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EDUCATION 4.0 FOR INDUSTRY 4.0: AS INDUSTRY CHANGES, EDUCATION MUST CHANGE

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Abstract

This paper is about the imperative of change predicated on the fact that as industry changes, education must change to be relevant to society. The 4th Industrial Revolution also described as Industry 4.0 which comes through the convergence of digital technologies and data science has induced change in the use of technology. The confluence of big data, artificial intelligence and connectivity is leading to the emergence of new industries out of old industries. Industry 4.0 coincides with the Age of Sustainable Development with the well-defined Sustainable Development Goals (SDGs). The pandemic has also instigated change in the future of work and learning. As industry changes, education, which equips learners with knowledge, skills, attitude and values must also change. The very structure of the brain made up of the disproportionately large frontal intellectual brain, the cerebrum, and the stunted intuitional back brain, the cerebellum, speaks to the lack of balance in the evolution of higher education curriculum. The lack of balance and blend of art and science in the curriculum is due to our abandonment of Nature Study. Otherwise, there is art and science in everything in Nature. Proper understanding and adaptation to the Laws of Nature and thus Nature Study humanizes us. Education 4.0 is about Education for Sustainable Development in which the SDGs are mainstreamed into the research agenda and the curriculum, constantly renewed with new knowledge discovered through research guided by Nature Study. Education 4.0 equips graduates with capabilities, capacities and competences fit for Industry 4.0. Thus learners graduate with university degree certificates, professional skills certifications and innovations. With creativity and innovative skills, graduates are equipped to solve problems of society, contribute to the SDGs, and create jobs and wealth through start-ups.

Keywords: 4th Industrial Revolution, Education 4.0, sustainable development goals, climate change, energy transition

Introduction

The world is facing major global challenges and changes which affect industry and society in general. The enforced transitions or transformations as they are called are caused by cosmic change. The source of the pressure enforcing this change is unknown to mankind but it was long foretold. From time-to-time astrologers report the visit of comets from the cosmos that affect and cause change in the mesh and balance of radiations around the earth, which in addition to the observed damage of the

ozone layer cause climate change. This change coincides with the Age of Sustainable Development with the well-defined Sustainable Development Goals (SDGs) and the 4th Industrial Revolution. It also coincides with the new Age of Knowledge, of the knowledge society, which in a limited sense is called is knowledge economy (Ogbonna *et al*, 2016; Uche *et al*, 2013, Akaranta *et al*, 2014).

Two major transitions are clearly obvious which drive and accelerate the wheel of change namely the global energy transition instigated by concern for climate change and the digital transformation instigated by the 4th Industrial Revolution also called Industry 4.0. The unfolding speed of energy transition is enforcing a new direction in the global energy industry, in particular the oil and gas industry. Every age requires a predominant source of energy to drive the infrastructure and development. The New Age requires zero carbon renewable energy to stem the tide of global warming due to the emission of greenhouse gases caused partly by the exploitation of fossil fuels. The global climate change affects health, agriculture, economy, infrastructure and practically every aspect of life. Then came the global COVID-19 pandemic which instigated shift to remote working and the future of work and education. Ultimately all these changes influence change in education which equips learners with knowledge, skills, attitude and values to adapt to these accelerating changes.

Could all these changes which clearly point to the end of an old Order and the beginning of a new Order be connected with the Cosmic Turning Point which brings about the New Knowledge of Creation?

Vollmann (1985) in his book **A Gate Opens**, drew attention to the recognition of Abbot Joachim of Fiore, a native of Calabria in Southern Italy, who in the Middle Ages between 1130 and 1202 came to an inner recognition of the Three Ages connected with the Holy Trinity. The Age of the Father which started with Abraham through the time of Moses; The Age of the Son which started with the Birth of our Lord Jesus and the Age of the Holy Spirit of Whom it was proclaimed in the Scriptures in the Gospel of John Chapter 14, that the He the Spirit of Truth will guide us into all Truth... and thus bring the Everlasting Gospel.

From the Writings of Vollmann we understand that an Age is approximately 2000 years and we are now in the Age of the Holy Spirit, in the Age of Knowledge, what some people call the Aquarian Age. The new knowledge fosters a new knowledge society. Therefore, the basis of the Knowledge Economy, is the comprehensive Knowledge of Creation, the Knowledge of the Truth which could lead us into an era of vibrant creativity and innovation and lively sustainable development. Unfortunately, we have been focusing only on the knowledge economy instead of the comprehensive knowledge that embraces all the pillars of sustainability. The four pillars of sustainable development are social, economic, environmental and cultural developments. These four pillars of sustainability in time and space ensure that there is balanced growth and development in keeping with the Creation Law of Balance! Sustainability, continuity and thus success lie in building upon the solid foundation of the Natural Laws of Creation which bear the Perfect Will of the Creator. That is why I have often drawn attention to the need to go back to Nature Study, the study of the perfect Laws of Nature and of Creation.

The overriding purpose of university education is the pursuit of Truth. Every study in every discipline is aimed at discovering the manifestations of Truth and the Laws of Nature. In a presentation at a Workshop on Building Innovation and Entrepreneurial Ecosystem for a Sustainable Development of the University of Port Harcourt, Professor Emeritus Nimi Briggs drew our attention to the Motto of Harvard University which is simply '**Truth**' and that of the University of Lagos being '**In deed and in Truth**' (Figure 1).

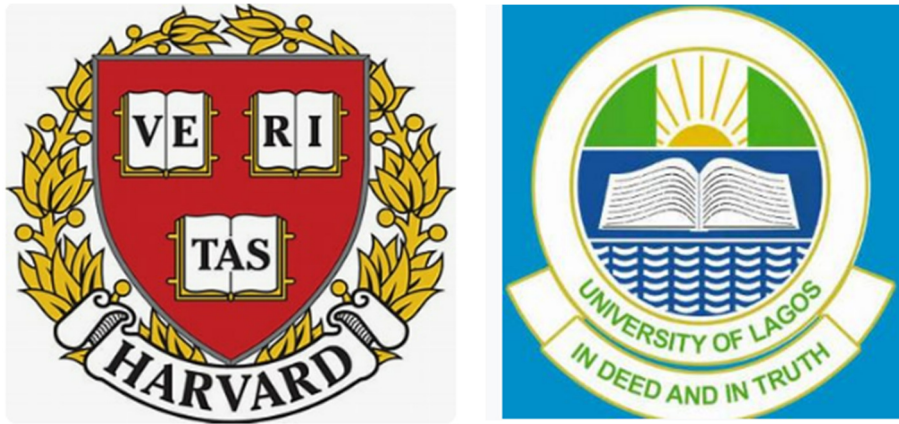


Figure 1: University Motto: Harvard and UniLag (Briggs, 2022)

All these, coupled with Industry 4.0, show a convergence of realisations and recognitions. Now let us examine these changes and challenges in some details.

The 4th Industrial Revolution, Industry 4.0

Industry 4.0 is about digitalization and digital transformation sweeping through all industries. The 4th Industrial Revolution or the digital era comes about through the convergence of information technology, internet of things, Machine Learning, smart systems, robotics etc (see Figure 2). It comes with accelerating waves of digital innovations. The confluence of Big Data, Artificial Intelligence and Connectivity is leading to the emergence of new industries out of old industries. For instance, the new financial technology (Fintech) industry has emerged out of the banking industry, a new medical technology industry (Medtech) is evolving from the medical industry. We are in the era of precision science and technologies, precision agriculture, precision medical diagnostics and personalized medicine. We are in a new era of real-time solutions to problems. The mobile phone is a confluence of several technologies.

The fourth industrial revolution brings peculiar revolutionary pressures for the development of new digital skills as old skills become obsolete. The graduates of the digital age need digital skills, creativity and innovation skills (Ajienka, 2017, 2019, 2022).

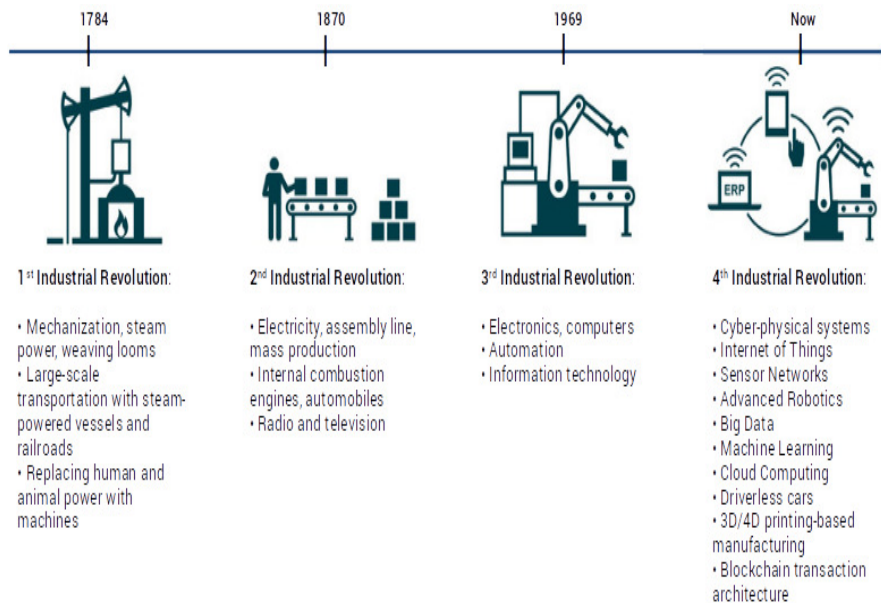


Figure 2: The Evolution of the Industrial Revolution <https://www.bing.com/search?q=industrial+revolution+timeline&aqs=edge.2.012j69i59j016.8822j0j1&FORM=ANAB01&PC=HCTS>

The New Age of Sustainable Development

We are in a new Age of Knowledge, which global public intellectual Jeffery Sachs of Columbia University calls the Age of Sustainable Development (Sachs, 2015). The signature tone of the new Age is **Going Green** in every sphere of our existence. Thus, we speak of green architecture, green economy, green culture, green energy, etc. The new Age of Sustainable Development is defined by the 17 global Sustainable Development Goals (SDGs), established by the United Nations in 2015.

As stated earlier, sustainability stands on four pillars and where the foundation of one of these pillars is defective, the structure of sustainable development will not stand the test of time and tide. Thus, the future lies in understanding Nature, which is **evergreen**; in understanding the fundamental Laws of Nature and of the Universe, among which is the Law of Conservation of Energy. These laws which we observe in our various disciplines show uniformity, consistency, immutability and clarity, such characteristics that point us to the perfection of the Creative Will that governs Creation.

The UNESCO declared a decade of Education for Sustainable Development, ESD (2015-2020) which is being monitored. However, this has not been effective in some countries (Ajienska and Uche, 2018).

The Future of Work

Although distance learning and Massive Open Online Courses Systems (MOOCS) have been evolving in higher education institutions (HEIs), the COVID-19 pandemic lockdowns instigated remote working and change in the future of work and learning

which is described as the new normal. The future of work requires lifelong learning skills and effective and efficient remote working. This change also enforces healthy living and hygiene from within and without.

Agarwal (2023), MIT professor, founder and CEO of edX, observed that higher education has an image problem as younger generations are losing confidence in structured degree programmes that do not meet their challenges and needs. He suggested that HEIs take bold steps to put learners at the centre of the future of higher education by integrating more modular, stackable, career-optimized programs into higher education programmes, thus instead of building ivory towers, give learners the building blocks to build their own LEGO Towers. That way, we can begin to regain the trust that has been lost and to create a new reality for higher education that puts the learner squarely in the centre.

Change in Education

The mission of the modern university is teaching, research, entrepreneurship and community service. The first mission is to disseminate knowledge through teaching, continuing education and capacity building programmes. Through these we produce knowledgeable graduates. The second mission is to conduct research to discover new knowledge for the benefit of society and to mainstream the new knowledge back into the curriculum to enrich learning.

The third mission is academic entrepreneurship and innovation to transform the outcomes of research to produce new technologies, goods and services through startups incubated in business incubators and accelerators in science or technology parks of HEIs. This is what transforms HEIs into entrepreneurial universities. The transformation to entrepreneurial universities is enhanced when we leverage on the development concept of Triple Helix of Government-academia-industry partnership (Etzkowitz, 2008; Etzkowitz, and Leydesdorff, 1998).

As industry and society change, education must also change. Even the concept of the classroom is changing so also has the concept of the library changed and have become even more digital. There are now more digital books and open-source educational resources than ever.

The new knowledge society also emphasises the need for Emotional Intelligence (EQ) which underscores the need for values education to balance the one-sidedly over-cultivated intellect evaluated in terms of Intelligence Quotient (IQ) The very structure of the brain made up mainly of the disproportionately large frontal intellectual brain, the cerebrum and the stunted (under-used) intuitional back brain, the cerebellum speaks to the lack of balance in the evolution of the curriculum and educational development. Therefore, we celebrate people we describe as being very cerebral and yet are less humane. Some say there are many people but few human beings. Human beings are those who appreciate the true essence of humanity, those who live by lasting values, people who live in peace and harmony with their neighbours and environment. Human beings are those who live responsible lives, who appreciate and live by the perfect Laws of the Will of the Creator and His Commandments (Ajienka, 2022).

One of these fundamental Laws of Creation is the Law of Reciprocal Action, of sowing and reaping, which Isaac Newton recognised in science as the third Law of Motion, that actions and reactions are equal and opposite. Whereas we can observe in Nature and in human relationships that actions and reactions are opposite but not equal. When we sow seeds of corn or indeed any fruits, we reap in multiples. In human relations those who contemplate the actions are not those who reciprocate with the reactions (Ajienka, 2019).

The Blend of Science and the Arts

The lack of balance in the content of the curriculum between art and science in various disciplines is simply because we abandoned Nature Study which enables us to understand the Laws of Nature which teach us about the nature of all things in equal measure without compartmentalising science and the art. There is art and science in everything in Nature. The proper understanding and adaptation to the Laws of Nature is what humanizes us with uplifting values to live as responsible human beings.

I am an advocate of Nature Study, the Study of the Nature of the Universe, of all things and creatures in Creation and of the Laws of Nature. Through the allegories, parables, proverbs and through storytelling, traditional societies enlighten us about the values and virtues of true humanity. Religion also enlightens us on how to become human beings worthy of name being. Unfortunately, the science students in particular are not taught these values as much as the humanities students who learn philosophy, law, music, religion, psychology and the arts (the beauty of Nature) as well as sociology, the science of society and of human nature and relationships. Thus, the science students in particular are grossly disadvantaged in their knowledge of the values of true humanity as far as university education is concerned. This clearly speaks of the fatal failure of the evolution of higher education. Otherwise we could have learnt that in their pursuit of Truth, the pioneer scientists of the medieval era such as Galileo, Ptolemy, Archimedes, Copernicus and others such as the celebrated Sir Isaac Newton, were balanced in the art and science of Nature Study. They made great discoveries and yet were also deeply rooted in the arts, played music and practised philosophy and astronomy. They were philosopher-scientists (Okebukola, 2022). It is therefore interesting to note that in some universities they still have Faculties of Art and Science and in some jurisdictions there are Academies of Science and Arts. We need a proper blend of Science and Arts to produce graduates fit for the Future of Work (Okebukola, 2022). Today story telling is an important skill which is rooted in the humanities. And this is needed in all industries to disseminate new knowledge. The change in HEIs is also obvious as we are experiencing an increasing change in focus from STEM to STEAM and now to STREAM. (STEM=Science, Technology, Engineering and Mathematics; A-Arts, R-Reading; thanks to Professor Gertrude Shotte who chaired the presentation at the virtual Conference of the International Society of Comparative Education, Science and Technology (ISCEST) IX Annual International, December 2022 with the theme *Rethinking Sustainable Education for Sustainability in a Pandemic Age*. She drew our attention to STREAM).

Education 4.0 is about Education for Sustainable Development (ESD) in which the Sustainable Development Goals (SDGs) are mainstreamed into the curriculum such that graduates become agents of transformation who through intensive research, find solutions to the challenges militating against sustainable development. In addition, the curriculum will constantly be renewed with new knowledge discovered through research. Thus, it is about a curriculum that is dynamic and enriched by waves of evolving new digital technologies and developments. The curriculum of Education 4.0 equips graduates with entrepreneurial mindset, big data sets, new toolkits and creative and innovative skill sets; it equips learners with competencies, capabilities and capacities required by Industry 4.0. It is about Nature Study and the appreciation of the balance between science and art in the nature of things.

Under Industry 4.0, industry schools focused on Outcome-Based Education (OBE) are emerging, offering programmes for transferable micro-credits and professional certifications. Our universities must adapt to this change and collaborate with

reputable industry schools just as we affiliate with faith-based institutions. Globally, the impact of higher education is being measured beyond the quality of graduates to measurable beneficial outcomes. Some of these outcomes are patents, licenses, startups, new policies and products such as technologies, software applications, goods and services that contribute to creating employment and wealth; contributing to the attainment of the SDGs, regional development and the GDP of the nation through academic entrepreneurship (Bindir, 2013, Shevel, 2014).

Curriculum of Education 4.0

In Education 4.0, students graduate with university degrees equipped with industry-relevant professional skills certifications and products from innovative research. Thus, students graduate with university certificates, industry certifications and startups. The curriculum for Education 4.0 must be re-engineered to cover all expected outcomes (Ajienka and Uche, 2018). It must be structured to give soft or essential skills, technical skills, entrepreneurial/project skills and internships which impart the right amount of knowledge, skills, attitude and values. We must also inculcate extra-curricular skills such as in sports, start up schools and business incubators. With digital transformation, we must be prepared to participate at digital platforms.

To be relevant in the emerging new time, our Departments/Universities must transform into entrepreneurial Departments/Universities and adopt the development model of Triple Helix Plus+ which is partnership between Government, Academia, and Industry in addition to collaboration with professional bodies, academies and industry schools. Our university lecturers must be the first to change in acquiring the skills to deliver Education 4.0 and change the paradigm from publish or perish to patent, publish and produce through academic entrepreneurship to develop innovation ecosystems that benefit school and society. We must also appreciate the new paradigm of collaborate or collapse in line with SDG 17 which is partnership for the goals. Higher Education Institutions (HEIs) must engage in extensive collaborations through internal multidisciplinary studies and research, and through external mutually beneficial collaborations with foreign institutions from different jurisdictions and with industries as well as relevant Government Ministries, Departments and Agencies (MDAs).

Conclusion

As industry and society change education must change to be relevant. We are in the new Age of Knowledge, the Knowledge of the Universe, of Creation and of the Perfect Will of the Creator. The university as the apex of HEIs derives its name from the word universe. Thus, the culture of the university is universal. Although HEIs must show their uniqueness through institutional differentiation, there is only one standard of quality. It is global. HEIs must leverage on the Triple Helix developmental model for greater impact; ensure internationalisation of higher education at home and brain gain from the Diaspora. We should seek affiliation with reputable industry schools particularly those who made substantial brain gain from retired professors from academia and use technology to create more access for higher education with high impact industry skills. HEIs must be abreast with the changing paradigms, concepts and landscape for instance from publish or perish to patent, publish and produce; from ivory tower to LEGO tower; from silo working to collaborate or collapse etc. Research must now go beyond being globally recognised and locally rele-

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vant to being extensively collaborative across disciplines, institutions, industries and countries as well being intensively sustainable to contribute to the SDGs.

Education 4.0 is about Education for Sustainable Development (ESD) fit for the 4th Industrial Revolution, Industry 4.0, which has brought the challenge of digital transformation and the attendant need for new digital skills. The future of work and remote working instigated by the COVID 19 pandemic has also brought to the fore the need for life-long learning skills. Education 4.0 must ensure global energy transition instigated by the pressure of climate change. The signature tone of the new Age of Knowledge and Sustainable Development is going green in everything, learning from Nature which is evergreen.

The overriding objective of a university is the pursuit of Truth for which a university like the Harvard University derives its motto (Truth). The question of what Truth is has baffled mankind for ages. Sitting in judgement over The Lord Jesus, Pontius Pilate asked Jesus the question, What is Truth? Philosophers have battled with the understanding of Truth. Truth is Unchanging Reality! And Reality is Being. God the Creator of the Universe is the Omnipotent Being, the Living Truth. All that we are studying is to seek an understanding of the working of the Universe, His Creation, the perfect Laws of His Will, and the Laws of Nature which guide the Universe. Like the internet of things (IoT), we need to understand the Nature of Things (NoT) including human beings and society. The understanding and proper adaptation to the immutable laws governing interactions is the basis of Nature Study and of sustainable development.

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