Higher Education and Human Capital Development

Md. Anisur Rahman (Daulatpur College, Bangladesh)

Abstract

Science refers to a system of acquiring knowledge, following a systematic methodology. This methodology includes observation, measurement and evidence to gain knowledge. Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. Sustainability is broadly used to indicate programs, initiatives and actions aimed at the preservation of a particular resource. It actually refers to four distinct areas: human, social, economic and environmental are the four pillars of sustainability. Higher education also includes teacher-training schools, colleges, universities and institutes of technology after passing secondary school certificate courses. Innovation is the key feature of sustainability. Sustainability can drive innovation by introducing new design constraints that shape how key resources like, energy, carbon, water, materials and waste are used in products and processes. Sustainable innovation is a rational and collaborative way to maintain socio economic values for present and future generations. A key role of higher education institutions is to drive innovation, with the aim of finding solutions to global challenges in areas that matter to socio economic development. The role of higher education for sustainable development involves changing the means and processes of knowledge production and the way in which students are trained, making students more socially responsible, critical and sensitive towards sustainability. This paper discussed the present global economic growth, how the economic growth can be sustainable by digitalization and the 4th industrial revolution, post covid19 economy and highly skilled workforce demand for innovative solutions in the workplace, higher educational institutions can build the students high skilled for present global job market.

This paper is based on observational methodology as a mixed research major in qualitative and minor quantitative. During the research period it was observed the qualitative development in ICT education each year in Bangladesh in SSC level. The observation was done upon (10+2) level students from different institutions after their SSC level.

In the developing countries of the world there is already a digital divide. Both developed and developing countries require more skilled workforce upon digital technologies for a faster recovery of the global economic losses. There needs global cooperation to reduce the obstacles for the ICT skill development at higher educational institutions. The higher educational institutions can build a research cloud for new innovative solutions from the academic institutions for SDGs. A neural network can be established for local and global solutions by making decisions upon data and information using artificial intelligence algorithms. There needs to be rational financing for research and innovation at the institutions for the outcome of global sustainability.

Keywords: Education, Sustainability, 4IR, Innovation & Skill

Background Information

Before covid19 pandemic the world was under a growth slowdown crisis. Covid19 pandemic lost global growth at a higher percentage. Post covid19 economy needs more productivity with less pollution. During covid19 pandemic digital dependency increased at a higher percentage and fueled digital transformation faster, the 4th industrial revolution and digital transformation can increase the value of goods and services by manufacturing goods with less pollution. Adopting digital transformation and 4th industrial revolution there needs a high skill workforce both in developing and developed nations. In many developing countries like Bangladesh there are some obstacles for the faster development of human skill in the higher educational institutions.

Research Questions

The following questions were set to conduct a mixed research major in qualitative and minor quantitative. These questions were asked to the target groups for 3 years to observe the qualitative development in ICT education each year in Bangladesh at SSC level. The base quality at HSC (12+2 level)who will enter at higher education level after passing this level of education.

Questions for the students: (Asked about 1000 students from 10 academy)

1. What level of skill have you gained from your academy at SSC level?

2. What is the main problem to make you skilled in ICT?

Questions for the Teachers: (Asked about 50 ICT and other teachers from 20 academy)

3. What is the main problem to make a student skill user in ICT at your institution?

Questions for the Parents: (Asked about 50 parents of the students)

4. Can you afford the expenses of necessary devices for a student to make him skilled in ICT?

Area of Research

Daulatpur Upa-ZIlla, Kushtia, Bangladesh. A rural-urban area with poor and marginalized people.

Research Objectives

Technological innovations are having a significant impact on educational systems at all levels. Online courses, teaching aids, educational software, social networking tools, and other emerging technologies are disrupting the traditional teaching and learning system. Education in the future will need to demonstrate how technology can be used to students' advantage, as well as teach

future generations how to handle problems that arise from it. Technology has the potential to revolutionize the traditional teaching and learning process.

Information and communications technology for development, or ICT4D, is the practice of using technology to assist poor and marginalized people in developing communities. It is a powerful tool for socio economic development. ICT can bridge the digital divide by ensuring equitable access to communication technologies.

The object of this research is to find:

1. The student's basic efficiency in ICT from their SSC level.

2. How their efficiency can be improved in HSC (10+2) level in ICT.

3. How the teacher's ability can be improved to teach them.

4. How the devices can be available to the students for their skill development practices.

Research Questions, Review and Analysis

Q No.	Starting	Review	Review	Review	Methodology	Result	Result (% Avg.)	Analysis
1.	2018-2019	2019-2020	2020-2021	2021-2022	Questions and Observation on Development	Not a Good Skill	80%	Need Development of Skill.
2.	2018-2019	2019-2020	2020-2021	2021-2022	Questions and Observation on Development	Lack of Sufficient Infrastructure and Devices at the Institutions	60%	Need Necessary Infrastructure and Devices
3.	2018-2019	2019-2020	2020-2021	2021-2022	Questions and Observation on Development	lack of Teachers Training on Curriculum	50%	Need More Teachers Training

4.	2018-2019	2019-2020	2020-2021	2021-2022	Questions and Observation on Development	Lack of knowledge and Finance	80%	Need to Aware the Parents about 21st Century ICT

The questions were asked to the target group from the academic year 2018-2019 and at the year 2021-2022. Due to Covid19 pandemic in Bangladesh the educational institutions were closed maximum in 2020-2021.

Introduction

Information and communication technologies (ICTs) can help to accelerate progress towards every single one of the 17 United Nations Sustainable Development Goals (SDGs). ICTs are able to achieve results timely and accurately from the given data and information.

A major digital divide is still in place, with more people offline than online and particularly poor access in developing nations. Technological inclusion in the institution has opened up many new doors in educational development but the low income and developing nations cannot take advantage due to policy measures and finances.

According to UN ESCAP July 2021during Covid19 pandemic the developed nations were able to achieve educational facilities more than 80% but low income and developing countries were only less than 30%. **[**_Sweta C. Saxena. Towards post-COVID-19 resilient economies, Economic and Social Survey of Asia and the Pacific 2021, Slide No.9_**]**

ICT can bridge the digital divide by ensuring equitable access to communication technologies. There needs a global cooperation for the digital revolution and human skill development for global sustainability.

Innovation is the key feature of sustainability. Sustainability can drive innovation by introducing new design constraints that shape how key resources like, energy, carbon, water, materials and waste are used in products and processes. Sustainable innovation is a rational and collaborative way to maintain socio economic values for present and future generation.

A key role of higher education institutions is to drive innovation, with the aim of finding solutions to global challenges in areas that matter to socio economic development. The role of higher education for sustainable development involves changing the means and processes of knowledge production and the way in which students are trained, making students more socially responsible, critical and sensitive towards sustainability.

ICTs have the potential to increase innovation by speeding up the diffusion of information, favoring networking, and enabling closer links between institutions, reducing geographic limitations and increasing efficiency in communication.

Higher Education and the Preparedness for Global Skill and Jobs

Higher education also includes teacher-training schools, colleges, universities and institutes of technology after passing secondary school certificate courses. These institutes are now most responsible areas to make a student prepared for the required global skill and jobs.

The world is transforming very fast. Socio economic structure of the world is changing rapidly. Digital technologies change almost every aspect of our daily life. Business services and manufacturing processes are changing and depending more and more upon the disruptive technologies mainly Artificial Intelligence, Robotics, Internet of Things, Genetic Engineering, 3D printing, Bio technology etc. digital technologies are playing the major role.

Covid19 pandemic increases the use of these technologies at a much higher rate than ever before. It will increase more in the future. Both developing and developed countries will require more skillful workforces upon these technologies in future for their manufacturing and service sectors.

Knowledge and skill upon digital technologies is a must to work in these sectors and the development of these sectors for competitiveness through innovation.

Covid19 Push Forward the Transformation

Corona virus was first to affect china in 2019, china first declared the genome sequence of the corona virus then the world found medicine for temporary medication before vaccine against corona virus by the use of AI technology.

Before any vaccine against coronavirus, the world was in lockdown; communication was mainly dependent upon the internet and digital technologies for the global mobility and continuity in health, education, business, governance everywhere.

Then the virus spread worldwide and was declared as Covid19 pandemic. The virus was detected in the human body by digital technology. Digital technologies were used to disinfect the hospitals, home and roads. The researchers collect data and information about the disease from all over the world through the internet and analyze them in computer by using AI and3D image processing for the new vaccines. Then they combine AI, Bio technology, genetic Engineering for a 3D unique image for vaccine. These technologies reduce the long term duration for the selection of vaccines. After selection of vaccines the manufacturers manufacture them by automated and robotic machines.

Covid19 proved the potentiality and the revolutionary power of the disruptive technologies in business and manufacturing under an interconnected system.

Digitalization and Global Trade

Digitalization is reducing the production cost of goods and services. Reducing the local and cross border trade cost. The internet of things and E-commerce are playing a big role. This is changing the traditional trading system into a modern business system in the global economy.

Big data and its analysis by human or artificial intelligence are reducing the communication cost. An individual and a country can communicate with others at a very minimum cost and can increase the sales of that product in the domestic and export market. A company can reduce its cost of goods by analyzing the big data and innovation of a competitive good. This innovation can increase the productivity of a country, where technological advancement can take place. This advancement of technology can be a strong tool for global technological cooperation. This cycle from big data analysis, production decision making, innovation of new goods with competitive prices, increasing domestic productivity and the readiness of global technological cooperation can create a sustainable digital transformation over the world.

Big Data and Artificial Intelligence is changing the traditional business pattern. This has the benefit for both the consumers and traders. Big data is different from traditional data base management system. In Big Data management system database includes a huge amount of data in different types like, numerical, text, audio, and video. These data can be analyzed very easily by analyzing tools.

Artificial intelligence can analyze big data and can take decision independently. It is an interaction between computer and artificial intelligence algorithm. Retailers can understand the consumer's behavior by using the big data. The suppliers can understand the retailers demand for their customers. Traders can understand the suppliers demand from this database and they can put their demand to the manufacturer according to the customers' requirements. The manufacturer can manufacture the goods according to customers need. If the consumer choice change upon the product they can research upon the product, can innovate the new product. Here is the central role player is the big data, where automatically database is developing through transactions. The cost of collection of data and communication in different layer of business is reducing. This is the reduction of transaction cost.

Use of crypto and digital currencies, digital assets and intellectual properties are dramatically increasing in business and trade over the world.

Ecological Factors, Economic Models for Economic Growth

United Nations Sustainable Development Goal (SDG) 2030 is targeted to reduce poverty and inequality and a safe environment for all. To reduce poverty and income inequality there need to increase the productivity and income for the growth of individuals and the country. On the other

hand there need to reduce the environmental degradation for better heath of the population of the world.

But there is a strong relationship between economic growth and the environment. Because there need to install more and heavy machinery for the increase in productivity. More use of oil, coal and gas are needed as fuel to run these machineries and to increase in electricity production.

Economic growth is an increase in real output, affecting consumption of nonrenewable resources which have a direct impact upon the level of pollution, global warming and loss of environmental habitats. But not all forms of economic growth cause damage to the environment.

Rising level of income for both in individual and national level can increase the ability to protect the environment, through development of consciousness and appropriate policy. Increase in productivity through improved automation and digital technology for economic growth can enable higher output with less pollution.

Figure 1: U-Shaped Curve for Economic Growth and the Environment:
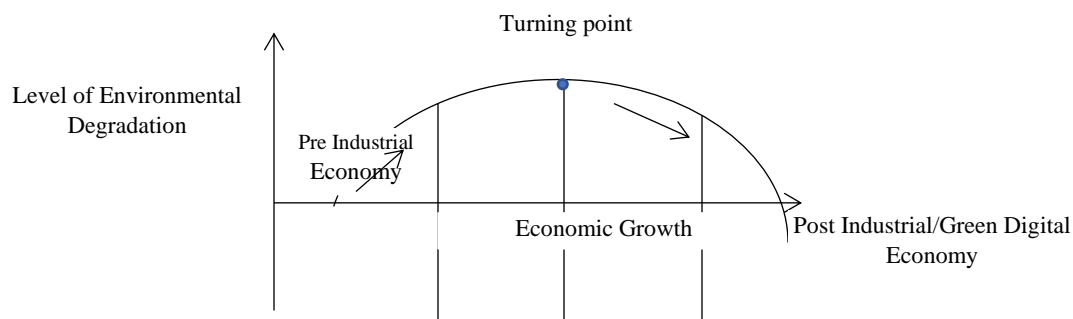
Source: Author

The U-shaped curve shows the relationship between economic growth and the environment that up to a certain point of economic growth worsens the environment, but after that the move to a post-industrial economy, it moves towards a better environment. [*Theodore Panayotou, Economic Growth and the Environment, Page-3*]

But, the world is suffering from a growth slowdown for the past several years. Moreover the Covid19 pandemic affect the manufacturing and services over the world, which turned global growth almost at the zero level and for some countries that is negative.

Figure 2: Growth Forecast.

	Global Economy			Advance Economy			Developing Economy		
Year	2019	2020	2021	2019	2020	2021	2019	2020	2021
Growth	2.9	-4.9	5.4	1.7	-8	4.8	3.7	-3	5.9

Source: World Economic Outlook Update June 2020

	Global Economy			Advance Economy			Developing Economy		
Year	2020	2021	2022	2020	2021	2022	2020	2021	2022
Growth	-3.2	6.0	4.9	-4.6	5.6	4.4	-2.1	6.3	3.2

Source: World Economic Outlook Update July 2021

The IMF estimates that the global economy shrunk by 4.4% in 2020. This is the decline as the worst since the Great Depression of the 1930s.

To reach the next normal of the world, there are no alternatives to grow the economy except the faster pace of increased productivity than ever before. Increase in productivity to raise the income of individuals and the country is the first condition to reach at the previous level of growth and to minimize the average level of intended growth for the world to reduce poverty and inequality. Industrial production and services will have to run together to achieve GDP growth. But there are the risks of the next pandemic for the global need and trend of over productivity that may affect the health and environment.

There are several debates upon growth limit theory. But after the pandemic this debate will rise more and more. For that, already environmental economics treats the natural environment as a separate sector for internationalizing the externalities, while ecological economics takes a more interdisciplinary approach of integrating the ecological factors governing resource regeneration and waste absorption into the economic models. [*Ramprasad Sengupta. Economic Theory and Ecological Limits, Page- 1*]

The concept of the 4th industrial revolution can meet the above mentioned criteria for ecological economy. The 4th industrial revolution is an interconnected manufacturing and service system by using automation and digitalization technologies. This can increase productivity, lower waste and use of alternative environment friendly energy.

Giving importance to the green economy of any economy can be a compound upon the 4th industrial revolution with the integrated, automation and digitalization technology. This could be helpful for the advanced relationship between GNP, GDP and environment.

Covid19 and the Agenda 2030

Covid19 shows great success in business and manufacturing by using disruptive technologies. It may be an example for the world about the use of disruptive technology in mankind like environmental protection, food production. The world can use these disruptive technologies in more other areas for a better world. This will be an adoption of the 4th industrial revolutionary system and technologies where there will lower waste and pollution in industrial manufacturing. Adoption of the 4th industrial revolution will require greater finance in technology and cooperation where the rich countries will have to come first. There will require a fragmentation of the international monetary and financial system through participation of both the low income to high income countries.

Changes in the real income in the low income and developing countries can create a longer version of recession in these categories. Human capital development through education, training and skill development is very essential in these countries to adjust with the 4IR specifications.

Adoption of new technologies always losses some jobs and also creates new job opportunities. There needs the development of national skill in government, public and private sectors. [*Irmgard Nübler, New technologies: A jobless future or golden age of job creation? Page-10*]

The world is transforming towards knowledge based economy, innovation is the key factor in knowledge based economy for capital formation, and the adoption of disruptive technologies with capital can increase value, productivity and income of our country and the world. This can help the post pandemic socio economic recovery and to achieve agenda 2030.

Covid19 and Human Knowledge

The world economy is transforming towards knowledge based economy and society is transforming towards knowledge based society as a whole the global socio economic structure is changing very fast based upon knowledge.

This transformation of the world is not always maintaining the sustainable standard. Education, training and skill development can ensure increased productivity and sustainability.

Education: Knowledge through education promotes protective behaviors by buffering the negative effects of pessimistic illness expectations. Knowledge based economies need new innovations and ethics on innovation for sustainable production and service to increase value and competitiveness. Continuous research in educational institutions is an important issue to direct a nation towards sustainable innovation.

Technological inclusion in the institution has opened up many new doors in educational development but the low income and developing nations cannot take advantage due to policy measures and finances. During Covid19 the developed nations were able to achieve educational facilities more than 80% but low income and developing countries were only less than 30%.

Training: Training for the teachers, trainers and employees is an important issue for the development of related instruction capability. Covid19 changed the traditional mode of training due to the rapid successful adoption of automation, digitalization and robotization in government, health, academic, business and manufacturing sectors.

Skill Development: Skill development is an essential part of a nation for the development in all areas of its activities. Covid19 pandemic has proved the potentiality of the disruptive technologies in the global socio economic activities. The world is adopting these technologies very fast.

Bangladesh is a middle income country and is already at a good position for its growth. The country is adopting disruptive technologies. As fast as it can develop its national skill to operate and govern this technological adoption in the right direction, it will contribute more to the global economy to reduce the global growth slowdown crisis.

Higher Educational Institutions Can Play a Crucial Role in New Innovation for Sustainability

Higher educational institutions can ensure the ethical innovation for sustainability by acting as entrepreneurs of sustainable development. Technology can play a crucial role in changing the traditional methods of teaching and learning by using digital technologies.

Inter connection with the several departments with their findings upon the recent crisis. A neural network can be established for local and global solutions by making decisions upon data and information using artificial intelligence algorithms.

Figure 3: Research Cloud Network.
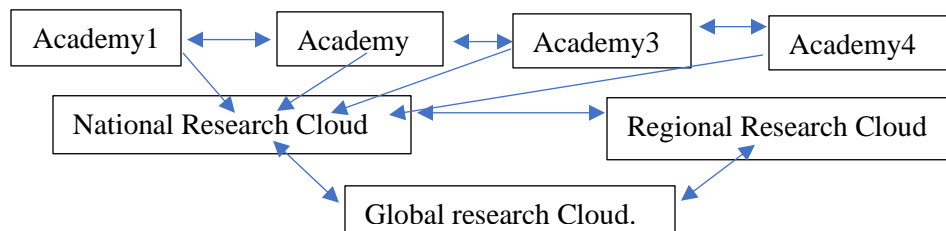
Source: Author

The education system must make a student a good user of a computer; teachers have to teach them efficiently at the high school level. After that in (10+2) level before entering in the universities the students must gain knowledge about computer hardware, software, browsing and use of the different software related to data and decision. At the university level they will use this knowledge for new innovation at their own subjectivity.

Colleges and the universities can work upon sustainability through research and innovation both the teachers and the students. These results are to be stored in a research cloud system for the next development at national level and these national results are to be connected with international research cloud for the next development. So, researchers and the policy makers can find fast, their local and regional crisis and their solutions if it is researched in their own country or not. This national and global research cloud can be governed by the United Nations to build up cooperation both in technical and financial terms between the countries of the world for faster achievement of the SDG 2030.

Research Result

In the developing countries of the world there are already a digital divide. During Covid19 pandemic the divide is shown in distance education and internet access in developed countries is more than 80% and the developing countries is less than 30%. But the socio economic transformation upon digital technologies is very fast. Both developed and developing countries require more skill workforce upon digital technologies for a faster recovery of the global economic losses. There needs a global cooperation. The students and the teachers of the rural and urban areas in Bangladesh are facing some obstacles to make them skilled at international level.

1. At the school level students are not trained as good computer users.

2. In many schools there are very minimal facilities for computer laboratories.

3. In (10+2) level the student cannot learn computer browsing and using different software as early as they need to be efficient due to lack of previous experiences.

4. Teachers are not well trained about their academic curriculum.

5. Shortage of computers in proportion with the students.

6. Student's parents are not able to buy a computer at their home for the home work of a student.

7. Insufficient academic infrastructure for a computer laboratory.

8. Higher academic institutions are not making a student innovative for sustainability due to the delayed entrepreneur role of the recent crisis of sustainability.

9. Insufficient fund and financing in research and innovation projects of sustainability at higher education.

10. Very minimum funds for research and innovation in the Non-government College and universities for sustainability, though in Bangladesh about 70% of the total academic contribution is from the Non-government College and universities.

11. Slower cooperation on a national and global level.

Conclusion

The world socio economic structure is transforming very fast and depending upon different disruptive technologies. The global job market is at risk, there need more advanced skilled workforces both in developing and developed countries. Covid19 affects almost all the targets of SDGs. The world needs urgent data and information to take action at the right place at the right time to survive SDGs. Digital technologies can connect all the 17 goals of SDGs through data and information for new initiatives. The skill upon disruptive technologies mainly the digital technologies is an urgent demand in the global job market. Higher educational institutions can make a student skill at a global level.

There are many human activities that are polluting the environment like land grabbing, over agricultural intensification, deforestation, river pollution etc. In business, manufacturing and communication the use of different technologies are increasing where privacy and security is at risk. In these cases sustainable innovation depends upon ethical innovations. Higher educational institutions can make a student ethically developed.

Higher educational institutions and their global interconnection and cooperation both technologically and financially can make the students ethically innovative to adopt socio economic transformation for a sustainable world.

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