
The Globalization of Higher Education as Part of the Fourth Industrial Revolution

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Abstract: *The world is in the early days of the Fourth Industrial Revolution, sometimes referred to as the Cyber-Cognitive Era. This new era will be marked by a deeper integration of technology into everyday activities, along with an increased need for not only initial education, but lifelong learning to keep pace with the change of business and technology. As this era unfolds education is moving in parallel, maturing from a traditional campus-based entity to a globalized virtual marketplace. This paper will explore how this globalization and commoditization of higher education is linked and necessary for the progress of the Fourth Industrial Revolution.*

1. Introduction

A highly competitive job market and an increasingly complex Technology of all types continues to be a more frequent, and more important, element of modern life across almost everything most people do. This impacts both industry and education, and the two fields are increasingly linked as higher needs in industry add demands to education and education adopts industry trends to improve operations. Two of the leading elements of these changes in the respective markets are industry's move into the Fourth Industrial Revolution (4IR) and education's continuing expansion into online learning.

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4IR is in its early stages, and historically industrial revolutions have taken a long time to fully impact society as a whole (Penprase, 2018). One predicted effect of 4IR, however, is that there will be a premium on educated professionals who can adapt and learn over time through continual, fast-paced changes driven by the technology integration of 4IR (Penprase, 2018). Education has, in some ways, preceded other industries in the 4IR shift. Rab et al. (2019) explain that the whole industry changed through digitalization and demand for online learning is expected to increase 15 times in the next decade.

One important factor to consider throughout this paper is that discussions of online learning, in this context, are no longer confined to the traditional bachelor's degree experience. 4IR will demand lifelong learning from most professionals, and that need for lifelong learning will, in many cases, be satisfied through online courses and programs. Online and blended learning designs provide professionals with the needed combination of flexibility and accreditation that will best serve working professionals (Laurillard et al., 2017).

This shift of demand to online delivery for professional education is already being seen in some sectors. Both Indiana University-Bloomington and the University of North Carolina-Chapel Hill, highly ranked business schools in the United States, have seen their online enrollment for MBA programs grow to exceed that of their on-campus enrollment (Whitaker et al., 2016). This aligns with the findings of Xu et al. (2018), who explain that the more natural fit of online education for adult learners provides institutions with expanded opportunities to increase enrollment through online programs targeted at the adult professional market.

These changes are pushing education as an industry to change teaching approaches to adapt to changes in delivery methods (Palvia et al., 2018). The changes are beyond those of simple convenience. Sinha et al. (2019) explain that the continued growth of online learning has helped to allow access to broader, more diverse groups, a trend that will need to continue in the future. What all of these elements combine to create is the intersection of globalized, online education and the Fourth Industrial Revolution.

Through the rest of this paper these factors will be defined and explored, both independently and in concert with one another. As the 4IR continues to grow and expand its influence education will be in a position of shifting focus and function to best serve the various constituencies needing to keep pace with changing industry demands. The most likely solution will be a globalized, virtualized higher education marketplace.

2. The Four Industrial Revolutions

While the industrial revolution is often used as a term referring to the rise of mass production in the late 19th and early 20th centuries that period was one of now four industrial revolutions, each of which have transformed communities and commerce. What each of the industrial revolutions have in common is that the advent of a new technology produced advantages that augmented human labor and, by extension, accelerated change and expanded production capacity. Penprase (2018) defined the four industrial revolutions as: 1. Steam Power, 2. Electricity-Based Manufacturing, 3. Computerization and Web-Based Interconnectivity, 4. Integration and Compounding Effects of Multiple Technologies (artificial intelligence (AI), nanotechnology, biotechnology).

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While it can be difficult to accept the concept that the computer age is essentially over, society is transitioning from a phase of integrating computer usage into industry and daily life to Penprase's definition where a confluence of technologies is creating the next steps in multiple industries, and doing so at a faster rate. Rab et al. (2019) define 4IR as, "the digital transformation of life as we know it – is based on a shift from digitalisation to innovation based on combinations of technologies, and it promises significant productivity increases in the late 2020s..." (p. 556). In approximately two centuries the world has only seen four industrial revolutions, in part because they are transformative for the world and that is a high bar to reach. Nonetheless, 4IR is here and is in the process of changing the world.

Penprase (2018) discusses a list of benchmarks that will signal the impact of 4IR on society in the coming years, including such things as significant market penetration of internet-connected clothes, connected glasses, driverless cars, and implantable cell phones, all by 2025. These things simply represent potential commercial applications of new technologies. The real change that will be driven by these and other networked devices will be a massive creation of data, which, coupled with advanced AI, will be processed and transformed into rapidly developing new knowledge that will drive still further changes.

These changes will create the need for individuals to have higher levels of skills, which will challenge higher education institutions to better deliver learning opportunities throughout a student's lifetime (Rab et al., 2019). Palvia et al. (2018) predict that one outcome of this shift will be online enrollments growing at a faster pace than traditional enrollments in the near future. With these shifts in mind there is a clear intersection of 4IR and higher education.

3. Higher Education and the Fourth Industrial Revolution

Higher education's role in the U.S. could be seen as conflicted in modern times. Institutions are leading fields in research, but also responding to the needs of practice in multiple fields. As the 4IR takes hold across society this blend of roles is likely to somewhat resolve as education will be working more in parallel with industry to develop new ideas and technologies while simultaneously preparing students to contribute to industry, and also providing lifelong learning opportunities to keep professionals up to date and productive in their respective fields of practice. Penprase (2018), summarizes this future trend by explaining that higher education in the time of 4IR will have to focus on interrelations and interconnections beyond the traditional model of simply solving set problems.

This closer connection between academia and industry has been growing throughout the recent years of the knowledge economy, essentially a precursor to 4IR. This history has seen higher education develop joint projects with industry, but as demand continues to increase and institutions need to scale their programs the most effective solution is likely to be shifting from on-campus to online programs (Sinha et al., 2019). Successfully scaling to meet demand is also being informed by the success of education-industry partnerships.

Van Damme et al. (2018) discuss the growing trend of higher education institutions joining together in consortiums to improve their global operations. All of these elements defining the emerging 4IR higher education marketplace align with the six dominant trends of the future of higher education as defined by Rab et al. (2019): Democratization of education, Lifelong learning, Individualism of education, Experimental technological advancement, Digitized students, and Changes in workforce demand. The ultimate outcome of these efforts and trends is to shift higher education away from the traditional local model to more of a global marketplace.

4. Globalization of Higher Education

The central theme of the relationship between 4IR and education is that both facilitate collaboration and connection more than previous models, the result being faster, more team-based development of new ideas. By necessity these collaborative efforts extend beyond localized resources, and today's information and communication technologies (ICT) make it more possible than ever before to engage in global efforts without the expense of physical travel. Through continually developing online education efforts higher education institutions are delivering on this need, and as such are actively supporting the growth needs of 4IR.

Blayone et al. (2017) describe the emerging practice as the fully online learning community model (FOLC), a model that uses effective online learning design and delivery to facilitate critical thinking and reflection to create opportunities for transformative learning. This view aligns with Rab et al.'s (2019) discussion of how higher education institutions, particularly through online learning, can democratize and transform the learning experience and, by extension, transform the economy. This view of expanding access and opportunity as a method to transform learning and economic activity is inexorably linked to the globalization of higher education and is being seen most directly with the emergence of open universities, open education resources, and massive open online courses (MOOCs) (VanDamme et al., 2018).

The shift to MOOCs is essentially an efficiency measure to expand access without exceeding the available capacity of the educational system to service students. Laurillard et al. (2017) discuss the fact the economies of scale have not traditionally been applied to past models of higher education, but MOOCs allow scaling, and with it much greater access by a more diverse audience, with far less labor inputs than a similar increase in access through traditional means. This model not only makes the globalization of

higher education more efficient for institutions, but also for the individual students who are engaging in educational pursuits.

Whereas the traditional requirement of living internationally to attend an institution was limited to only a small percentage of students, online learning, through MOOCs and other platforms, provide much greater accessibility at far lower costs to many more students (Bruhn, 2016). This expansion provides the opportunity to vastly improve the talent pool available to 4IR firms around the world, and as the workforce is enhanced so too will the productivity of the firms improve. Whether through MOOCs or more traditional online approaches there is substantial growth in online education globally.

In the U.S. online enrollments in higher education have grown for 15 consecutive years (Palvia et al., 2018) with 76 percent of U.S. institutions offering some online classes and 15 percent of degree-seeking U.S. students in fully online programs (Xu et al., 2019). International online education is growing at a similarly fast pace. Sinha et al. (2019) project that online education in India will grow from USD247 million to USD1.96 billion by 2021, with the online market in Africa growing from USD792 million to USD1.81 billion by 2024.

It is noteworthy that these growth figures are essentially stand-alone operations growing with market demand. If such phenomenal growth is happening already with independent efforts then it is reasonable to expect growth to increase much faster when institutions more actively pursue partnerships and collaborative efforts such as those mentioned earlier. This compounded effort and compounded effect is likely to be the future of the parallel growth of 4IR and higher education.

5. The Collaborative Future

4IR is, at its core, an intersection of multiple technologies all working together to speed innovation and development in multiple fields. Gordon (2016) refers to this emerging age as the Cyber-Mental Era, where computers and networks move from being separate tools to being integrated elements of life and work. As such, the speed of the network begins to accelerate the speed of human knowledge creation, and as the body of knowledge grows larger there is more from which to base new innovations, which continues the acceleration along the innovation curve.

The advances in technology should make almost everything happen faster, but for that speed to be productive there need to be intelligent, well-trained humans directing the work and making the final decisions. This direction is going to include many different technical tasks, from the maintenance of hardware and software, to advanced programming, to operations that likely do not exist at the time of this writing because the technology to require those operations has not yet been developed. The overall productivity of 4IR systems will, barring a much more advanced AI platform than is currently predicted, rely on an extensive collection of highly trained humans.

This need for training will also extend far beyond the information technology assets that are at the core of most of the 4IR integration of disciplines. As explained by Penprase (2018), fields like biotechnology, nanotechnology, and others are going to combine with each other, through the unifying presence of advanced computing and AI assistance, to drive future innovations. Virtually everyone in advanced fields will need a good level of user skills for technology, but there will be many more non-technology experts than dedicated technology experts because there are so many fields that will be engaged in research and development for the future.

Add to this the fact that the rapidly increasing pace of change across disciplines is going to require more frequent updating of skills and the heavy burden on higher education institutions in the near future is clear. The current level of production is already insufficient to provide the necessary volume of skilled workers to some industries, and that is likely to get worse as demand for those skilled workers increases. If left unable to produce sufficient initial numbers of experts, higher education will be unable to take on the added responsibility of facilitating lifelong learning opportunities for those experts in the decades following their initial graduation from an institution.

The answer for how higher education will successfully support 4IR is most likely for higher education to actively engage with and adopt the best practices of 4IR. Utilizing technology as a force multiplier for expert instructors will be a critical way to increase the scale of education delivery without exceeding the capacity of institutions. MOOCs, as they exist today, are a good first step in that effort, but their general lack of real interaction and targeted instruction limit their effectiveness, particularly for introductory and lower level courses where students generally need more assistance from an instructor.

Going forward this is likely to change as AI platforms develop the ability to more effectively tailor both instruction and assessment to individual learners. Such courses would still utilize humans as subject matter experts and a final authority for content and credentialing, but much of the labor-intensive course content could be shifted to more efficient automated means. This meld of human and intelligent technology labor in the education process will mirror what is happening in industry as part of 4IR.

The parallel track to integrating 4IR practices in higher education will be for 4IR firms and higher education institutions to partner with one another to mutually support their efforts. This is in many respects already happening in some academic disciplines

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through internships, crowdsourcing, and consulting efforts, but going forward the relationships will need to be closer and more formal. Higher education will need the insights of industry to be able to structure programs and continuing education that prepares students at any level for what is coming rather than only preparing them for what is happening at the time. This will be perhaps the biggest challenge going forward as there will be a constantly changing body of knowledge, from which all involved will be trying to discern future directions so that everyone can build their foundation to succeed in an unknown next stage.

6. Conclusion

The world is likely to experience unprecedented changes in the near future as the intersection of quantum computing, 5G networks, and AI radically change the ability of humans to not only collect and process data, but also identify unique outcomes from new data with the application of AI to problem solving and innovation. At the core of these changes will be people who need skills and opportunities to develop those skills so that they can effectively contribute to the newest industrial revolution.

Higher education has done this before, although in different forms. When steam power developed as the driving force of industry training programs opened for steam engine designers, mechanics, and operators, and those training to run businesses were educated on how to leverage steam power for their competitive advantage. The same happened with electricity, and then with computers, and the same will ultimately happen again as we move into the AI-driven 4IR.

The challenge will be effectively driving change in an industry, higher education, that is notoriously averse to changing. Flexibility and adaptability will be critical, and those institutions that prove capable of taking such actions will likely be winners in an environment that will inevitably create winners and losers, as

happens in every radical market shift. The time to prepare is now, ahead of and not behind the coming rush of changes. Preparing for the ability to adapt will put institutions in the right position to take action when there is a clear direction for such action.

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