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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S. McKee (✉) · D. Gauch
World Didactic, Bern, Switzerland
e-mail: steve@labtech.org

D. Gauch
e-mail: Gauch@worlddidac.org

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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 it 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/>

Panel session participants from which the material was collated for the above report:

1. Dr. Steven McKee, Moderator, President of Worlddidac and President of Labtech International (e-mail: steve@labtech.org).
2. Danny Gauch, CEO of Worlddidac (e-mail: gauch@worlddidac.org).
3. Dr. Gatot Priowirjanto, Former Director-General of Southeast Asian Ministers of Education Organization.
4. Prof. Dr. Noraini Binti Kaprawi, Director of Malaysian research Institute of Vocational Education and Training (MYRIVET).
5. Elmer K. Talavera, Executive Director of TESDA National Institute TESD, the Philippines.
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>.

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