the SG Digital movement. The Government has also been actively promoting the use of technologies to strengthen workforce development in organizations and businesses.

JobKred supports a company's workforce transformation journey by helping the company identify the future-ready skills they want within their company, and by supporting the development of competency frameworks to guide skills and career development. A workforce development platform then profiles all employees, to identify and validate the skills inventory within the company, and helps the company keep a pulse on their skills development progress. Finally, personalized learning recommendations and digital career guidance help employees quickly gain skills relevant to the needs of the company.

JobKred has worked with various Singapore Government agencies to educate employers on the necessity and process of workforce transformation, and to provide a platform to help facilitate that transformation. With a tech solution, employers can quickly deploy their transformation plans to the entire organization, while saving up to 90% of cost and time compared with traditional methods.

Evaluation

The SkillsFuture Initiative has taken the right direction and has brought about a change in the mindsets of the people. Increasingly, the national conversation is shifting from why one should engage in lifelong learning to how one can do so effectively. The range of subsidies and funding has greatly helped in the process of encouraging both businesses and workers to invest in constant upgrading.

However, the industry skills frameworks on which the Government depends to guide its plans are unfortunately static and cannot keep up with changes in the industry. As they were crafted with help from industry experts and consultants, both the industry skills maps and qualifications require manual refreshment and often lack real-time information to refer to, resulting in the inability to update quickly and forecast accurately.

JobKred has used Big Data and AI to provide targeted and personalized digital career guidance and lifelong learning to both individuals and enterprises, with focus and emphasis on jobs and skills, and with relevance to the latest industry skills demand. The track record achieved, powering Singapore's national skills and job portals; and use by the majority of universities in Singapore, as well as by employers from 15 industries ranging from small enterprises to Fortune 50 companies reflect JobKred's effectiveness and success in changing how Singapore is preparing for the future of work.

Conclusion

With the changes in the world of work, it is of rising importance that people constantly upgrade themselves to lead innovations and not be disrupted by them. Governments, businesses, and individuals should actively support this workforce transformation, and ensure that a scalable system connecting labor demand information, training, and career development is utilized to reduce lag time in workforce transformation.

Link to the presentation material: https://events.development.asia/materials/20171213/jobkreds-technology-platform-bridging-skills-gaps.

Chapter 32
How Technology Affects Jobs: A Smarter Future for Skills, Jobs, and Growth in Asia

Sameer Khatiwada

Jobs are in a constant state of evolution. Today's labor markets are far different from those of decades past. The types of jobs workers need to sustain their livelihoods, the industries that power economic growth, even the societal expectations of what a job represents are all subject to constant change. At present, there is nothing more transformative concerning the nature of jobs and the future of work than the Fourth Industrial Revolution (4IR)—a new era built on the use of more sophisticated robots and computing power and the automation of tasks once thought to be uniquely human (ADB 2018). In this essay, we examine the literature on how the 4IR is changing the demand for jobs and explore the implications of new technology on jobs in Asia and the Pacific.

Throughout history, humans have always endeavored to produce things better, faster, and cheaper: from the use of water and steam power to mechanize production in the First Industrial Revolution, to the use of electric power for mass production in the Second Industrial Revolution, to the use of electronics and information technology to automate production in the Third Industrial Revolution, and to the extreme automation, connectivity, and the wider implementation of artificial intelligence in the 4IR. Just like the industrial revolutions preceding it, the 4IR will profoundly affect people's lives.

As the 4IR unfolds, some types of jobs will disappear, while many others will be created. Recent studies, discussed below, show that new technologies will result in higher productivity. While displacing some jobs in their wake, new technologies will simultaneously unleash countervailing forces that generate more jobs, and the net effect at the aggregate level will be positive.

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Issues and Challenges

The Asia and Pacific region is home to more than 60% of the global working-age population, and six out of ten young people in the world today live in this region.[1] The future of work globally is tied to labor market outcomes in Asia and the Pacific—in fact, there is no other region in the world that highlights the challenges and opportunities that stem from the 4IR better than Asia. There is one question that is on everyone's mind when it comes to the 4IR: Is this time different? As new technology allows us to automate increasingly complex tasks, should we finally be worried that "technological unemployment," as was warned by luminaries such as David Ricardo, Karl Marx, and John Maynard Keynes, would be borne out in the near future?

As computing capacity improves and becomes cheaper, its usage in production and delivery of services will spread across industries. For example, blockchain, which is "a digital, distributed ledger that keeps a record of all transactions across participating peer-to-peer networks," is set to transform businesses worldwide. But, is it different compared with technological innovations in the past? Economic history tells us that the invention of electricity and computers impacted all sectors and industries and spread across the globe. They gave rise to occupations that did not exist before, such as electricians, electrical engineers, computer engineers, software developers, website designers, etc. The technology of today will have similar effects; it is not evident why things would be different this time. But there is one aspect of the 4IR that is different than before: Increasingly complex tasks can now be automated (Autor 2015, Acemoglu and Restrepo 2018, ADB 2018). But this is to be expected, as technology has evolved from electricity and computers to quantum computing and artificial intelligence (AI). Should we be surprised that humans have invented increasingly complex machines to make production more efficient and cheaper? With each generation of technological breakthroughs, this is to be expected, as that is the very definition of human progress. It also gives rise to new types of jobs—from auto repair workers in the past to computer engineers and web developers in the present.

Moreover, it is important to keep in mind that not all technology displaces human labor. For example, magnetic resonance imaging (MRI) or X-ray machines in hospitals perform functions that humans cannot do, but they complement human labor in the delivery of medical care. Should we be worried about these types of technological advancements? No. This phenomenon has been described as "deepening of automation": when technological improvements increase the productivity of capital in tasks that have already been automated (Acemoglu and Restrepo 2018). Furthermore, with sophisticated medical technology, nurses can perform tasks typically performed by doctors. Also, these types of technologies have had the fastest adoption rates, as they are used in the delivery of services such as medical care that are in high demand. Breakthroughs in biotechnology do not destroy jobs, but they augment the value of human labor. Similarly, technological advancements in the delivery of public

[1] Youth population refers to people between the ages of 15 and 24.

services such as health, education, and social security do not necessarily destroy jobs but enhance the quality and provision of these services.

History suggests that technological advancements have raised labor productivity, lowered prices for consumers, increased demand, raised incomes, and underpinned economic growth and job creation. This time should be no different. However, displacement of workers from jobs that are being automated is real and has consequences on their future employability, income, and living standards (ADB 2018). Indeed, if history is any guide, the introduction of new technology during the first industrial revolution led to rising labor demand and wages, but this came after a protracted period of stagnant wages (Acemoglu and Restrepo 2018). This phenomenon has been dubbed "Engel's pause" or the "living standards paradox." As in the past, labor regulation and social policy can play a critical role in breaking out of the "Engel's pause" such that wages rise with increasing productivity. Technology is partly responsible for rising income inequality in recent decades (Autor Levy and Murnane 2003), and whether new advancements in automation will slow this trend depends critically on whether technology complements or substitutes human labor. If labor gets substituted in a greater number of occupations than before, then income distribution depends on whether labor has the bargaining power to reap the benefits of productivity gains. The role of labor market institutions and skills of the workforce is key in understanding how wages evolve and whether workers can transition smoothly to new tasks and occupations.

Recent Evidence

As big data and AI make possible the automation of even highly complex manual and cognitive tasks, there is increasing public concern that new technologies will soon take over everyone's jobs. Further fueling concerns are estimates indicating that more than two-thirds of jobs in various economies of developing Asia are at risk of automation. Will automation lead to widespread job displacement, with robots taking on the role of human workers across industries? How bad is this going to be?

Industrial robots, used largely in manufacturing, have become much more powerful and sophisticated due to technological advancements in AI and computing capacity. In recent years, the use of industrial robots has increased considerably: Between 2010 and 2015, the stock of industrial robots in Asia increased by 70% to 887,400 units (ADB 2018). The People's Republic of China (PRC)—the largest market for industrial robots—accounts for about 43% of all sales of industrial robots to Asia and the Pacific. Another 24% of sales is accounted for by the Republic of Korea, followed by 22% by Japan.

So, do robots displace human workers? According to Acemoglu and Restrepo (2017), the use of industrial robots in the United States between 1990 and 2017 was negatively associated with employment and wages. They found that an additional robot reduced employment by six workers, and one new robot per thousand workers reduced wages by 0.5%. They also found that the negative effects of robots on labor market outcomes were more pronounced in the manufacturing sector and in routine, manual, and blue-collar jobs. A study by the United Nations Conference on Trade and Development (UNCTAD) (2017)— which included a sample of 64 countries between 2005 and 2014—also found that increased robot use was associated with a slight decline in the share of manufacturing in total employment and in real wage growth. Further, robots displaced routine tasks usually done by workers on the middle rungs of the pay scale.

In contrast, Graetz and Michaels (2015) found that industrial robots increased labor productivity, total factor productivity, and wages in a sample of 17 developed countries, including 14 European countries, Australia, the Republic of Korea, and the United States. They showed that robotics accounted for 10% of gross domestic product growth, 16% of labor productivity growth, and wage growth within industries with higher robot density. In line with the result of Acemoglu and Restrepo (2017), they found that robotics reduced the employment of low-skilled workers and, to a lesser extent, middle-skilled workers, but had no significant effect on high-skilled workers.

Automation is set to replace more jobs in developing countries than in developed ones, according to a recent study by Frey and Rahbari (2016). They estimate that the share of jobs at risk of automation is about 77% in the PRC, 69% in India, and 85% in Ethiopia. This proportion is lower in Organisation for Economic Co-operation and Development (OECD) countries, averaging about 57%. Similarly, a recent report by Chang et al. (2016) showed that new technology poses both risks and opportunities for the Association of Southeast Asian Nations (ASEAN) countries. Several sectors with high value-added and providing employment to a large part of the population face risk of digitization and automation. For instance, in the auto sector alone, more than 60% of salaried workers in Indonesia and about 73% in Thailand face automation risks. In the case of Viet Nam, about 75% of workers in electronics 86% in apparel and footwear are at risk of automation.

However, the overall picture is not too grim. ADB (2018) finds optimism in developing Asia's job prospects based on the following four observations: First, new technologies only automate certain tasks but not the entire job. In fact, the automation of routine and manual tasks frees up human work toward more complex tasks. Second, job automation occurs only when it is both technically and economically feasible—a requirement met mostly in capital-intensive manufacturing, where, according to the report, employment shares were already low in 2015. Third, rising demand offsets or compensates for the job displacement effect of automation. Finally, technological change and economic growth create new occupations and industries, offsetting the displacement effect of automation.

When new technologies make possible the production of goods using fewer workers, the job displacement effects are often countered by other forces at play, with the net effect at the aggregate level being positive. For instance, the study by Bessen (2017) finds that computer use in the United States between 1984 and 2007 was not only associated with job losses in manufacturing industries but also with employment growth in nonmanufacturing industries. In particular, computer use was associated with a 3% per year job loss on average in manufacturing industries, but a

1% per annum faster employment growth in nonmanufacturing industries. Moreover, according to the McKinsey Global Institute (2017), automation at the aggregate level could raise productivity growth by 0.8%–1.4% annually.

As some jobs are made obsolete by new technologies, entirely new categories are emerging. An analysis of occupation titles in India, Malaysia, and the Philippines found that 43%–57% of new job titles that emerged in the past 10 years are in ICT (ADB 2018). For instance, in India, new jobs were driven mainly by different types of specialized technicians needed to work with computer-controlled machines. Many more new jobs will arise in healthcare and education and in finance, insurance, real estate, and other business services. Further, a recent study by Khatiwada and Veloso (2019) also find evidence that new jobs provide higher wages than old jobs.

Implications for the Future

While we should not necessarily be worried about massive job losses in Asia and the Pacific due to automation, it is becoming clear that shifts in the demand for workforce skills require adequate skills development or retraining and that workers with weaker foundational skills will face hurdles in seizing the opportunities that new technologies provide. The 4IR is expected to increase the demand for nonroutine cognitive tasks as well as generate new jobs that pay better wages. However, taking advantage of these developments requires a supply of agile and competent workers.

Indeed, as some jobs become obsolete, entirely new categories of jobs are emerging. According to ADB (2018), demand for jobs is shifting towards those that require nonroutine cognitive, social, and information and communications technology (ICT) (ICT) tasks. An analysis of four economies in developing Asia shows that over the past decade, employment in nonroutine cognitive tasks expanded 2.6 times faster than total employment (Figure 32.1, Panel A). Moreover, wages have also grown faster in nonroutine/cognitive types of jobs than those for manual jobs (Figure 32.1, Panel B).

ADB (2018) also finds that most new job titles have emerged in the cognitive and nonroutine category, with as much as 82% of new jobs in Malaysia in this category, and around 60% in India and the Philippines. A recent study by Khatiwada and Veloso (2019) categorizes new occupation titles by skill level. The authors find that majority of new work requires high skills: 62% of new job titles in India, 82% in Viet Nam, 80% in Malaysia, and 61% in the Philippines (Figure 32.2).

Khatiwada and Veloso (2019) also find evidence that new jobs pay better than old jobs. For instance, they find that in Viet Nam, across all industries, average monthly wages in new jobs are higher than those of old jobs. The wage gap is most apparent in mining, manufacturing, and construction. Even in agriculture, where wages have been persistently low, new jobs pay much better than old jobs. On average, new jobs pay 1.5 times more than old jobs in Viet Nam.

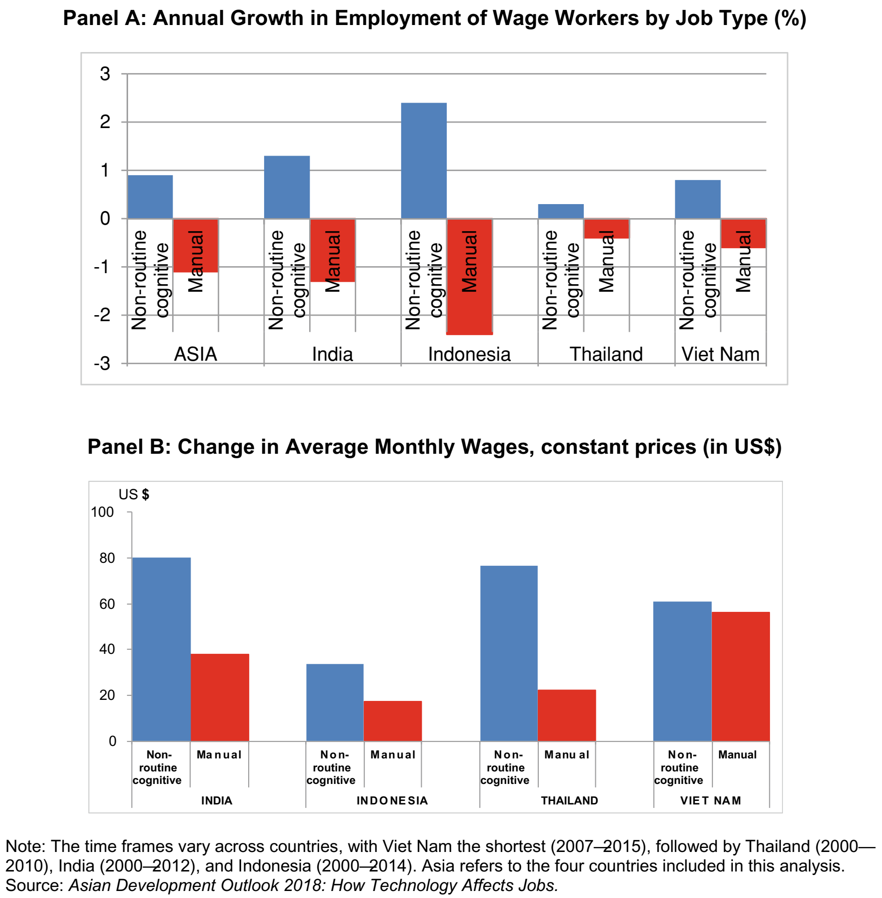

Figure 32.1 Change in Employment by Task Intensity of Work: Nonroutine Cognitive versus Manual Work. *Note* The time frames vary across countries, with Viet Nam the shortest (2007–2015), followed by Thailand (2000–2010), India (2000–2012), and Indonesia (2000–2014). Asia refers to the four countries included in this analysis. *Source* Asian Development Outlook 2018: How Technology Affects Jobs

Conclusion

The Fourth Industrial Revolution provides a unique opportunity for the region to create new high-quality jobs and vastly improve the job quality and productivity of existing work. However, capitalizing on new opportunities in promising sectors will require strengthening and reforming national education and training systems and equipping workers with the qualifications and skills to compete for emerging jobs.

Policymakers should enhance the quality of available technical training programs and ensure that they meet the current and future labor market needs. The inclusion of technical training in secondary education by developing technical and vocational

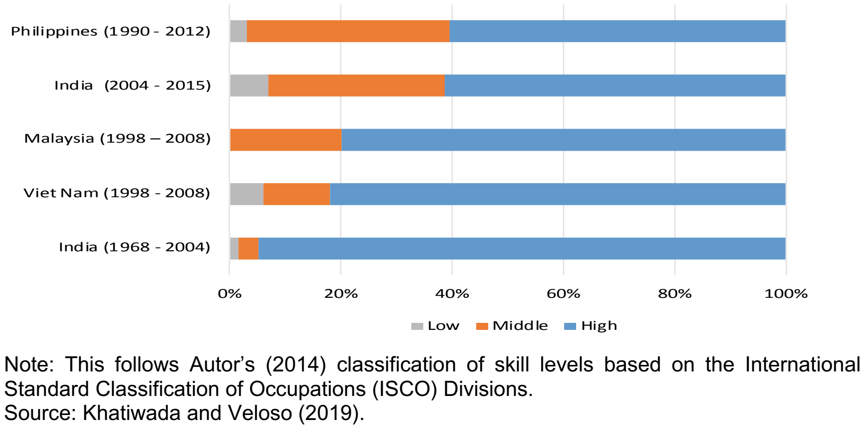

Figure 32.2 Share of New Job Titles by Skill Level. *Note* This follows Autor's (2014) classification of skill levels based on the International Standard Classification of Occupations (ISCO) Divisions. *Source* Khatiwada and Veloso (2019)

education and training (TVET) hybrid models should be strengthened. High-income countries are increasingly characterized by knowledge rather than means of production. Countries in Asia and the Pacific must also ensure that their workers have the skills to thrive in the knowledge economy. Delivering TVET through quality apprenticeships will benefit both workers and potential employers. Moreover, direct industry involvement in curriculum development and quality assurance ensures that TVET is in line with labor market demands.

There is also a need to increase the use of ICT in education. Policymakers should take advantage of the scalability of ICT by making it an integral part of education delivery. Using ICT can help deliver TVET to a wider audience, create a more open and flexible learning environment, and allow access to enhanced learning through interactive content. Such flexibility will produce TVET that is more responsive to the labor market's needs.

Link to the presentation material: https://events.development.asia/materials/20171213/jobs-and-technology-implications-education-and-skills-development.

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Chapter 33
Skills Development Driven by Labor Market Demand

Sang Hyon Lee

In 2017, I visited the Samsung Electronics Bac Ninh near Ha Noi to provide consultation services to design the labor market information system for Viet Nam's Ministry of Labour, Invalids and Social Affairs. At the time, Samsung Electronics Bac Ninh was a mega factory with 110,000 employees. The inside of the factory was quite surreal to me. Thousands of young ladies were lined up in rows, wearing the same pink uniform, knotted hairstyle, and sandals. The factory was so huge that you could even see vanishing points. I had been in many mega-factories such as Pohang Iron and Steel Company or POSCO (the largest steel processing company in the Republic of Korea), Hyundai Heavy Industries, and LG Chem in the Republic of Korea (ROK). However, this branch of Samsung Electronics was really different in that it was extremely clean, quiet, and labor-intensive.

The building at Samsung Electronics Bac Ninh that I visited was where smartphones were assembled. One unit of the assembly line consisted of around six steps. The sixth step resulted in a completely assembled smartphone. The HR manager who showed me around the factory proudly told me that they had replaced one step of the assembly line with a robot. One out of six workers had replaced with a robot. One out of six jobs—gone. The Fourth Industrial Revolution, or Industry 4.0, was underway at Samsung Electronics Bac Ninh.

With the introduction of Industry 4.0, technology is changing at an unprecedented rate. What's worse is that technological development is speeding up and affecting other fields. With all of these technological changes, labor market dynamism is growing faster than ever, and the mismatch between workers' skills and the skills required by available jobs has become a high-priority policy concern. Many employers report difficulties finding suitably skilled workers, even though the unemployment rate is high (OECD 2019).

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Skills are an essential asset for individuals, businesses, and societies. To challenge the rapidly changing labor market, it is necessary for workers to receive lifelong learning and career development, as well as employment services for career transition. Training institutes must adopt a more agile and resilient approach to planning, implementing, and evaluating courses and curriculum based on rapidly changing labor market demands and emerging industries. Training programs must close skill gaps and address the mismatch between supply and demand to address labor market dynamism (OECD 2017).

However, many countries in which I have provided consultations, especially those with limited resources for skills development, have not been able to achieve successful results with their skill development programs. Skill development is an important major investment in social and individual assets. However, many skill development programs perform poorly and do not translate into employment. These poor returns of investment are mainly caused by programs' lack of relevance with labor market demand and weak link to employment services. The ultimate goal of skill development is not a graduation or the completion of the training course. The ultimate outcome of skill development is matching trainees to jobs. To make a wiser and more productive investment in skill development, skill development should be linked to labor market demand and public employment services.

Sources of Labor Market Information

Accurate, relevant, timely, and accessible labor market information is critical to the nation's economy. Labor market information is essential for building a skilled workforce, supporting career choice and development, and understanding the rapidly changing world of work. It is important to develop evidence-based skill development and career counseling using labor market data. Labor market information includes all quantitative or qualitative data related to supply and demand in the labor market, such as the size of the workforce, unemployment, wages, working hours, worker statuses, skills, training and education requirements, and job descriptions (Woods and O'Leary 2006).

Skill development policymakers and training institutions are required to plan, implement, and evaluate programs, and to develop curricula that meet the needs of both jobseekers and employers. Labor market data, based on the skill sets in demand in each regional area, can be used to design the curriculum. Training policymakers can also use this data to determine the scale of training programs. Career counselors can help training candidates make decisions that will give them a higher chance of employment, based on labor market demands.

There are several ways to identify labor market demands and to close the gap between supply and demand. Some of these methods include labor demand surveys, employment projections, future job research, and real-time labor market information systems.

First, labor demand surveys are widely used and collected by governments to verify and analyze skill development needs. Labor demand surveys are conducted to find out about businesses' labor demands, such as the current number of employees, the number of job vacancies, the number of employees to be hired, the number of job openings, and the number of filled job openings, by industry, occupation, and establishment size.

Most countries conduct Labor Force Surveys (LFS) related to labor market data. Since LFS cover a limited number of occupational categories, they are useful for policy development; however, it is hard to use these surveys for skill development at the training course level.

In the ROK, the Ministry of Employment and Labor (MOEL) surveys a sample of 32,990 workplaces with five or more permanent employees. This survey is conducted twice every year, on April 1 and October 1. Survey items cover the current number of employees, number of job openings, number of filled job openings, number of unfilled job openings, number of job vacancies, number of employees to be hired, and reasons for unfilled job openings of 423 different occupations (4 digits level of Korean Employment Classification of Occupations). The government uses the survey results to develop various policies for the effective adjustment of labor demand. Training is one of these policy areas. Training authorities and institutes review the results of the labor demand survey and develop reasonable training courses (MOEL 2019).

However, the conventional way of collecting labor demand data through surveys is becoming costly and complicated. The biggest challenge of the labor demand survey is that it identifies demands in 423 occupations, but does not pinpoint any specific skills. To develop curricula, training institutes must take the survey results and conduct further research on the skill sets needed. The industrial sector, for example, uses labor demand survey data and develops curricula through the National Skill Standards.

Second, long-term labor market projection is critical for the preparation of skill development programs and policies. A labor market projection gives important information regarding supply and demand in the labor force. If we predict in advance that mismatching is likely to occur due to imbalances between the education and skills developed by employees and the demands of employers, it is possible to reset and provide additional education and skill development as needed.

In 2006, the ROK established the Labor Market Projection Center inside of Korea Employment Information Service and developed a long-term projection model for labor market forecasting. Ever since 2006, the Labor Market Projection Center, every 2 years, has developed 10-year projections using data from the Labor Force Survey, Local Labor Force Survey, National Income, Real Value Added by Industries, and Korea Labor Income Panel Study. Using this information, the center has been able to make long-term projections identifying the fastest growing and fastest declining jobs among 300 occupations (3 digits level of Korean Employment Classification of Occupations). By making projections about changing trends in the labor market by industry and occupation, the center has provided policymakers with the information needed to build a more efficient market mechanism for the development and allocation of national resources for skill development (KEIS 2012).

Third, IT technology and data have been developed for government services and policy decisions and are strong alternatives to the traditional survey method. Large volumes of government job-matching data may soon become the basis for people to find new solutions and may even give us insight into skill development programs that were previously not feasible. Job-matching data are real time-based and reflects current labor market supply and demand at the very detailed level of job descriptions, skills, qualifications, education, training requirements, working hours, wages, occupation, industry, and location (down to the street address).

The type of detailed information provided in Figure 33.1 cannot be collected using conventional methods, such as the survey program. Huge amounts of detailed information on jobseekers, job openings, and job placement are provided here, all in one place at a location called 'WorkNet.' WorkNet is an online and mobile job matching system that is used as a real-time labor market information system (LMIS) in the ROK. In 2018, WorkNet placed 1.8 million people among 4 million jobseekers to 2.4 million job openings. It also contains millions of data for big data analysis related to skill development.

Further, real-time LMI, with new technologies such as big data and artificial intelligence, may provide us with the new tools we need to solve many of our current issues in the labor market. For example, the ROK developed 'The WORK' system, which uses big data analysis on millions of clients who have successfully found jobs. Through 'The WORK' system, clients are able to receive personalized recommendations based on big data analysis using integrated information on jobseeker types and user characteristics, education, and training. Clients automatically receive a variety

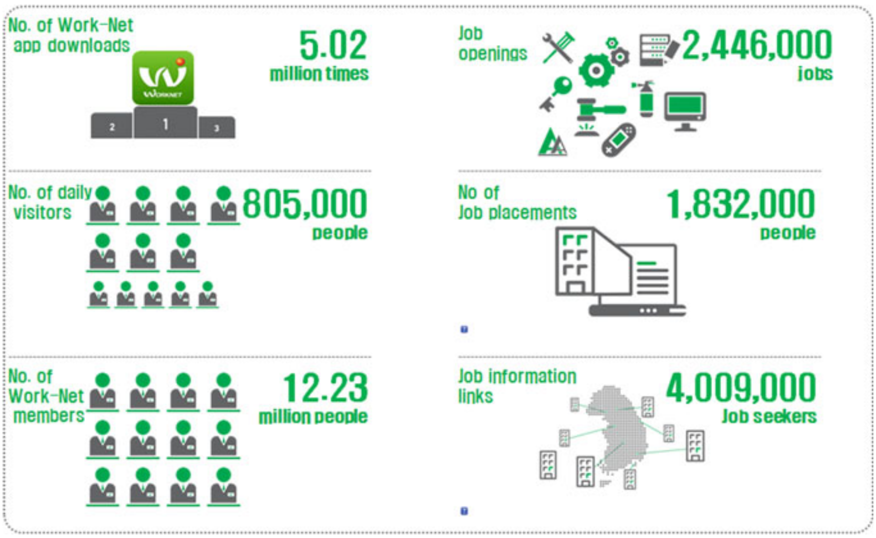

Figure 33.1 Aspects of LMIS the WorkNet

of individualized employment-related information, including information on vocational training, job openings, and government employment programs, all based on the stages-of-life analysis and answers provided by the individual user (Lee 2017a, b).

The WORK system is a smart matching service for individuals that uses big data. If we take a deeper look at big data, we may find company-specific skill sets, and even develop AI recommendations for training institutes based on the skill sets needed in the same city as the individual user. Skill development authorities and training institutes may also use this information to make decisions on training course size and/or curriculum. In the future, if we look deeper into big data in terms of real-time labor market information, we may gain a better understanding of real skill development mechanisms.

Collaboration Between Skill Development and Public Employment Services

PES (Public Employment Services) is an institute for unemployment insurance, the collection and provision of labor market information, career and skill development counseling, and job placement services. PES has the potential to play a key role in ensuring skill matches and investing in training. PES should reinforce the necessity of skill development as an important component of Active Labor Market Programs (ALMP).

Collaborating and connecting skill development with PES is critical for solving mismatching in the labor market. In order to promote collaboration between skill development and PES, in some countries such as the ROK, Japan, Germany, and the US, job centers provide individual counseling services for clients who want to participate in job center training. Clients must go through career counseling at job centers before they can join skill development programs. By undergoing career counseling, clients have a clearer understanding of labor market demands and training courses, including the job placement rate after course completion. They also have a clearer understanding of training purposes and career goals. After the training, participants are able to receive continued support from the career counselors at job centers for job placement. Job centers stay in constant communication with jobseekers, employers in the industry, and regional skill development institutes. In these and other ways, PES can help develop an ecosystem of employment and increase the performance of skill development programs.

Skill development programs and PES should communicate or collaborate to achieve better results and return the investment put into training. However, in Asia and the Pacific, PES and skill development institutes are often located under different Ministries; many of these ministries are very weak in terms of their communication with one another and their promotion of collaboration between job centers and training institutes. In many cases, public employment services in Asia and the Pacific have very limited functions except some developed countries.

For countries with weak PES, online and mobile job matching systems may be a very helpful alternative for physical job centers, since they are able to provide real-time labor market information with relatively low investments. I initiated official development assistance (ODA) programs for building job matching systems and mobile-based smart job centers with Viet Nam, Cambodia, and Mongolia.

Conclusion

The world of work is changing at a speed that we've never experienced before. People today must change their careers more often than in the past to meet the demands of the labor market. The key concept of career development has also changed from the personality of the individual to the social construct of a career. People keep adjusting their career goals based on their identity rather than interest, instead of staying at their workplace and maturing into a single career. Lifelong learning and lifelong career design are needed in order for people to increase their ability to adapt to a new job and workplace.

For lifelong learning and lifelong career design, skill development has become more important than ever before. Skill development represents a large time investment by the government, which theoretically translates into earning opportunities for participating trainees. To increase the cost–benefit of training investments, training decisions should be made based on clear evidence of labor market demand. In order to make informed decisions, governments must develop strong data on labor market demands in different areas and provide analytical research on LMI, occupational information, and employment forecasting.

However, even the LMI that do exist are not used fully by training institutes or local PES. In most cases, skill developers are not specialists in labor market statistics. Career counselors are sometimes inadequately prepared to deal with labor market information while providing skill development counseling for the purpose of publishing training vouchers or individual training cards. We need to increase the competencies and knowledge of LMI for skill developers and career counselors so that these programs can be better understood and used.

Skill development should not be isolated or located someplace far away from the labor market. It should be strongly and closely linked with the world of work. We need to look again at the roles of PES in skill development.

Link to the presentation material: https://events.development.asia/materials/20190828/labor-market-demand-driven-skill-development.

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Chapter 34
Implications of Industry 4.0 on Skills Development

Steven McKee and Danny Gauch

Much has been discussed over the past few years about Industry 4.0 on what it is and how it is transforming industry. The educational community has been examining the growing pace of industrial transformation through the lens of the Fourth Industrial Revolution, also known as Industrial Revolution 4.0 (IR 4.0) or simply Industry 4.0. It is clear that TVET will have an important role in supporting industry advancement while mitigating the fallout caused by the associated disruptions.

The main issues or challenges for TVET in this transformation require elevating learning and reskilling. We need to elevate our training systems to be able to train a highly skilled workforce that is required to support IR 4.0. This involves training new, more highly skilled workers or upskilling those already in industry. Those countries that are unable to do so may find that their industries may not be able to transform, which may therefore limit their competitiveness. This could also result in industries moving away from countries that cannot support the transformation. A number of industries and jobs may also become obsolete in the near future. Many of these vulnerable jobs are characterized by having predictable physical and routine tasks, collection of data, analysis of data, and processing of data. These displaced workers will need to be reskilled to do other jobs that are still in demand.

How do we then prepare our society for new jobs and opportunities that will arise and open up from these new technologies? Since we are unsure what these

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opportunities are, this poses a huge problem for the education system concerning how to train for jobs that we cannot yet define. This creates a dialogue about re-examining the foundations of learning and how best to strengthen foundational knowledge and skills.

IR 4.0 and the resulting changes may trigger what might be termed a Second Wave of Globalization. As industries transform, they may find that their older factories could now be considered to be in a suboptimal location. For example, in the textile or garment industry, as the plants become fully automated, they no longer need to be in a low-wage low-skill country as they need only very few highly skilled workers. Therefore, the new major considerations for location may change and things like the availability of highly skilled workers, proximity to markets, and/or sources of raw materials may become more important.

The future will see once again shifting economies and wealth, shifting production locations, shifting jobs, increasing urbanization, rising digital-based economies, increasing jobs mismatch, and displacement of workers all fueled by the relentless pace of change. The positive news is that it is very likely that the new age of IR 4.0 will bring increased growth in economic wealth as well as new jobs, businesses, and industries. Now, it is up to the society to take up the guardianship role to deploy that wealth in a way that is positive for not just our economies but for sustainable social transformation.

Issues and Challenges

Many challenges for both industry and education surround IR 4.0 such as issues that are still being debated and those that hinder the way forward. These include the lack of a clear understanding of digital operations, vision and investments required; unresolved issues around data security and data privacy in connection with the use of external data; insufficient talent to develop and implement these changes; a lack of digital standards, norms, and certifications; and those concerns around a loss of control over intellectual property.

Managing changes in teaching and learning is another challenge. Youth today are living in an increasing digital world and are adapting to technology quicker than is the education system. They are living, playing, communicating, and learning differently. They like to learn something when they need it (Just-in-Time Learning), not before. The old style of organizing education on an assembly line, time-based system which tries to load as much knowledge into the minds of the youth in advance of when they might need it is quickly becoming irrelevant and unnecessary. Can the present school system be transformed to deliver the current needs? The curriculum needs to be updated more frequently and to incorporate digital learning into its delivery methodology. A new pedagogy needs to be developed that will incorporate digital learning techniques. Moreover, teacher's skills and pedagogy need to be updated to infuse more technology into their teaching styles.

In terms of education, and also for TVET, we need to prepare a highly skilled tech literate workforce that can function in a multidisciplinary work environment and is comfortable incorporating technology in both their work and social lives. The job market is changing rapidly, and research indicates that perhaps 50% of the jobs that will be available over the next 10 years will be new and do not exist today. So how can TVET train for jobs that we do not know about and cannot measure and map? The TVET system needs to produce highly skilled workers with cross-disciplinary knowledge. Labor market information will be more important than ever before. However, producing forward-looking labor plans, based on existing or current data, will be increasingly more challenging as new jobs enter the market faster than we can define or quantify them.

Most countries' education systems, especially in developing countries, are geared towards training school-age learners. However, IR 4.0 requirements indicate that adult education will also need important attention for upskilling existing workers and retraining displaced workers. Changing skills will also have an impact on labor migration where workers are trained in their home countries to work in other countries. In order to be accepted overseas, higher and higher level of skills will be required.

IR 4.0 Challenges and Changes to the Workforce and the Society

There are many current perceptions of how AI will impact the future of work and many are not yet backed up by current evidence and are highly speculative.

Large changes and increases in productivity are expected in consumer goods, retail, hospitality, food services, energy, mining, media and communications, transport and logistics, manufacturing, construction, and financial and professional services. Traditional non-digital sectors such as healthcare are expected to reap up to three times the productivity and benefits of digital sectors. Many middle-income countries such as the Philippines, Indonesia, Malaysia, India, Thailand, and the People's Republic of China could see the highest employee productivity gains of up to 52% by 2021. AI and new technologies could create new jobs through three channels: directly within the tech sector (direct effect), indirectly in other sectors (spillover effect), and at the broad economy level (income effect).

There is contradicting information on where disruptions will hit the hardest and whether this will occur in developed or developing countries. However, what is certain is that there will be disruptions. Low skill and repetitive work such as in the textile and garment industries are vulnerable and many workers may be displaced.

In Asia, key challenges that could limit the benefits or results of IR 4.0 include the relatively low and uneven adoption of new technologies across firms and workers in different Asian countries. Moreover, there is a general lack of awareness by workers about reskilling benefits and opportunities. Governments and employers are often unable or reluctant to implement and/or fund worker-retraining programs. In addition, there is a lack of effective, scalable lifelong learning models and educational curricula struggle to keep pace with evolving skill needs.

It may not be necessary for all countries to adopt IR 4.0 to be economically successful and socially stable and satisfied. The more essential social debate is what do we want to be and what is our role in a technological future. It has been postulated that digital transformation is changing the world faster than we, as a society, have the capacity for change.

Each change from IR 1.0 to 4.0 has been accompanied by social and economic upheavals that happened either quickly or gradually. It seems certain that transformation will not happen evenly nor even all over the world at the same pace. Educational development projects need new models for designing, planning, and delivering new educational initiatives with a need to incorporate digital learning strategies.

Proposed or Useful Solutions

Learning How to Learn in a Digital Age—Embed Lifelong Learning into Schools

For IR 4.0 perhaps one of the best ways to prepare students for a more fluid workplace where they will regularly need to update their skills or learn new skills is to focus on teaching students how to learn. Use new technologies to create digital content that can be interactive and online so as give training when and where it is needed. In this way, the learning landscape can be widened and taken outside of the classroom. Schools need to be turned into learning organizations that also applies not just to students but to teachers and administrators. Teachers and administrators also need to practice lifelong learning.

Changes to the Educational System

It is recognized the growing importance of soft skills such as the 4Cs and these need to be embedded into learning and cultivated in students. Shifting from static educational systems to more dynamic ones would be a fundamental and positive change in many ways. Incremental improvement in the class and curriculum as well as learning together would promote lifelong learning and keep learning up to date and relevant. The organization of school faculties needs to be examined in the light of IR.40 and converging technologies. School design and organization should be different for digital learning: learning spaces in schools need to be created for digital learning, labs need to be restructured, learning expanded to outside the schools so that it can be anywhere, anytime (AWAT). The role of teachers will change to manage learning, mentor, and guide student skill development. TVET needs to continue to establish better and closer links with industry.

Making Use of New Technologies for Teaching and Learning

Schools and Institutions should develop their digital educational platforms for delivering new technologies. New digital content should be both interactive and engaging so that is matches the way students like to learn today. Cloud-based solutions are used to reach students off-campus and in remote areas. "AI experts" will arise for education to assist students while in school and afterward. There will be increased use of digital learning resources including VR and AR and new frameworks need to be developed for this. New structures such as open entry open exit classes or courses can be considered together with micro-competency certifications. These new technologies may be able to deliver differentiated and adaptive learning that will enable us to move away from traditional time-based education towards real competency-based learning tailored to individual needs.

Big Data and AI Enabling New Types Learning

Learning platforms in the future can be created that monitor student and teacher performance providing assistance and guidance during the learning process. We should move away from Linear Learning and move toward Non-Linear Learning. This would enable multiple learning pathways that could allow the students to learn at their own pace and in the manner that suits them. The data generated by student learning activities can develop a learning profile for each student that can then present the learning resources in the way most suited to them and adapted to their own preferences.

These above new requirements will not only increase the need for funding but also in the long run lower educational costs. Should all the burden of transformation fall onto governments or should this be shared by industry?

Examples of Good Practices

Development models and standards: The International Society of Technology in Education (www.iste.org) has very good standards for what it means to deliver twenty-first- century learning for students, teachers, administrators, and coaches. This is a good framework for sustainable transformation of learning in schools. The "3 I" model of investing proportionately in Infra-Structure, Info-Structure, and

Info-Culture provide a balanced implementation model for successfully introducing technology into educational systems.

K–12 preparation programs: Programs such as STEM stimulate students to be interested in science, technology, and engineering. STEM also strengthens their foundational knowledge of applied math and science thereby deepening the understanding of technology and engineering.

Curriculum implementation mapping: This needs to include not only theory and hands-on guidance but also digital learning needs. Lecture, Lab, and Digital modes of learning should be considered when planning where, when, and how instruction is delivered.

Models from industry: The use of continuous and incremental improvement systems with feedback loops has been the key factors in industrial transformation. The R&D process is also a good model for learning as it encourages learning by discovery, planning for outcomes and measuring results.

Application of Good Practices or Examples

During ADB's 8th International Skills Forum (2019) roundtable discussion on the implications of Industry 4.0 on skills development, the session provided illustrations of what is occurring around that world and provided a window on the change that is already happening. There were many models that were shared from the Asian region such as Malaysia, Singapore, Thailand, Indonesia, the Republic of Korea, the People's Republic of China, Cambodia, Japan, SEAMEO, India, the Lao People's Democratic Republic, Viet Nam, Australia, New Zealand, and others. The following are some of the good practices discussed:

Developing National Plans for Coordination of Industry and/or Education Towards IR 4.0

- National Plan for IR 4.0. Examples: PRC, Indonesia, Japan, the Republic of Korea (ROK), Malaysia, Singapore, Thailand
- National IR 4.0 Educational Frameworks. Examples: Malaysia Framing Malaysian Higher Educational 4.0; SEAMEO initiative on TVET 4.0; PRC, Japan, ROK, Singapore.

Stimulating Greater Technology Adoption and Worker Reskilling

- Ensure strong and even adoption of technology across firms and workers. Examples: Australia, Japan, ROK, Malaysia, Singapore.
- Build awareness of reskilling benefits, critical skills, and training opportunities. Examples: Australia, ROK, New Zealand, Singapore.
- Incentivize and encourage employers to retrain their workers. Examples: Hong Kong, China; Japan; ROK; Singapore.
- Foster close collaboration among governments, industry, and civil society to create relevant and effective nationwide retraining frameworks. Examples: Australia, Japan, Singapore.

Promoting a Shift in Emphasis from Qualifications to Skills

- Establish effective and skills-focused lifelong learning models. Examples: India, ROK, Lao People's Democratic Republic, Singapore, Thailand, Viet Nam.
- Ensure the relevance of educational curriculum to emerging skill needs. Examples: India, Indonesia, Japan, ROK, Thailand.
- Encourage focus on skills rather than just qualifications in both recruitment and national labor market strategies. Examples: PRC, Malaysia, Singapore.

Building Inclusiveness to Extend Benefits for All Workers

- Build inclusive models that allow underserved groups to benefit from new technologies. Examples: Australia, Cambodia, India, Indonesia, Japan, ROK, Malaysia, the Philippines, Viet Nam.
- Create social protection mechanisms for flexible workers. Examples: Australia, Malaysia.

Specific Initiatives to Support TVET and Educational Development

- Frequent curriculum updating. Examples: IAT schools in the UAE do it annually. The fluid and organic curriculum program in Malaysia may also move to annual reviews.
- Developing curricula that have multiple levels (like low, medium, and high skills) so that training can be delivered in an appropriate manner for different needs, as proposed by Malaysia.

- Developing Smart Campuses. Examples: PRC, India—Odisha (sponsored by industry), Japan, ROK, Singapore.
- Changing courses to match with Industry requirements. Examples: Universiti Tun Hussein Onn Malaysia (UTHM) of Malaysia, Future Skills Singapore.
- Southeast Asia Creative Camp sponsored by SEAMEO is doing summer workshops that experiment with training for new technologies such as VR, AR, Game Development, 3D printing, basic AI, Internet applications in courses outside of the regular school curriculum.
- Migrant worker upskilling. Example: The Philippines' TESDA is trying to create an online upskilling system that will offer higher levels of skills for its workers who intend to work abroad and to keep them relevant.
- STEM implementation as a feeder to TVET. Many countries, such as Indonesia, Malaysia, the Philippines, Singapore, and Thailand, are moving forward to adopting and infusing more STEM programs into their curricula.

Implications for the Future

It is clear that fundamental changes to the education system are needed to match our rapidly changing world. The dividing line between academic educational systems and TVET should perhaps be blurred, merged, or even eliminated. Enrollment ratios of Academic to Vocational schools at high school and tertiary level should be reconsidered with more students going into vocational or skill based programs.

Our educational leadership should be encouraged to develop a future vision that will transform our predominantly static systems into being more dynamic and open-ended. We also have a fundamental problem in that our leadership is aging while we are facing a situation of perhaps the largest generational change that we have seen (since the introduction of public education) and not all may fully understand or agree with this transformation. This change requires our educational leadership to not just allow institutions to transform but to rethink our overall systems. This requires brave, thoughtful, and dedicated leadership.

Events such as the ADB Skills Forum are vital in stimulating the dialogue that precedes change. Educational Ministries and Institutions would benefit by finding more ways to cooperate and collaborate with the educational industry to develop new educational platforms and content that utilize these new technologies for teaching and learning. In this way, the new systems that are being created would better match with overall needs and help propel educational transformation forward.

Conclusion

Now is the time to work towards using technology to implement better teaching and learning. Just like in industry, it is the effective use of technology that will transform our educational systems. By using new and converging technologies in various combinations we can open up a world of possibilities for educational transformation. Let us not forget that 5G communications will soon spread around the world and that will transform the potential for how we can connect and deliver educational resources. This is when this transformation can be turbocharged.

This may result in the most fundamental changes in a century to our educational systems. However, in this rush of transformation, we should not forget that we need to build into the future a useful, productive, and secure place for all people. Our educational systems are the guardian of our youth and culture while providing the foundation for our future. We need to not just curate but actively lead to ensure the world transforms into a better place.

Notes

A fuller version of this report can be downloaded from the following website: https://labtech.org/resources/

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6. Konstantin Matthies, Engagement Manager, Alpha Beta, Singapore.

Link to the presentation material: https://events.development.asia/materials/20190829/so-what-do-we-do-now.

Part VII
Cross-Sectoral Collaboration for Skills Development

Chapter 35
Build4Skills, TVET, and Infrastructure—An Innovative Initiative

Marion Edel

TVET in German Development Policy

The German Federal Ministry for Economic Cooperation and Development (BMZ) strongly champions recognizing the potential of technical and vocational education and training (TVET) for addressing youth unemployment, provided that a nation's TVET system delivers the skills required on the labor market. TVET is much more than just the mere acquisition of employable skills; it is a tool for empowerment and ultimately a facilitator for finding decent employment and securing a livelihood. A skilled workforce is a country's most valuable resource for achieving sustainable economic growth and development.

Germany is currently the world's largest bilateral donor in the TVET sector. The German official development assistance (ODA) allocated for TVET (€231 million in 2017) even exceeded the corresponding contributions of the European Union and the World Bank. The BMZ is providing support to develop TVET systems in more than 70 countries, including India, Indonesia, Lao People's Democratic Republic, Mongolia, Myanmar, Pakistan, and Sri Lanka in Asia, as well for five regional cooperation projects with the Association of Southeast Asian Nations (ASEAN) and Southeast Asia Ministers of Education Organization (SEAMEO). The BMZ's projects are implemented mainly by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), KfW Entwicklungsbank, and their partners in the respective countries.

The German TVET system is well suited to demonstrating how responsibility for administering and executing TVET may be a shared partnership between government and the private sector and how on-the-job training plays a significant role in acquiring the knowledge and skills needed to perform a job well. TVET programs in partner

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countries commissioned by the BMZ take inspiration from five key elements of the German dual training model:

(I) Close cooperation between the public and private sectors
(II) On-the-job training/workplace-based learning
(III) National TVET standards
(IV) Training of vocational teachers and instructors
(V) Institutionalized research and career guidance

In its programming, the BMZ emphasizes skills development in the context of forced displacement and migration, in the informal economy and in light of the new world of work and digitalization; TVET in rural areas and fragile countries; gender equality; and financing of TVET systems. The BMZ also places high emphasis on establishing like-minded strategic partnerships, such as the joint Declaration of Intent on TVET signed by the Asian Development Bank (ADB) and BMZ in 2016 at the 49th ADB Annual Meeting in Frankfurt, Germany. The joint objective of enhancing work-based training has been translated into the Build4Skills initiative (formerly known as the "Digital TVET Tender").

Untapped Potential for TVET in Development Banks' Infrastructure Projects

For decades now the German Government has been a reliable partner of multilateral and regional development banks in terms of providing funding for infrastructure and other development projects, and also in regard to providing start-up loans and support for entrepreneurs.

The world is witnessing a massive infrastructure gap. The United Nations defines such a gap as a pressing need for infrastructure development in the areas of transportation, energy, and water and sanitation in developing economies brought about by migration, climate change, demographic development, and urbanization. To enable economic development, developing countries, in particular, need sufficient infrastructures like railways, roads, and harbors. "[…] investing in a sustainable and resilient infrastructure, […] is a pre-requisite for achieving many of the SDGs" (source: https://developmentfinance.un.org/closing-the-infrastructure-gap). The Addis Ababa Agenda for Action—the outcome document of the Third World Summit on Financing for Development—calculates for this infrastructure gap an annual funding requirement of $1.5 billion—and upward. Many financing institutions and development banks, such as ADB, the African Development Bank, the Inter-American Development Bank, and KfW, or new players in this field like the Asian Infrastructure Investment Bank (AIIB) or new national development banks and venture capitalists are trying to bridge this gap. Mostly they perform quite successfully, even if the challenges remain massive. However, funding agencies worldwide are failing to tap into an additional potential of infrastructure projects: skills development! International, as well as national construction companies, tend not to consider the local labor force to any significant extent, nor would local labor markets be able to provide the number and quality of skilled workers needed. This results in staff being hired from abroad for the construction phase.

Apart from the BMZ's firm commitment to help fill the global infrastructure gap, we say: Let us do more than infrastructure! Young people worldwide need future prospects. Let us provide them with chances to equip themselves with skills for a prosperous future. TVET has the ability to produce larger macroeconomic gains for developing countries, to bridge the large gap in skilled workers, and to increase the effectiveness of development cooperation as a whole.

Infrastructure projects like roads, airports, harbors, etc., are among the most labor-intensive types of development interventions. Workers with various occupational skills are required. But how do we equip workers with the skills that are needed to turn those extensive projects into a success story for society as a whole?

Based on their Declaration of Intent on TVET signed in 2016, ADB and BMZ have launched the joint Build4Skills initiative, targeted at integrating TVET components into infrastructure projects.

The Innovative Vision of Build4Skills

BMZ's and ADB's joint initiative, Build4Skills, is aimed at generating dual development benefits from financial commitments for infrastructure. Its innovating idea is to leverage the potential of workplace-based TVET in infrastructure projects funded by regional and multilateral finance institutions such as ADB—meaning that, whenever a development bank like ADB makes a loan to a government, it will be used to build up infrastructure and for workplace-based training of local workers on the construction site. Build4Skills' long-term aspiration is to establish vocational education and training as a standard in invitations to tender for infrastructure programs.

Build4Skills will ensure that trainees learn in workplace-based settings and thus gain hands-on competencies that will increase their employability after they complete their training. Furthermore, it will enhance certification standards and the recognition of prior learning in line with the national TVET system. The project will assist public agencies in further developing their skills certification and assessment systems. Moreover, Build4Skills will include a digital tool for labor market monitoring and analysis, allowing for evidence-based policymaking.

ADB and BMZ have agreed on joint implementation guidelines that form the basis for their cooperation within the Build4Skills initiative. Together, they set up a steering committee to accompany the implementation process. ADB's core commitment is to provide Build4Skills with a construction site for on-site training. Furthermore, the Bank will highlight Build4Skills at major ADB events such as the International Skills Forum and in other formats within ADB to share good practices, as well as identifying other potential ADB projects for the implementation of Build4Skills. BMZ's contribution through its global project Build4Skills will be to manage the implementation of the initiative. Furthermore, a German expert seconded to ADB headquarters will liaise between ADB and BMZ and with other stakeholders and will support the development and implementation of Build4Skills.

The project references the successful TVET system that is operated in Austria, Germany, Liechtenstein, and Switzerland—the so-called dual system. Close collaboration between the government and the private sector is a critical part of a cooperative TVET system. The dual system's responsiveness to the private sector's needs makes it an internationally acknowledged and renowned point of reference for others.

The partnership with development banks, together with their engagement in infrastructure activities, provides the perfect setting for TVET measures. The potential impact is as follows:

- Infrastructure projects not only have a physical impact in terms of construction but can also contribute significantly to building up the pool of workplace-trained workers.
- Improving national certification and assessment systems for occupations in the construction sector as well as recognition of prior learning (RPL) will formalize competencies of workers and establish a reliable basis for recruitment.
- At the end of their training, trainees will leave with a nationally approved certificate that increases their employability.
- Skilled local workers will be available for the construction sector in a country.
- Skills development will serve to boost the competitiveness of companies and will foster economic productivity and development.
- Integrating a range of labor market data into a digital platform will facilitate skills gaps analysis with regard to future demand in the construction sector.

The benefits of the Build4Skills approach for our partner countries are obvious: On the one hand, a skilled local workforce that is well qualified for future infrastructure projects will be built up. On the other hand, the established workplace-based, nationally accredited training will significantly enhance both people's employability and the economic productivity of the country as a whole. We firmly believe that including TVET as an element in the tendering processes and procedures of infrastructure projects will ultimately benefit everyone: developing countries, the private sector, the lending institutions, and certainly young people seeking employment.

Build4Skills Taking Shape—A Pilot Project in Mongolia

Pilot projects are crucial for the realization of a new initiative: Substantial results need to be produced early on. Once initial successes and promising examples can be demonstrated, other countries and actors can be convinced to take part. After a sequence of consultations and missions on the design of Build4Skills, BMZ and ADB identified Mongolia as the first pilot country.

The ADB-funded Ulaanbaatar Urban Services and Ger Areas Development Investment Program, with its substantial volume of ongoing and planned infrastructure measures, will be the operational framework for the trainings. The project sites will provide the "on-site training space" for the work-based training. Together with Build4Skills, the German bilateral TVET project will provide technical assistance for adapting and developing on-site and school-based training modules to the needs on the construction site. For the assessment and certification of skills, Build4Skills is collaborating with the Mongolian TVET Assessment Center and the Mongolian Builders Integrated Association. Furthermore, Build4Skills will support in-company trainers of the contracted companies working on ADB's project sites with training in instruction and training methods for workplace-based learning.

Additionally, Build4Skills will support the development of a digital interface that collates a range of labor market data and information about future demand in the construction sector. The integration of existing data from several sources, such as the Ministry of Finance, the National Development Agency (NDA), the General Office for Labor and Social Welfare Services (GOLWS), the TVET Assessment Center, and the Builders Association, into the interface will provide more sound and valid data, thus allowing for evidence-based policymaking. The Mongolian University for Science and Technology (MUST) will carry out the development of the interface's concept. The interface will serve to assess the need for certain skills and the availability of skills, and analyze current and future gaps. Data analysis of the platform will have an impact on the national TVET system. It will be possible to reform it and adjust it to current needs: What is actually required by the labor market—now and in the future—will be clearly shown.

Build4Skills—Moving Forward

Build4Skills combines important strands of development cooperation. We are convinced that the joint contribution of ADB and BMZ will produce net benefits both for high-quality infrastructure development and for a sustainable society by creating future prospects for a country's most valuable resource—its human resources!

To make the project a success, the engagement of private companies is crucial. To run a dual and cooperative TVET system, public and private stakeholders need to play their part, cooperate, and share responsibility in order to build up a well-qualified workforce. Build4Skills will advocate building up strong networks of relevant stakeholders, jointly shaping TVET systems according to the needs of everyone involved—companies, trainees, and the state.

Build4Skills' long-term vision and aspiration is to establish TVET as a requirement in tendering processes for infrastructure projects (similar to social and environmental standards). We would like to encourage our partners to take advantage of this early stage of the project to identify viable solutions to create a double impact from infrastructure loans.

The unique partnership of BMZ and ADB within the framework of Build4Skills can serve as a promising model of interorganizational cooperation for other sectors of development cooperation. With the valuable insights gained from the pilot in Mongolia, the Build4Skills initiative could be rolled out and adapted to the context of other partner countries facing similar challenges in the construction sector, and thus attract the attention of more donors and increasing the interest of the private sector in taking part in this innovative approach. Therefore, BMZ intends to promote Build4Skills further among its partners. The innovative approach of ADB and BMZ will be highlighted using proven evidence and best-practice examples from our pilot projects to keep the initiative on the global agenda.

Links to the presentation materials: https://events.development.asia/materials/20160920/skills-development-part-infrastructure-projects, https://events.development.asia/materials/20190828/build4skills-innovative-idea-shaped-being.

Chapter 36
STEAM Platform: Transforming Youth Leadership for a Smart Circular Economy

Lerwen Liu

The Problem Stated

The greatly changing global youth population dynamics, especially in the Asian region, along with a significant rise in skilled youth unemployment, is alarming for global organizations. Youth are expected to play a critical role in the rapid development from a linear to a circular economy with the adoption of next-generation technologies such as advanced robotics, big data analytics, artificial intelligence (AI), nanotechnology, biotechnology, 3D printing, Internet of Things (IoT), etc. The convergence of these technologies is transforming food and agriculture, energy and environment, manufacturing, healthcare, and materials. It is critical to equip the future workforce with the convergence of knowledge and skills through capacity-building programs that embrace such a technological revolution including Industry 4.0 (IR 4.0) and the so-called smart circular economy.

In the Asian developing countries, particularly non-English-speaking countries such as Thailand, most youth lack confidence and are poor in communication, especially in English. This, together with other cultural reasons, has resulted in the youth of today lacking motivation and clear goals, and they are poor in planning and in the systematic execution of tasks. This has led to poor performance and levels of accomplishment and has created a vicious cycle of lack of motivation, goals, planning, execution, performance, accomplishment, and confidence.

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Finding Possible Remedies

To address these challenges, the authors of this article created the Science, Technology, Engineering, Arts, and Mathematics or STEAM Platform at King Mongkut's University of Technology Thonburi (KMUTT) in Bangkok in June 2018, to build youth leadership through promoting excellence in research, innovation, education, and entrepreneurship (RIEE) with a focus on young researchers including undergraduate and graduate students.

The STEAM Platform consists of three pillars: knowledge convergence, skills and mindsets, and entrepreneurship (see Figure 36.1). It focuses on four sectors: food/agriculture, energy, materials, and healthcare. STEAM Platform seeks to empower youth in Asia to become global leaders, equipped with the convergence of science, technology, engineering, arts, and mathematics (STEM) knowledge, life cycle thinking, and strategic communication skills and entrepreneurship practices toward the Sustainable Development Goals (SDGs) 2030 and the Smart Circular Economy transformation. This seeks to create a positive cycle of motivation (excellence), goals (SDGs 2030 and Smart Circular Economy related to their studies and research), planning (scientific and systematic thinking), execution (entrepreneurship practices), performance, accomplishment (excellence), and confidence (strategic communication skills).

The STEAM Platform adopts a unique approach (see Figure 36.1) in transforming students and young researchers and faculties at KMUTT who have represented Thailand's leadership in sustainable development through a Smart Circular Economy at various global forums. These approaches are globalization couples with localization; digital couples with physical; peer-to-peer couples with senior-to-youth;

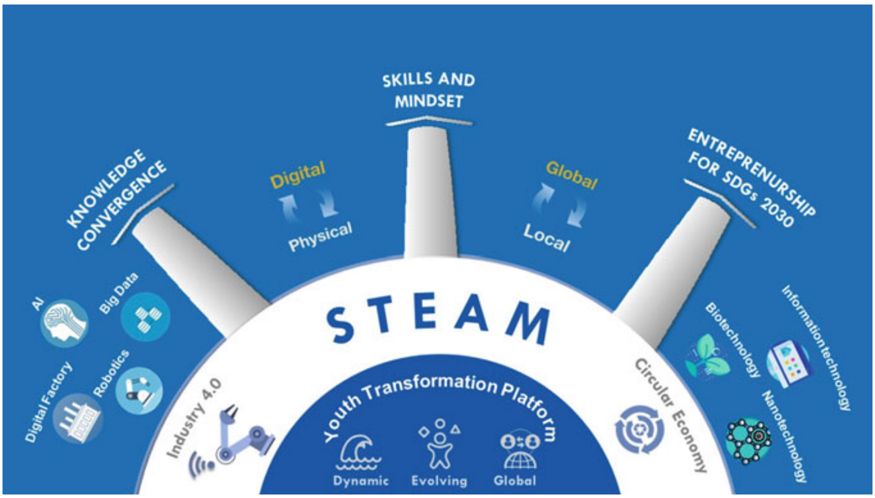

Figure 36.1 STEAM platform framework

entrepreneurship driven by the convergence of STEAM knowledge and business models (designed according to the sustainability principle, Circular Economy, and SDGs 2030); and skills and mindset developed experientially through STEAM Platform internships.

The Platform provides internships, workshop training, and one-on-one mentorship for youth by forming teams of STEM students/researchers with a diverse technical background and design/communication expertise, guided by technical experts and entrepreneurs. The STEAM interns are provided unique opportunity to showcase their activities in RIEE at global forums, exhibitions, workshops, and seminars where they are able to communicate their ideas and output to their peers overseas as well as to experts from all over the world. The output of the STEAM Platform includes confident and excellent communicators of STEM knowledge and motivated passionate technopreneurs who transform the perception of Asia as global leaders in IR 4.0 and Circular Economy. The STEAM Platform builds partnerships with stakeholders and global players in transforming the world for sustainable development. STEAM integrates AI, biotech, nanotech, and information and communication technology with a sustainable business model (ethics in responsible development) in solving problems and empowering young entrepreneurs in driving the green economic transformation.[1]

How Is This Accomplished?

The STEAM Platform focuses on the goal of promoting academic excellence and purpose of SDGs 2030 and circular economy transformation through various activities and engagements. Among these are short-term goal-oriented and contemporarily relevant technology innovation contests and showcases at global forums (in Austria; Hong Kong, China; the Republic of Korea; the Philippines; and Singapore within a year) focusing on enabling technologies for IR 4.0, such as advanced robotics, digital factory, big data analytics, IoT, and machine learning, and circular economy relevant sectors, such as energy (solar photovoltaics, bioenergy, and system solutions), food/agriculture, and materials. Another activity is conducting training: Strategic Communication Training for young researchers to enhance visibility and impact, build confidence, acquire presentation skills, and develop a global perspective; and Skills and Mindset Training on the life cycle and critical thinking, media communication skills, and entrepreneurship; and global mindset. STEAM Platform also engages in building strategic partnerships with global organizations (including the Asian Development Bank [ADB], World Bank, and United Nations) to create impact and further enhance motivation and goals for the youth; piloting a general education module GEN352 to scale the STEAM Platform program to undergraduate students within KMUTT; and internships to promote learning by doing. Details of GEN352 can be found in the textbook "Introduction to Circular Economy"

[1]The STEAM Platform's progress is being live-updated at its website www.steamplatform.org, the Facebook-STEAM Platform, and YouTube Channel STEAM KMUTT.

published by Springer Nature in October 2020, edited by Lerwen LIU & Seeram RAMAKRISHNA.

The following two case studies elaborate on these practices:

Example 1: Technology Innovation Contests

The STEAM Platform was launched by competing in the international contest of InnovAction (iCAN) 2018 held in Hong Kong, China. iCAN started in 2007 at Peking University initially with the goal of promoting students' confidence and capabilities in developing products based on microelectromechanical system (MEMS) technology. It has become one of the world's leading technology innovation competitions for students, hosted by academic institutions in Asia, Europe, and North America.

iCAN 2018 was hosted by the Hong Kong University of Science and Technology (HKUST). The STEAM team first carried out a university-wide campaign to identify and select competitive innovations for competing in iCAN 2018. More than 30 innovations were submitted by students, 5 of which were selected for intensive training after two rounds of pitching with mentorships by experienced international academic and industry mentors. The intensive training involved forming a team mixed with technical and design students as well as their advisors with personalized training by STEAM Founding Director Dr. Lerwen Liu, Senior Advisor Prof. Supapan Seraphin, and Communication and Intellectual Property (IP) Specialist Ms. Eliza Stefaniw from KMUTT for 3 weeks. Five teams were intensively trained on strategic communication (value-chain positioning and real-world relevance, English speaking and writing, and infographic representation), business models, and effective pitching techniques. KMUTT's performance at iCAN 2018 transformed the perception of Thailand in the arena of technology and innovation. The founding director of iCAN Prof. Alice Zhang from Peking University was particularly impressed and invited the STEAM Platform to be an iCAN partner in the Association of Southeast Asian Nations (ASEAN).[2]

The impact of the STEAM Platform on the four teams of undergraduate students (total of 12) who participated is summarized as (i) significantly enhanced self-confidence; (ii) development of a systematic and structured thinking for communicating deep scientific research; (iii) strengthening motivation for research, innovation, and entrepreneurship by developing the ability to link science to real-world issues relatable to the layman; (iv) obtaining a global perspective and positioning for knowledge and research topics; (v) receiving industry feedback and acknowledgment of their innovation and further strengthening confidence and motivation; and (vi) enriching cultural experience through interacting with peers from other countries.

[2]The following is the list of final projects selected and presented at iCAN 2018: (i) innovative pressurizer for engineered cartilage (https://www.youtube.com/watch?v=4HEtA6L-FO0); (ii) Agoribot (https://www.youtube.com/watch?v=kc8vlOF_vuA&t=137s); (iii) environmentally friendly and machinable lead-free brass (https://www.youtube.com/watch?v=c9KZk7UE9Z4&t=16s); and (iv) sustainable replacement of antibiotics and preservatives (https://www.youtube.com/watch?v=NqIPfFuOEkA&t=19s). Posters of the showcase are available at the STEAM Platform website, and their performance videos are in the links given.

One of the STEAM-trained teams (Pacharavajee Duangkaew and Neeranuch Rukying) developed bio-active peptides (with innovative processes resulting in improved functionality and lower cost) during their undergraduate final-year project under the supervision of Dr. Nujarin Jangruja (an assistant professor in the Department of Microbiology). After receiving intensive training on the STEAM Platform, the team, together with their advisor, won first prize in a start-up competition organized by the National Innovation Agency of Thailand on February 2, 2019, Thailand Inventors' Day. They also received first prizes in innovation competitions in Singapore (2018) and Malaysia (2019).

Example 2: Mentoring and Training

A final-year master's degree student, Mr. Podsawat Worakuldumrongdej (nicknamed Arm), was sent to us for mentoring by his thesis advisor Dr. Thavida Maneewarn (one of the top robotics researchers in Thailand) at the end of April 2019. Under the technical supervision of Dr. Maneewarn, Arm developed a drone with an innovative shooter that is able to perform precision rice seed sowing (with a few centimeters precision), which will transform rice farming and improve life on the farms, especially in Asian countries. He was also involved in producing solar farm-cleaning robots and other autonomous vehicles that are transforming manufacturing in Thailand. We trained Arm on (i) strategic communication for his innovations and products; (ii) zooming out of his innovative shooter, justifying the necessity and relevance of seed sowing on Asian rice farms; (iii) structuring his presentation and speaking/writing in English; (iv) entrepreneurship practices; (v) providing more data and demonstrations on real-field experiments; (vi) designing a business model for ANT Robotics as well as his drone, such as solar farm-cleaning robotics; (vi) business development and management; (vii) confidence building through presentation skills training; and (viii) providing a global platform for him to communicate and receive feedback from experts in agriculture and business from ADB, Japan, and Thailand.

We brought Arm together with other STEAM team members to showcase his solar farm-cleaning robot and drone at the Asia Clean Energy Forum 2019 during June 17–19. Our intensive 6-week training for Arm enabled him to articulate his innovative technology/product/solution, which has attracted interest from ADB's Private Sector Operations Department and Rural Development and Food Security (Agriculture) thematic group. The outcome of our training and mentoring of Arm has resulted in his having the confidence to set up ANT Robotics and become the chief executive officer. Arm was invited to exhibit at the ADB Rural Development and Food Security Forum from October 28 to 30, 2019 and is expected to be funded to conduct field experiments at the International Rice Research Institute in the Philippines in March 2020. See Figure 36.2.

Figure 36.2 Summary of STEAM platform's impact on Arm

Moving Forward

Within a year, the STEAM Platform has influenced more than 10,000 people worldwide digitally, and over 3,000 physically through events organized and participated in as well as training workshops. It has provided personalized training for more than 300 students and researchers. It has connected with over 100 companies globally and showcased over 50 innovations from KMUTT at global forums. See Figure 36.3.

The STEAM Platform has positioned KMUTT as a representative of Thailand being a regional/global leader in the areas of IR 4.0 and Circular Economy in research,

Figure 36.3 Summary of STEAM platform's impact during May 2018 to June 2019

innovation, education, and entrepreneurship. And KMUTT youth have been transformed to become confident, motivated, more innovative, and entrepreneurial with a global mindset.

We have established partnerships with ADB in the areas of education, rural development, food/agriculture, energy, healthcare, as well as ADB Investments and ADB Ventures; German Corporation for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit (or GIZ) in the fields of energy, food/agriculture, and circular economy; United Nations Development Programme (UNDP) Co-lab and United Nations Environment Programme (UNEP) in IR 4.0 and Circular Economy and youth entrepreneurship and leadership; and Leave a Nest in the areas of youth entrepreneurship, food/agriculture, and robotics/drone and bio/green materials.

Conclusion

By combining STEM knowledge with life cycle thinking and strategic communication skills, as well as entrepreneurship practices, Asian youth can be better prepared toward SDGs 2030 and a Smart Circular economy transformation. The STEAM Platform in KMUTT is able to demonstrate this by engaging and empowering youth in its various activities.

A full summary of STEAM Platform activities during 2018–2019 is available on STEAM Platform website (www.steamplatform.org). Currently, KMUTT has funded STEAM Platform during May 2018 to September 2020. We seek partnerships to scale up this platform to empower more youth in developing countries to transform global economic and social dynamics for a sustainable future.

Link to presentation material: https://events.development.asia/materials/20190927/asian-youth-driven-leadership-platform-towards-smart-ce-transformation.

Chapter 37
Human Resource Development and Gender Mainstreaming Under ADB-Funded Technical and Vocational Education and Training Project in Tajikistan

Eiko Izawa

The Strengthening Technical and Vocational Education and Training Project (the project/STVETP) was designed to promote a demand-driven, quality-assured, and flexible technical and vocational education and training (TVET) delivery system in Tajikistan. The Asian Development Bank (ADB) approved the project on 9 November 2015 for $34.0 million (ADB financing of $30.0 million, Clean Energy Fund financing of $2.0 million, and counterpart funding from the Government of $2.0 million). The project became effective in March 2016 and will close in February 2021. It is based on demonstrated market demand and is helping develop and implement industry-endorsed competency standards and competency-based training (CBT) through upgrading of the physical learning environment, training TVET teachers and masters, and strengthening the governance and management of the TVET system. To ensure market responsiveness, the project is promoting private sector participation in TVET policy, operations, and service delivery.[1]

The project is designed to include a strong gender mainstreaming element, promoting gender equity by directly addressing the problem of women's limited engagement in nontraditional higher paying occupations. The Ministry of Labor, Migration and Employment (MOLME) is the executing agency of the project. The project administration group (PAG) under MOLME is the implementing agency.

[1]Asian Development Bank. TA 9639-TAJ: Skills and Employability and Enhancement Project. Final Mid-Term Report. September 2019. Unpublished.

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Key Issues

Not Enough Jobs Being Created

Growth in the economy and population is not resulting in parallel growth in job opportunities. The country's economy is expanding, with its gross domestic product (GDP) growth rate among the highest of neighboring countries. Between 2010 and 2018, the average growth rate in GDP was 7.0%, and it is expected to be 7.0% again in 2019 and 6.5% in 2020.[2] Demographics present Tajikistan with an opportunity in that 55.0% of the population is under 25 years of age, meaning there will be a growing working-age population.[3] The working-age population in Tajikistan is expected to grow from 56.0% of the total population in 2010 to 62.8% in 2050. However, this economic growth is not being accompanied by job creation, and within the economy, there are several structural issues. The average growth in GDP between 2003 and 2013 does not correspond with the growth of new jobs in that employment increased by only 2.1% yearly.[4]

There is an urgent need to address the unemployment crisis. Skills upgrading, basic skills training, quick turnaround certification, and access to credit to promote self-employment must be put in place as soon as possible. A comprehensive program for job creation needs to be designed and implemented. Jobs must be created in rural areas. The industry and services sectors need to establish more sustainable, labor-intensive small- and medium-sized enterprises.

Labor Force Participation Is Low, Especially Among Women

The overall labor force participation in Tajikistan is low relative to its comparators, especially for women. In 2016, the female labor force participation rate was only 40.6%, which was 32.7 percentage points below the male labor force participation rate. In comparison, female labor force participation in Kazakhstan was 75.0%, 60.0% in the Kyrgyz Republic, and 51.0% in Uzbekistan.[5] Figure 37.1 shows that female participation lags behind that of males.

Women Tend to Be Lower Paid

Women tend to make up the majority of workers in agriculture. While agriculture accounts for only a quarter of GDP, 57.7% of the working force is employed in this sector, and very little has changed in this regard. In both 2010 and 2018, about 73% of the population lived in poor rural agricultural areas, where wages tend to be lower than in other sectors.[6]

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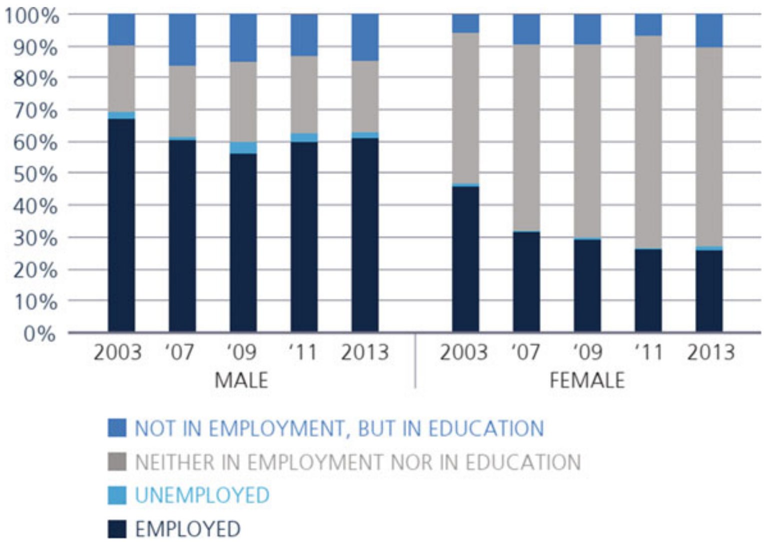
[2] World Development Indicators, The World Bank https://datacatalog.worldbank.org/dataset/world-development-indicators accessed 2019-07-10.

[3] World Bank. 2014. "The Skills Road: Skills for Employability in Tajikistan." Washington, DC.

[4] International Bank for Reconstruction and Development/World Bank. 2017. "Jobs Diagnostic: Tajikistan: Strategic Framework for Jobs." Washington, DC.

[5] *Ibid*.

[6] World Development Indicators, World Bank. https://datacatalog.worldbank.org/dataset/world-development-indicators accessed 2019-09-06.



Source: World Bank. 2017 "Jobs Diagnostic: Tajikistan: Strategic Framework for Jobs"

Figure 37.1 Labor force status as a percentage of total working-age population males and females 2003–2013

The informal sector represents a large and growing source of jobs in Tajikistan, but informal workers tend to be poorer than formal sector workers. While 18% of informal workers are in the poorest quintile of household consumption, only 11% of formal workers are in the bottom quintile.[7] Informal workers are more likely to live in rural areas and are more likely to work in construction and agriculture. Youth and females make up a large percentage of the informal workers with jobs that offer significantly less protection and poorer working conditions.

Challenges in the Technical and Vocational Education and Training System

The TVET system in Tajikistan is largely supply-driven. Most course structure and content are outdated, resulting in a mismatch between graduate skills and labor market demand. Ineffective engagement of private sector partners in TVET, both employers and private trainers, is a key problem. Skills gaps to address climate change are also an issue. Most TVET institutions have obsolete and inadequate equipment, dilapidated school buildings, and poorly maintained dormitories. The condition of physical facilities and the lack of modern curricula reinforce the generally low social image of TVET, contributing to the system's inability to attract students, particularly females.

Primary TVET suffers from deficiencies in both quality and quantity. The total enrollment in 63 lyceums in 2014 was only 21,593 students, of whom 18% were girls. The average enrollment size of 343 students per lyceum results in low student–teacher ratios (9:1), high unit cost (TJS1,400 per student per year compared with

[7] World Bank. 2014. "The Skills Road: Skills for Employability in Tajikistan." Washington, DC.

TJS900 in general education), and a low percentage share of internally generated funds (22%) to total funding.[8]

Weak faculty development has resulted in inadequately trained teaching staff. The salary scale of TVET teachers and masters remains very low compared with other civil servants, and employees in the industry and services sectors. Investment in TVET teacher salaries and training is required to build capacity, modernize technical and training skills, match skills to emerging market needs, and increase retention of qualified TVET teachers and masters. Efforts are also required to attract more female teachers and masters to act as role models for female trainees.

Gender Mainstreaming

The project targets to significantly increase female enrollment in nontraditional TVET courses through a number of strategies. Tajikistan has a relatively traditional culture when it comes to the role of women in society, and to overcome this tradition it was determined that there will need to be a multipronged approach to encourage more females to want to work in nontraditional jobs. An intensive and extensive social marketing campaign was initiated to encourage parents and communities to send their girls for training in nontraditional occupations. The project is also providing stipends to encourage girls to enroll in and train for nontraditional occupations. To make female trainees feel comfortable within the living environment while attending courses, exclusively female sections are being created in dormitories. Also, female-friendly facilities are being installed in school buildings such as gender-segregated toilets. To provide positive role models for girls, the number of female teachers and masters in nontraditional courses, and the number of women in the management staff of TVET institutions are being increased.

One of the key project activities is the Gender Equity Model Program (GEMP), which is the overall program for the project's gender mainstreaming including a survey, training, awareness-raising, gender networking, and impact assessment. The GEMP will further address low female participation in TVET, which will demonstrate the effectiveness of temporary special measures in encouraging women and girls to get into nontraditional occupations.

[8]ADB. 2013. *Technical Assistance to the Republic of Tajikistan for Preparing the Strengthening Private Sector Participation in Technical and Vocational Education and Training Project.* Manila (TA 8546-TAJ).

TVET System Methodology Modernized

To ensure that new methodologies for TVET reflect basic core messages on gender equality, a modular training guide was produced and adapted to each of 17 occupations for curriculum and learning materials developers. To adapt each of the 17 occupations being developed, the project hired an international gender expert to conduct trainings for those who draft curricula and learning materials. At least 50% of the members of each of the 17 groups of curriculum and learning materials developers (composed of industry experts and TVET curriculum experts) have undergone gender orientation/training. All Engineering Pedagogical College in Dushanbe staff (49), all Center for Training Methodology and Monitoring of Education Quality trainers, all members of each of the five industry working groups, all nominated expert panels, all members of each industry association, and all members of industry advisory committees (IACs) of each lyceum have undergone gender orientation to understand gender issues relevant to their TVET areas.

The participation of women experts in the industry expert panels and curriculum expert panels was ensured by having the PAG Gender and Education Specialist jointly with the CBT Coordinator and the Industry Partnership Specialist always consider the participation of women in all panels during the formation and functioning of the groups. In the five sectoral working groups under the ministries and state committees, of a total of 40 members, 9 or 22.5% are women, and of 195 members of industry expert panels, 60 or 30.8% are women. The project is working toward having at least 25% of the technical experts trained and accredited as competency assessors be women.

Gender analysis of assessment results is being undertaken to identify factors that explain differences in assessment results, as well as to determine recommendations to address gender issues that have emerged. To do this, student assessments will be disaggregated by sex with a particular emphasis on female students enrolled in nontraditional courses.

Physical Learning Facilities in Selected TVET Institutions Upgraded

To ensure that each dormitory rehabilitated has a separate and secure section for females with appropriate equipment and facilities, each of the contracts with different construction companies specifies that these conditions must be met. The PAG legal advisor, Gender and Education Specialist, National Regional Centers (RCs), and GEMP Coordinator conducted special information sessions or construction workers. All rehabilitated classrooms and workshop buildings will have separate toilet facilities for females with doors that ensure privacy and security.

Access to Quality TVET Programs Improved

To ensure participation of women as TVET teachers and masters in competency-based trainings, the goal was to have at least 35% of all TVET teachers and 25% of the masters in project lyceums and adult learning centers trained on competency-based teaching methodology be women. To achieve this goal the PAG staff pays special attention to the implementation of this target with the result that women in pilot lyceums, RCs, and IACs constituted from 33 to 55% of the participants who underwent training on CBT methodology.

To increase female enrollment in nontraditional occupations, intensive community awareness-raising activities were undertaken. The goal is to have at least 30% of students enrolled in diploma and certificate courses in project lyceums be females and at least 25% of students enrolled in 12 nontraditional occupations be females. To facilitate the development of awareness of nontraditional occupations, an advertising firm was hired. In the early stage of the project implementation period, the project has reached nine districts and cities covering nearly 2,000 parents and community leaders. Three kinds of brochures and leaflets were drafted, published, and distributed among the population, community leaders, and RCs, and used as handouts during trainings and round tables. The publications on GEMP were done in three languages: Tajik (6,000 copies), Russian (100 copies), and English (100 copies). One film on nontraditional occupations was produced and used during advocacy campaigns. Hired in September 2018, the local implementation firm Peshsaf has continued with this work, resulting in a number of articles appearing in newspapers and magazines, and on television and radio.

The goals are to have the average enrollment of females in 12 CBT nontraditional courses in the five pilot TVET institutions under the GEMP increased to 25% of total enrollment by the third quarter of 2020 and to have at least 50% of GEMP graduates certified in nontraditional occupations. To this end, 2,230 women and girls, including those who are poor and vulnerable, in selected lyceums are being fully supported in the GEMP through stipends and priority placements in rehabilitated dormitories. To facilitate the offering of stipends and priority placements, MOLME signed a decree on 5 March 2018. As of September 2019, there were 873 female (39%) GEMP beneficiaries. To speed up the process, the project announced a contest for the best gender advocate. Students are receiving stipends upon receiving relevant certification documents. The process of payment for teachers who provided 3-month services in the courses, which were not budgeted, has started.

The industry partnership specialists (international and national), while working to forge partnerships with industries, are attempting to ensure the employment of female graduates of nontraditional courses, with the goal that at least 50% of all project partner enterprises employ female graduates in nontraditional occupations.

The project is attempting to ensure there is significant participation of women in its Market-Responsive and Inclusive Training Program, which provides skills training beyond the 17 priority occupation skills, targeting youth in 29 districts. As of June

2019, the total number of trained people through this program was 510, 277, of whom 54,3% were women.

Governance and Management of TVET System Strengthened

To project the importance of having women in leadership roles, the project has hired 27 women out of a total of 87 PAG staff or 31%. All PAG officials, staff, and consultants are familiar with the project Gender Action Plan and are aware of their specific roles relevant to the achievement of these targets. This was achieved through conducting trainings, workshops, and gender sessions for different target groups in which PAG officials, staff, and consultants participate and as well during staff meetings.

The goal is to have at least 20% female membership in each IAC established in each lyceum receiving additional support from GEMP. The total number of IAC members is 125, of whom 28 or 22.4% are women. All women management staff in each project lyceum are to participate in trainings on modern educational management approaches. Of the 2,634 participants who took part in the CBT trainings, 798 or 30.3% were women. Gender indicators have been included in the monitoring framework for the project with the baseline and tracer studies, which included the requirement to collect additional gender-disaggregated data. Official statistics are being collected from MOLME on the enrollment of students and employment of graduates, as well as gender analysis of trends in the employability of TVET graduates. For the 2018/19 school year, the total number of students in lyceums was 22,903, of whom 5,075 or 22% were girls. This compares with 21,593 students and 18% females in 2014.

Conclusion

The STVETP is a little over halfway completed, has shown good potential for addressing several of the issues related to TVET in Tajikistan, and is showing good progress at ensuring that more females are trained in and assume jobs in higher paying nontraditional technical jobs. The next 3 years will be critical in ensuring that the activities that have been initiated show whether gains will be made in the number of females being trained in lyceums across the country.

Link to the presentation material: https://events.development.asia/materials/20190828/energy-human-resource-development-and-gender-mainstreaming-under-adb-funded-tvet.

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Chapter 38
European Training Foundation: Sector and Cross-Sector Cooperation

Cesare Onestini

Traditionally, sector cooperation has been used as a mechanism to bring the world of work closer to the world of education through the creation of a mechanism for identification of trends and gaps, translation of skills to meet the needs for the future, and education requirements. It is now widely accepted that achieving viable sector dialogue is vitally important.

More recently, countries globally have experienced a more fluid and fragile situation. Changes in the labor market have become faster and deeper, breaking the cycle of established settings even in more stable and consolidated sectors. The European Training Foundation (ETF) publication "Getting Ready for the Future" outlines how in the fast-changing labor markets of today's economies, countries face difficulties to keep the labor market, with new forms of labor and economy, under control. Furthermore, a number of new actors are influencing and actively contributing to the skills "ecosystem," making the dialogue around skills much more demanding to be brought into order.

In today's and future scenarios, the ability of countries to effectively respond to the challenges related to human capital and skills development and usage will be linked to the ability to ensure an effective, multilevel governance, bringing together sectoral cooperation and multisector cooperation at different levels in the system from the provider level to the international and global levels.

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Issues and Challenges

The ETF Process review[1]—completed in 2017 covering 25 countries and analyzing the issues, progress, and future plans of countries concerning skills development and vocational education and training—shows that most active sectors in skills policy dialogue are mainly traditional sectors such as agriculture, construction, and tourism. More and more countries are also developing sectoral approaches to skills development in sectors like the energy, automotive, and textile industries and information and communication technology (ICT). In Serbia, for example, the ETF works closely with the ICT cluster of the autonomous region of Vojvodina, which is an example of how local actors cooperate within a specific sector approach.

In most countries analyzed, sector cooperation exists either in the form of sector councils or in the form of sectoral working groups/task forces. Positioned mainly at the national level, sector cooperation remains a key pillar of good governance of vocational education and training. However, there are new opportunities emerging and new modes of dialogue, which are being introduced to address the needs of countries to identify skills and offer increased opportunities for identifying labor demands. The needs of large sectors, as well as sectors not organized, or not formally identified as sectors, are all equally important when it comes to the identification of skills and future labor demands. The reason for the failure of a traditional approach to sector cooperation resides mainly with three key trends in the skills identification and formation process.

First, sectoral authorities/organizations are involved mainly in the formulation phase of policies, and not enough involved in the delivery, hence staying still too far from actual contribution to ensure the highest impact on skills formation. There is also a differentiation to be made between the dynamics and contribution of sectors characterized by the presence of large companies, and sectors composed of small/individual companies. Large company-based sectors have a higher capacity for involvement in the delivery of training, for example, through the provision of work-based learning, and participation in the identification and certification of qualifications. Small company-based sectors are more difficult to involve in the delivery of education and training, as they have limited capacity in terms of resources to interface with the formal education system.

Second, in most countries in development and transition, there are still limited opportunities for work-based learning and schoolwork alternation throughout life, hence diminishing the potential of the skills ecosystem that could be created by strong collaboration between sectors and providers.

Third, today and tomorrow's skills development and demands are more fluid and need other dimensions, on top of the sectoral one, to effectively form and deploy their potential.

[1]The ETF leads The Torino Process since 2010. The Torino Process is a comprehensive review of human capital policies and education and training systems, covering 27 countries in the EU neighborhood and Central Asia. The ETF will release in 2021 the results of the new round of reviews implemented in 2019–20.

A future-oriented skills development system plays across the local–global axes, requiring a high level of international cooperation in sectors subject to trade and economic agreements as well as with high mobility potential and requiring a smart skills specialization locally to ensure a "fit for potential" formation and deployment of skills in a given context.

Proposed Solutions

What are therefore the features of a future-oriented skills development system? Three features emerge from the ETF studies on governance in ETF partner countries:

The first is the effort to identify ecosystems for skills development that are more flexible and allow workers to shift and move in their careers as well as to understand complementarities. This implies that sectors and actors should "cowork" skills demands and skills formation requirements through building agile partnerships, which increase the relevance of skills provision. Even in traditional professions nowadays, there is higher complexity and higher demand for cross-sectoral cooperation. To achieve this, the traditional sectoral dialogue based on tripartite arrangements is enlarged to include diverse sectoral representatives but also adding to the dialogue are civil society, researchers, and local authorities to ensure that there is an attentive balance between present and future needs, as well as focus on flexibility and portability of learning pathways.

The second solution is a strengthened vertical dialogue, wherein skills come at the center of the reflection around the specialization and development of a locality, a region, or a geographically delimitated space. Next to sector councils, more and more countries are moving in the direction of regional and local councils/working groups focusing on skills development and partnerships. At the local level is often where communities emerge as innovative and entrepreneurial, pushed by a vision for development and competitiveness, which triggers the demand for, and hence the development of, skills.

The third solution is increased public–private partnerships in skills development and skills provision—a growing involvement of private actors in contributing to all phases of the skills development cycle, including in particular focusing on innovation and future demands. The increased presence in countries of innovation hubs, clusters, and innovation centers that bring together multiple actors with an economic drive focused on the future is an emerging model in many countries from Israel to Kazakhstan, to Belarus, Uzbekistan, Jordan, Morocco, Serbia, and many others.

Examples of Good Practices

Future skills need innovation and partnership to come into existence and to blossom. These factors are often to be found in cooperative arrangements that bring together multiple disciplines and expertise, and that have a high sense of ownership, of belonging, which is often found at the local level in communities working toward a shared vision and objectives.

In the past years, the ETF has implemented a project aimed at spotting these experiences in developing and transition countries. Ten practices were selected from Algeria, Belarus, Georgia, Israel, Jordan, Kazakhstan, Lebanon, Moldova, Montenegro, and Serbia and their features analyzed to distill the essence of what makes a local ecosystem work toward future skills and future work.

Some of these practices have been revolutionary for the impact they have made on policies. Take the case of Montenegro, where a small initiative in the village of Budva initiated by Chef Vuksan Mitrovic in the back of his kitchen became the first hotel school of the country and gave an opportunity for employment to thousands of people in the growing hospitality sector on the coast of the country. Or take the case of Algeria, where a farmer, Mohammed Brik, through his intuition and commitment, pulled together farmers to work with the local university and give hope and a future to the traditional agricultural methods, bringing youth back and ensuring sustainability and innovation in his territory. Or take the case of Kazakhstan, where a young entrepreneur, Arman Toskanbayev, sparked a partnership between employers and schools in the region of Karaganda and developed an initiative for training teachers in companies so they could be closer to the world of work and in turn be more attentive to their students' skills needs and development.

This project concluded that these partnerships exist and flourish despite the presence of institutionalized cooperation arrangements; but that only where these exist and have high recognition by policymakers can these visionary initiatives and practices flourish and influence system change. What policymakers should do in their own context and level of intervention is to ensure that the dialogue with local communities about the needs of citizens is continuously fed back into the policy agenda.

Recognizing the potential of cooperation of actors at the local level reinforces the ability of a system to identify the skills that are needed. Local, national, and also international dialogue on skills should communicate and cross-fertilize each other. In this context, some countries have increased their focus on decentralization of functions and roles with the creation of regional and local councils, which are often multisector.

In many countries where the ETF is active, decentralization and higher involvement of regions and local authorities in the dialogue around skills needs identification and skills formation is high on the policy agenda. The Torino Process of the ETF concluded in 2017 involved more than 30 regions from Kazakhstan, the Russian Federation, Tunisia, and Ukraine in the examination of skills demands and policies and practices at the local level. As of today, many more regions have joined the effort, with more than 50 regions now involved in the analysis of skills demands and policy relevance. This process increases the capacity of local actors and authorities to carefully analyze, consult, and make decisions on future actions to make skills more relevant and in turn to improve social and economic cohesion in their territories.

Also at the political level, decentralization in the area of vocational education and training is gaining momentum, and the ETF has been actively involved in countries such as Tunisia and Ukraine in supporting regional authorities that could take the lead and deliver on diverse skills demands and challenges at the local level.

The cross-country digest of The Torino Process, published in 2017 by the ETF, reports that: "*It is, perhaps, surprising to discover that only six partner countries* (out of 25) *refer to decentralisation processes in their national report*." The report, citing a study of the European Commission in 2013, notes that there is still a divergent trend between the evidence emerging on the benefits of decentralized governance systems in education and training, and the speed of countries to move toward such arrangements. This is partly due to the difficulty of many countries in shifting the policy culture and traditional setup to move toward governance arrangements that are most suitable and better support innovation and future skills development.

It is fair, however, to highlight that we cannot provide the perfect solution and a general model that could describe the perfect governance arrangement for ensuring skills for the future and innovation of vocational education and training systems. What can be said, with a certain degree of evidence coming from reports and from practices described above, is that the core of success relies on ensuring consultation, negotiation, partnership, and exploration of multisector needs at different levels from the local to the international.

How a country should then organize its own governance to ensure consultation; support partnership creation; and promote community, sector, and multisector innovation is something that needs to fit the specific country context, culture, and administrative arrangements.

Implications for the Future

Moving toward the future for sector and cross-sector cooperation means for countries ensuring a clear vision for skills development and requiring a high level of innovation orientation to keep up with the demands of the fast-changing needs of the labor market and forms of work. Countries are already and will be further investing in the revision of their governance models; they will review legislation but also increase the flexibility of arrangements, of support to partnerships at all levels in the system through soft measures and through incentives to capitalize on the potential of resources present in the country. To this purpose, the study on governance modalities completed by the ETF analyzing governance arrangements and effectiveness across more than 20 countries confirms that change management will be key for future vocational education and training systems.

Countries should equip themselves with a very clear understanding of different sector axes of operations, which will require a more demanding mix among key competences, sector-specific skills, cross-sector skills, and international qualification comparability and transferability.

Traditional actors engaged in skills development must further concentrate their attention to better analyze trends and include in the dialogue new and emerging sectors, and new actors. The roles of informal economy actors, civil society, employers who are not organized, self-entrepreneurs, and cyber and tech workers are evolving fast, and those actors will be essential for addressing skills needs and grasping the potential of future forms of work.

Conclusion

Effective multilevel and multi-actor governance arrangements remain at the heart of the possibility of a country system to meaningfully capture skills needs and anticipate demands. Sector consultation remains key in this picture, but it is not enough anymore. Effective skills policies in the global world of today require policymakers to be attentive learners to spot opportunities and learn from practices to mobilize change at the system level. In this context, ensuring partnership mechanisms from the local to the international level, and across sectors, is key for the future of skills.

Capturing the complexity and the diversity of needs will allow policymakers to transform demands into multiple opportunities, giving an inclusive answer to the diverse needs of citizens and societies. We can conclude with five pointers for sector and cross-sector cooperation for skills development:

(i) Ensure that multilevel and multi-actor governance principles are embedded in the system as a pillar of good governance.
(ii) Review legislation and soft mechanisms in place to bring them closer to respond to the needs of today and to prepare for the demands of tomorrow.
(iii) Focus not only on horizontal cooperation but also on vertical cooperation, which is by nature more multisector oriented.
(iv) Analyze sectors active in skills development policy dialogue and bring onboard new ones, in particular nontraditional sectors that are not organized.
(v) Learn from community-level initiatives, and let them flourish, eventually providing incentives to make them visible.

From the ETF "Getting Ready for the Future" report, we know that "*Ultimately, two things will shape the future of each country: their capacity to make a sound and realistic analysis of where they are today, and their ability to make the right choices and implement the right solutions to make the most of the opportunities and mitigate the challenges that change brings for sustainable and inclusive growth.*"

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Chapter 39
Developing a Robust System for Upskilling and Reskilling the Workforce: Lessons from the SkillsFuture Movement in Singapore

Michael Fung

The Fourth Industrial Revolution

The impact of the Fourth Industrial Revolution on economies, jobs, and skills, heightened by the exponential rate of change, is considerable. With digitalisation, we are seeing significant shifts in job roles and the corresponding skills required. A large part of our work today will likely be automated, leading to a decline in jobs in some areas, job growth in other areas, and substantive changes to many job roles.

In the future of work, the shelf life of skills is anticipated to decrease to five years, with individuals expected to update and refresh their skills six times throughout their 30-year careers to remain relevant at their workplace (Deloitte 2017). In Singapore, an aging population exacerbated by a shrinking workforce (DOS 2017) creates an even sharper need for individuals to remain employable for a longer period of their lives. This means that employability will depend more heavily on lifelong learning and skills development, and less on initial qualification (ManpowerGroup 2018).

Singapore's Minister for Education Ong Ye Kung said, "The entire education experience is changing because of the emphasis on experience and skills. Industries will now support a more skills-based model to ensure that young people stepping out of education institutions can contribute almost immediately. Hence, education and industry will be drawn closer together in the coming years, and industries will play an increasingly bigger role in education and training" (Singapore Ministry of Education 2019).

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Implications of the Fourth Industrial Revolution for Education and Training Systems

Education models in most countries, including Singapore, are still predominantly classroom-centric and institution-centric. Traditional, front-loaded education and training systems cannot fully prepare young adults for the jobs and skills required for the future (WEF 2017). To respond effectively to these new developments, education and training systems should shift towards a continual learning system for the workforce (Bughin et al. 2018).

SkillsFuture Singapore (SSG) works closely with stakeholders such as government agencies, institutes of higher learning (IHLs), and employers to ensure that skills training and upgrading for individuals continue to be readily accessible throughout their lives even as they move out of the school environment into the workplace. The IHLs together with employers and private training providers, form the three key pillars in our adult training and education landscape. In particular, the IHLs have evolved to play an increasing role in continuing education and training (CET). Traditionally focused on pre-employment training (PET) and education, the IHLs are now major providers of CET and promoters of lifelong learning, to ensure a tight nexus between learners' PET and CET throughout their lives. The National University of Singapore has moved to a model of "4 + 20" for its undergraduate education, whereby students graduating with a 4-year bachelor's degree can come back to the university for the subsequent 20 years to upskill themselves.

The IHLs are progressively incorporating more workplace learning components in their programme offerings. For example, the SkillsFuture Work-Study Programmes, introduced in 2015, is a work-study system that moves away from a model of classroom learning to one that involves industrial practice as an integral part of the curriculum. The system comprises the Work-Study Diploma (run by the Institute of Technical Education), Work-Study Post-Diploma (previously known as the SkillsFuture Earn and Learn), and Work-Study Degree run by the universities. There are some parallels between the Work-Study system and successful apprenticeship models in Germany and Switzerland. The intention is to scale up the range and intake of such programmes such that it becomes a mainstream pathway in our education and training system.

For working adults, the IHLs take the lead in offering the SkillsFuture Series courses across eight emerging and priority skills domains: data analytics, finance, tech-enabled services, digital media, cybersecurity, entrepreneurship, advanced manufacturing, and urban solutions. These short, modular courses focus on emerging skills and are available in three levels—basic, intermediate, and advanced—catering to learners with different skills proficiencies. Individuals can continually sharpen their existing skills and build new ones to stay relevant at work. By the end of 2018, more than 30,000 Singaporeans had attended courses in the SkillsFuture Series (SSG 2019).

To raise the quality of training and adult education, SSG introduced the Training and Adult Education Sector Transformation Plan (TAESTP) in 2016. The TAESTP identifies focal areas and recommendations to deliver CET training for the training and adult education sector. Initiatives such as the Education Industry Transformation Map and the Skills Framework for Training and Adult Education have been introduced to uplift the sector. As the education sector continues to transform, it is vital for individuals to achieve a spirit of lifelong learning and keep pace with the changing skills needs of the economy.

The SkillsFuture Movement

The SkillsFuture movement was launched in 2014 as a national skills strategy to help build the foundation for a highly skilled, productive, and innovative economy. Besides serving an economic objective, the SkillsFuture movement also seeks to help individuals realise their full potential, regardless of their starting points, enabling them to pursue their careers and interests. Various SkillsFuture initiatives have been introduced to target three groups of stakeholders, namely individuals, employers, and education and training institutions.

Individuals

Singaporeans can tap on SkillsFuture initiatives from as early as Primary 5 at the age of 11 years. For instance, the MySkillsFuture portal allows individuals to discover their interests through tools such as online self-assessment and games to help them understand the different industry sectors. The portal also allows them to explore education and training opportunities, and search for job openings across various industries.

In higher education, the SkillsFuture Work-Study programmes offer opportunities for students to learn through meaningful work assignments and industry exposure. The Work-Study Post-Diploma places fresh school leavers from vocational/technical tracks in salaried jobs while undergoing structured on-the-job training that lead to industry-recognised certifications. Some IHLs also offer overseas entrepreneurship programmes where students are attached to start-ups and tech companies in countries such as the People's Republic of China, India, United States, and Europe, to equip them with knowledge and appreciation of work cultures in different countries. These efforts by the education institutions ensure tighter coherence between education and work.

Beyond the schooling years, SSG ensures that learning continues to be accessible. All Singaporeans (aged 25 and above) are given a SkillsFuture Credit of SGD500, which can be used for some 20,000 courses on the MySkillsFuture portal. They can attend complimentary SkillsFuture Advice workshops to find out more about SkillsFuture initiatives and grants that can support their learning plans. Singaporeans in the workforce who wish to deepen their skills can apply for SkillsFuture Study

Awards or SkillsFuture Fellowships, which provide monetary awards to defray their out-of-pocket training expenses.

Employers

Companies and industry players (including trade associations and professional bodies) help identify skills gaps and shape the development of the SkillsFuture initiatives. At the industry level, employers participate in the development of Industry Transformation Maps and Skills Frameworks, which provide key information on various sectors, corresponding skills required for the occupations and job roles, and relevant training programmes. Employers also play a key role in employee training. They can leverage initiatives such as the Enhanced Training Support for small and medium-sized enterprises (SMEs), and participate in a range of Work-Study programmes to address their talent needs.

Exemplary employers that champion skills development are recognised through the SkillsFuture Employer Awards. The National Centre of Excellence for Workplace Learning was launched in 2018 to help employers enhance their workplace learning capabilities and develop in-house training systems. SMEs looking to expand their business overseas can also tap on the Internationalisation Talent (iTalent) Solutions Map and Internationalisation Skills (iSkills) Talent Development Programme to build their capabilities and skills.

Education and Training Institutions

SSG supports education and training institutions in their transformation of course delivery to ensure learning becomes even more flexible and accessible. A strong pool of private training providers, including publicly funded CET centers, exists to support upskilling and industry transformation. The CET centers offer a comprehensive array of courses that cover a wide range of industries, and provide additional services, such as employment advisory and placement. Additionally, there are capability development grants and technological support under the iNnovative Learning 2020 (or iN.LEARN 2020) initiative to support institutions on curricular and pedagogical innovation that facilitates learning beyond classrooms.

Critical Success Factors for the SkillsFuture Movement

Since the launch of the SkillsFuture movement, more than 465,000 Singaporeans and 12,000 enterprises benefited from training subsidies in 2018. In the same year, over 3,500 people participated in SkillsFuture Work-Study programmes, while over 52,000 individuals attended workshops run by SkillsFuture Advice (SkillsFuture Singapore 2019). With the wide range of SkillsFuture initiatives, it is important to track training outcomes and the effectiveness of training. At the national level, the training participation rate of Singaporeans in 2018 was at 48% (MOM 2018). SSG also conducts regular surveys of individuals and companies that have participated in the Singapore Workforce Skills Qualifications training. According to the survey, 8 in 10 Singaporeans who attended SkillsFuture-funded courses last year found that their training helped them in their work (Straits Times 2019).

The two critical success factors of the movement are (i) the broad-based promotion of skills and literacy, and (ii) the cross-collaboration efforts among multiple agencies such as government bodies, IHLs, unions, and employers.

Broad-based Promotion of Skills and Digital Literacy

As technology continues to change the way companies operate, it becomes even more critical to build digital capabilities in workers across all major industry sectors to support business digital transformation. Adopting new technology alone is not adequate if workers are not trained to optimise the use of these tools. Recognising this, SSG launched the SkillsFuture for Digital Workplace courses to equip employees with foundational digital skills and help build their digital confidence. For example, the National Taxi Association and ComfortDelGro Taxi Company have trained close to 10,000 taxi drivers to pick up essential digital skills such as using e-payment applications. Another initiative is the SkillsFuture Series, where the short modular courses in data analytics and tech-enabled services have proven to be particularly popular.

Multi-agency Efforts

Cross-collaboration with multiple agencies, involving government agencies, industry bodies, unions, enterprises, and education and training providers, is crucial for the success of the SkillsFuture movement. One example is the development of the Skills Framework. An integral component of the Industry Transformation Maps, the Skills Framework provides key information on career pathways, emerging skills required, and a list of training programmes for skills upgrading. To date, over 30 Skills Frameworks have been rolled out for sectors such as aerospace, electronics, and financial services. Another example of a multi-party effort is the Systems, Applications and Products (SAP) Skills University Singapore, an effort among the German multinational software company SAP, SSG, and five polytechnics in Singapore to equip the workforce with critical skillsets in emerging technologies like artificial intelligence, data analytics, and the internet of things.

Conclusion

Education and training systems need to be even more agile and innovative than before to keep pace with the accelerating rate of change. To do so, training needs to be delivered in different modes, and in a timely manner to ensure relevance to the varying needs of learners. Learning also needs to evolve from a linear model to a flexible, adaptive, and lifelong model. The SkillsFuture Movement represents a major effort by Singapore to shift the education and training system to address the shortening shelf life of skills fueled by the Fourth Industrial Revolution. However, a truly effective lifelong learning system cannot be delivered by the public sector alone. A multi-stakeholder approach is required. Strong partnerships with education institutions, industry partners and employers are keys to success. Everyone needs to play a part in building up a responsive and effective skills ecosystem to establish a highly skilled workforce, in the spirit of lifelong learning.

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Chapter 40
Conclusion and Recommendations: Implications and Way Forward

Brajesh Panth

Key Achievements

The Asia and Pacific region has made impressive gains in education and schooling in the past 50 years.[1] The mean years of schooling for population 20–24 years increased from 3.5 years in 1960 to 8.9 years in 2010. Enrollments have increased at all levels of education with a much better gender balance. Almost all countries have achieved universal or near-universal primary education, while many have also achieved universal or near-universal secondary education. Many countries have also significantly expanded their technical and vocational education and training (TVET) and higher education.[2] The performance of participating economies in the Programme for International Student Assessment (PISA) shows that some of the best education systems in the world are in the Asia and Pacific region, such as in Japan, the Republic of Korea, and Singapore.[3] In recent years, while some participating cities in the People's Republic of China are among the best performers, Viet Nam is widely viewed as being the best-performing lower middle-income country in the world. Many of these achievements have been possible largely due to public policy and investment but also due to the heavy involvement of the private sector which remains a major player in many countries, particularly in post-basic education.

[1]Asian Development Bank. 2020. Asia's Journey to Prosperity: Policy, Market and Technology Over 50 Years.

[2]Ibid.

[3]McKinsey & Company. 2007. How the world's best-performing school systems come out on the top.

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Major Challenges

Despite remarkable progress in improving access at all levels of education, developing Asia is facing four major challenges. First, most of the worlds' 15–24 years youth with low reading proficiency are in the Asia and Pacific region, and a significant percent of 10-year-olds attending schools in the region cannot read a simple story. These learning deficits are so serious that there is a "learning crisis."[4] Second, the region is facing serious skills mismatches.[5] In some cases, a majority of education and training providers indicate that they are providing the skills needed by the employers, while the employers indicate that only around one-third of job applicants meet their job requirements.[6] Third, many Asian countries are underinvesting in education. While UNESCO recommends that countries need to spend around 4–6% of their gross domestic product, or 15–20% of the annual budget, on education to achieve Sustainable Development Goal 4 by 2030, many countries in the region are spending less than this recommended level, making it difficult to make good progress by 2030. Along with an adequate share of the budget, the quality of expenditure to ensure that resources are prioritized on proven strategies is equally important. Finally, many countries lack a capacity to undertake and sustain reforms that require new, innovative thinking, and new approaches to equip learners with twenty-first-century skills and to forge effective new partnerships to sustain reforms.

Moving Forward

As noted in the introductory chapter, and as implied throughout this book, education systems that were founded 100–150 years ago to meet the needs of the first and second industrial revolutions (which is the case for most education systems in countries throughout the world) are failing to meet the needs of the Fourth Industrial Revolution (4IR) and twenty-first-century skills that go beyond the three Rs (reading, writing, and arithmetic) to include digital and soft skills. Against this backdrop, the book has attempted to provide the following messages.

1. It is important to rethink and reimagine education and training (Part I). At a time when technological change and automation are disrupting virtually all spheres of daily life, there is a need to rethink and reimagine education and training to make sure it meets the needs of all types of students, to prepare them for current, emerging, and future skills and jobs. The risk of proceeding with a "business as usual" approach is likely to exacerbate inequity since those that have access to twenty-first-century skills will have a much greater edge over those without such opportunities.

[4] World Bank. 2018. World Development Report: Learning to Realize Education's Promise.

[5] Manpower Group. 2015. 2015 Talent Shortage Survey.

[6] Asian Development Bank. Forthcoming (2020). Assessing skills and technology for high-growth industries in South-East Asia: Insights from Cambodia, Indonesia, the Philippines, and Viet Nam

Research referred to in this book clearly shows that, more than school attainment, the quality of schooling is more closely associated with economic growth (Hanushek, Chap. 4). This relationship is a more powerful indicator of how investments in human capital can serve as a robust predictor of nations' ability to sustain economic development and innovate. A two-pronged strategy is necessary for developing countries to "go back to the basics" to improve learning outcomes for all students while paving opportunities for leapfrogging. It is not only important to ensure *learning for all* in schools but also to ensure that they are ready to meet the changing needs of today's job market, is key (Lee, Chap. 5). Education systems need to produce self-directed learners because learners need the right skills and they should also know how to apply such skills as a foundation for sustainable development (Schleicher, Chap. 7). Due to rapid advancements in education technologies, there is a real opportunity to leverage such technologies, especially through online and blended learning, to improve teaching and learning at scale (Kim, Chap. 3).

While the mean years of schooling have increased in all developing countries, they still have a small share of people in the workforce with higher level skills. Ultimately, for developing countries to accelerate development, they will need to "leapfrog industrialization to the high-tech economy" and this will require prioritizing investments in people for higher level skills (Frey, Chap. 2). This is consistent with labor market projections around the globe which indicates that there will be less demand for lower level skills and more demand for higher level skills in the coming years. To develop such skills, universities have to transform and enable "academic entrepreneurs in close partnerships with industry" to provide a mix of hard and soft skills including entrepreneurship skills to innovate (Koh, Chap. 6).

2. Schools need to customize rather than standardize education to meet the learning needs of all types of learners (Part II). The main criticism of the current school system, which has little changed over the past 100–150 years, is that it treats all students as one assembly-line product. But there is an increasing recognition that a "one-size fits all" approach is leaving the majority of learners behind since they come with diverse learning needs and backgrounds. According to the multiple intelligence theory, all students have the potential to learn and excel, but teaching and learning need to cater to the different learning styles of learners—some learners are logically mathematically oriented, some are verbally oriented, and some are physically oriented.[7] Similarly, some are fast learners and some are slow learners. This means that current education systems have to transform by moving away from classifying all learners into one category—as average learners.[8] Brain science research asserts this line of thinking and that teaching and learning have to be adapted to the needs of learners. In the absence of continuous formative evaluation, and understanding the learning needs of different students, many teachers in developing countries are unable to teach at the grade level.

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[7]Howard Gardner. 2011. Frames of Mind: The Theory of Multiple Intelligences. Basic Books.

[8]Todd Rose. 2016. The End of Average. Harper and Collins Publishers.

The biggest challenge for most low-income and middle-income countries is the learning crisis that they are facing, despite remarkable progress in access to education. In their blog on learning deficits, the director of UNESCO's Global Monitoring Report, and the director of the UNESCO Institute for Statistics, have cautioned that "without a shift from 'business as usual', the world will miss its goal of a quality education for all by 2030."[9] Their concern is based on their projections on progress countries are making toward Sustainable Development Goal 4. Similarly, a report by the International Commission on Financing Global Education Opportunity notes that "if current trends continue, by 2030 just four out of 10 children of school age in low- and middle-income countries will be on track to gain basic secondary-level skills."[10]

Rote learning is rampant in most developing countries and, in many cases, it has been difficult for teachers to apply a learner-centric pedagogy. Some evaluation of teacher professional development shows that such training is not leading to improvements in learning outcomes. National student assessments show that over 50% of 10-year-olds cannot read a simple story.[11] For many developing countries that have participated in PISA tests, their poor performance is calling for a rethinking of their approach. "Boosting student learning starts with a good understanding of challenges that countries face, and best practices that could be learnt from the experiences of others" (Belfali, Chap. 8). For example, "Viet Nam has made excellent progress in developing a teacher assessment system based on national professional standards" and it aims to "unify that system with the professional development of teachers." (Cammaert, Nguyen, and Tanaka, Chap. 12. Similarly, in the Philippines (Bernido and Bernido, Chap. 9) and Pakistan (Aziz, Chap. 11), nongovernment organizations are complementing the government's efforts to provide good quality education. Building on such partnerships, and with the use of educational technologies, it is possible for teachers to use assessment tools to continuously monitor students' learning levels and align classroom instruction to ensure that every child is effectively learning (Kumar, Chap. 10).

3. Technical and vocational education and training requires public–private partnerships to respond to industry 4.0 needs (Part III). All governments in the region are concerned about quality jobs. Since rates of youth unemployment are usually 2–3 times higher than regular unemployment rates, governments are very keen to enhance the employability of the youth. However, the technical and vocational education and training (TVET) systems in many developing countries are supply-driven and fragmented due to the involvement of multiple agencies, and they are generally underfunded. Rapid changes in technologies, automation, unprecedented labor mobility, and aging populations are prompting governments to rethink workforce development. Labor market projections indicate that, due to increasing automation,

[9] Manos Antoninis and Silvia Montoya. July 2019. The World is Off Track to Deliver on its Education Commitments by 2030.

[10] The International Commission on Financing Global Education Opportunity. 2016. The Learning Generation: Investing in Education for a Changing World.

[11] World Bank. 2018. World Development Report: Learning to Realize Education's Promise.

lower order skills of a repetitive nature will be replaced by machines, while there will be a shortage of workers with higher order skills. This has huge implications for how education and training need to respond to the future of skills and jobs to reduce growing skills mismatches in an age of continuous digital disruptions and short shelf life of skills.

The dual training system that Germany, Austria, and Switzerland have successfully implemented is seen as one promising model for preparing job-ready workers. In the Philippines, the dual training program that the government is promoting under its flagship K-12 reform shows how the 6-month to 2-year certificate programs with technical support from GIZ are preparing job-ready learners through partnerships between employers (Philippine Chamber of Commerce), government (Technical Education and Skills Development Authority), and selected training providers (Don Bosco, German Confederation of Skilled Crafts and Small Businesses) (Dernbach, Chap. 13). In New Zealand, the industry training organizations are recognized for working with industries to develop occupational standards and training and assessment packages, as well as in promoting on-the-job training and school to work transitions (Williams, Chap. 15).

Countries with large shares of youth population realize the urgency to provide their youth with employability skills to reap the benefits of demographic dividends. This requires not only providing occupational skills but also soft skills since many youths may come with inadequate skills due to weak schooling. In India, where over 80% of the workforce is in the informal sector and there is a high attrition of skilled workers, Gram Tarang Employability Training Services, a social entrepreneurial partnership approach with Centurion University in Odisha, India is skilling and upskilling migrant workers from disadvantaged groups in close partnerships with industries to provide job-ready skills in sectors such as manufacturing, automotive, and hospitality (Madan, Chap. 16). In Bangladesh, another country with a large percentage of the youth population, the Ministry of Finance is directly engaging selected industry associations in priority growth sectors to skill and upskill the workforce with relevant education and skills to improve productivity and to address the emerging skills needs to be propelled by IR 4.0 (Lee, Chap. 17).

In the People's Republic of China (PRC), where the population is aging fast, the Government is focusing on several complementary areas to strengthen the quantity and quality of TVET graduates. The Government has expanded the capacity of TVET at the senior secondary level by developing a sound legal framework that requires TVET trainers to have industry experience, promote work-based learning with quality assurance and credible assessment and certification, in close collaboration between industry and TVET institutions, and enhance the use of information and communications technologies in the delivery of TVET programs (Maruyama, Chap. 18). Since the PRC has been improving the quality of compulsory education up to grade 9, the improved foundational skills from better schooling provide a good foundation needed for TVET programs. Where students are coming from weak schooling, it is important to complement occupational skills with foundational skills.

4. Higher education needs to be practically oriented to prepare graduates for higher level skills with an innovative and entrepreneurial mindset (Part IV). Successful countries like the Republic of Korea (ROK) and Singapore have transitioned from "low skill equilibrium" to "high skill equilibrium" by building a solid school system followed by market-responsive TVET and a high-quality higher education system. These countries have demonstrated how they have evolved as economic powerhouses by investing in human capital despite lacking natural resources, and with the availability of cheap labor being short-lived. While other countries in the region are trying to emulate this success, for such a strategy to work well, it is important to consider different innovative models of universities to develop higher level skills and entrepreneurs and to spur innovation. In other words, high-quality universities can help leapfrog development by preparing high-tech graduates in priority areas such as modern agriculture, biotechnology, and information and technology.

The Hong Kong University of Science and Technology in Hong Kong, China, demonstrates how a well-funded university in a vibrant city led to high-quality science and technology and business programs by attracting world-class faculty, and how it adopted a unique entrepreneurial research culture that promoted transfer and the commercialization of technologies (Postiglione, Chap. 19). In the ROK, high-quality universities such as the Korea Advanced Institute of Science and Technology have contributed to the ROK's transition into a knowledge-based economy by promoting science, technology, and entrepreneurship. In Indonesia, the Institut Teknologi Bandung is institutionalizing innovation and entrepreneurial spirit that has led to 70 start-ups and 6 spin-off campuses. ETH Zurich is yet another example of a high-quality university that has been a driving force of industrialization in Switzerland since its establishment in 1855.

The collaboration between Shenzhen Municipal Government and Tsinghua University provides another example of how the municipality has successfully evolved from a fishing village to a thriving commercial and innovation hub by attracting high-quality universities that have collaborated successfully with industries in promoting innovation and joint research and the commercialization of new products (Kang, Chap. 20). In the Pacific Region, the University of the South Pacific (USP) serves as a regional university, owned by the governments of 12 Pacific island countries, by adopting a regional cooperation strategy to support small island countries to provide good quality higher education through a network of branch campuses in all the member countries (Thonden, Chap. 21). By also linking with different networks (American, Australian, New Zealand), USP has been able to maintain its quality and achieve high recognition. Similarly, the State University of New York is fostering high-quality entrepreneurial ecosystem in the ROK through a Center of Global Entrepreneurship which was launched in 2017 in collaboration with a global and domestic network of entrepreneurship communities (Hsieh, Chap. 22).

5. Education Technology has the potential of transforming teaching and learning and in providing twenty-first-century skills by supporting personalized learning and helping teachers to customize learning (Part V). Unlike in the past, education institutions are not the only place where students learn. Students come from different backgrounds with diverse learning styles and needs. At the school level, in addition to the 3Rs (reading, writing, and arithmetic), schools are also required to provide twenty-first-century skills such as soft, digital, and entrepreneurial skills. Developing countries that are struggling to attract qualified teachers with strong content knowledge are facing an additional challenge of ensuring learning for all. Given that many developing countries are facing a learning crisis, it will not be possible to make the desired progress in improving learning levels by 2030 without major transformative changes.

EdTech solutions offer effective ways of transforming teaching and learning in a number of ways: (i) students can improve learning outcomes at their own pace and learning level through adaptive learning programs; (ii) rich contents can be drawn from global good practices and in partnership with employers in close alignment with national curriculum; (iii) teachers can continuously enhance their knowledge and skills through blended online teacher professional development programs; (iv) teachers can use EdTech programs to continuously assess student learning to align their teaching at the grade level; (v) teachers can use learner-friendly content to improve their instructions; and (vi) the governance and accountability of education systems can improve by sharing the performance of students, teachers and schools on a regular basis with key stakeholders.

With growing investments in EdTech solutions, the emerging trends show promising results. During the early stages of online learning, the emphasis was overshadowed by too much of a focus on hardware and an inadequate support on software and content. However, with time, there is growing evidence of EdTech programs having a positive impact on student learning outcomes (Garcia, Chap. 23).[12] There are different examples of good practices in ICT-based learning that look promising: (i) there are several online and blended learning providers of massive open online courses that can be useful in ramping up skills in high demand courses such as machine learning, artificial intelligence, big data analytics, and coding and (ii) there are learning management systems that enhance governance and accountability of teaching and learning institutions (Pavlova, Chap. 24). While it is important to take calculated risks with the use of EdTech solutions, it is important to embed research with such programs to build evidence and demonstrate what works and what does not.

To address the needs of the 4IR, there is growing recognition among key stakeholders that the traditional education systems require total transformation. Mobile learning is increasingly promising given the easy access it provides to millions of learners in a flexible way and at a fraction of a cost for traditional education. The "ubiquity of digital software and mobile technologies have created a new set of rules,

[12]There are a number of research findings that show the potential impact of EdTech solutions on learning outcomes: (i) J-PAL. 2016. Will technology transform education for the better?; (ii) Karthik Muralidharan et al. 2016. Disrupting Education? Experimental Evidence on Technology-Aided Instruction in India. National Bureau of Economic Research Working Paper 22923; (iii) Maya Escueta et al. 2017. Education Technology: An Evidence-Based Review. National Bureau of Economic Research Working Paper 23744; (iv) Rob Sampson et al. 2019. The EdTech Lab Series: Insights from rapid evaluations of EdTech products. Central Square Foundation and ID Insight.

a new world order, that is unlike anything we have seen before" (Pohjavirta, Chap. 25). Similarly, the massive open online course providers are innovating to create a robust lifelong learning ecosystem to upskill and reskill the workforce around the globe with micro-credentialing of curated courses that continuously respond to emerging labor market needs (Qiu, Chap. 26).

With the growing demand for workers with information and technology (IT) knowledge and skills, many countries are requiring their education systems to include coding from an early stage to prepare students for future jobs in IT (Nambiar, Chap. 28). In India where a large percentage of engineers joining the IT industry do not come with the expected skills to work in customer projects, there is a big demand to train them so they are able to understand systems, solve problems, communicate effectively with customers, and relate to real-world problems (Parthasarathy, Chap. 27). To address the acute problem of a lack of qualified teachers in many developing countries, online blended programs are emerging as an effective way of promoting teacher professional development programs at scale without losing the quality that cascade training face (Lim et al, Chap. 28).

6. Technology platforms can reduce skills mismatches by better anticipating and preparing for emerging skills and jobs (Part VI). In the current age of digital disruptions, the nature of work is changing rapidly, with a growing demand for higher order skills and decreasing demand for lower order, routine skills that can be automated. While the technologies that emerged from previous industrial revolutions also displaced workers using manual labor, the question now is, is it different this time? (Khatiwada, Chap. 32) Singapore is reducing skills mismatches by developing real-time labor market information systems using artificial intelligence and big data analytics to help job seekers match their skills profiles with the skills that potential employers are seeking (Gan, Chap. 31). In the ROK, there are continuous efforts to enhance collaboration between skills development and public employment services to reduce skills mismatches using a combination of different approaches: (i) regular labor demand surveys, (ii) long-term labor demand surveys, and (iii) AI and big data analytics to replace traditional approaches to promote job-matching (Lee, Chap. 33).

Another important side is how schools and training providers are responding to 4IR challenges in reducing skills mismatches. Due to a lack of information, access, and guidance, a large percentage of Filipino youth are not entering higher education. To reverse this trend, and to capitalize on the digital exposure of Gen Z (those borne from 1995 onward), it is possible to provide online information on schools, courses, and careers to encourage them to acquire higher level skills (Motte-Muñoz, Chap. 30). There is a need for training institutions to focus on the regular renewal of curriculum to match with emerging industry needs and to foster close collaboration between government, industry, and training providers to support lifelong learning for continuous reskilling and upskilling of the existing workforce.

Finally, according to UNESCO, around 1.5 billion students were out of school in over 180 countries due to the COVID-19 pandemic. In some countries like the People's Republic of China, online learning has surged and, for the first time, this also forced public education to seek online learning at an unprecedented scale. Many governments are now more open to online learning and EdTech solutions, which will require rethinking education, promoting innovations, and developing evidence for improving teaching and learning. Drawing lessons from such experiences will be important to building on this momentum to improve the quality of education particularly for those students that are lagging behind. This will also require strong coordination and partnerships to develop a flexible learning management system that can interface with some of the best available multi-channel platforms (online, Offline, TV and radio, delivery of printed materials), experts, and teachers and trainers.

7. Education and training is a major catalyst that can bust silos and promote cross-sectoral collaboration for sustainable economic transformation in developing countries (Part VII). Education is key to unleash the full potential of human capital since it provides the foundation for gender equality, healthy lifestyles, employability, innovation, peace, and sustainability. Therefore, education is seen as a catalyst, and the *master key*, to achieve all the 17 sustainable development goals (SDGs). Education is a prominent component of the global competitive index (interrelationship between education, skills, and work), as it is for the global innovation index (education's close relationship with skills, entrepreneurship, science & technology, and research & development).

Part VII highlights five interrelated examples of how education drives cross-sectoral collaboration. First, the example of a pilot in Mongolia (Build4Skills) shows how TVET can be integrated with infrastructure projects to drive workforce development through on-the-job training in partnership with industry (Edel, Chap. 35). Such an approach provides excellent opportunities to companies to not only improve the quality of infrastructure but also help develop skills of the workforce, particularly in countries that rely on foreign labor.

Second, the example of how a university can use STEAM (science, technology, engineering, arts, and mathematics) education to prepare youth with employability as well as entrepreneurship skills in Thailand demonstrates how twenty-first-century skills can be developed while promoting sustainable development (Liu, Chap. 36).

Third, the example from Tajikistan on how TVET can train women in non-traditional, higher paying technical fields and occupations demonstrates a promising strategy to provide more inclusive TVET to women (Izawa, Chap. 37). This approach promoted the combination of social marketing, campaigns, stipends, dormitories, and female-friendly facilities. Fourth, the example of the Torino Process promoted by the European Training Foundation shows how a combination of traditional and nontraditional approaches can make TVET more inclusive while addressing the different needs of diverse students (Onestini, Chap. 38).

Finally, in light of the massive disruption of IR4 on the future of skills and jobs, there is a need to reskill and upskill the existing workforce in a continuous manner as part of lifelong learning. Singapore's SkillsFuture demonstrates how this can be done through a voucher scheme that incentivizes individuals and companies to reskill and upskill through a choice of highly relevant courses offered by national and international training providers through blended learning platforms (Fung, Chap. 39).

Such an approach is gaining traction everywhere, as a result of which reskilling and upskilling is developing into one of the largest industries in the world.

The future world of work requires agile and independent workers who are ICT literate and readily able to upskill and/or retool. To prepare for this future, higher education and TVET systems need to be conducive for lifelong learning, enabled by various learning and training modalities of skills development. At the same time, national qualifications systems, learning pathways, and recognition and validation systems of learning also need to be enhanced to motivate learners and workers to continuously learn. Linkages among governments, industries, and educational institutions would be critical in ensuring that curricula and learning interventions are relevant. Finally, development cooperation would be instrumental in addressing learning inequities among regions and countries as well as in sharing good practices and replicating effective models for lifelong learning through continued investment in human capital development.

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