ICT Education in Bhutan's Tertiary Institution

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Industry 4.0

The new Industrial Revolution has dawned. Industry 4.0 has brought about unprecedented changes across economies. Technological disruption in the market, through automation and artificial intelligence and the like, has machines replacing humans in unimaginable ways. Scholars predict that about "five million jobs will be lost within 2020". It marks an era where humans may see themselves becoming irrelevant in no time.

Nevertheless, the technology-driven world opens up unlimited opportunities. Laboratory grown meat is soon expected to hit the market at the price of USD 10 per pound, which will replace conventional beef farms and related industries that are hard to run and environmentally disastrous. Robotic surgery, which ensures minimal incision and takes care of complex procedures with much higher precision, is on the rise, to address human health issues more effectively.

Emergence of 5G with greater speed and reliability is expected to accelerate Internet of Things (IoT) innovation and further the surge of ICT based solutions to many issues facing human beings, including autonomous cars. New economic scenarios are gaining impetus, such as gig economy, circular economy and sharing economy, all of which have the technological revolution at the core.

As we march through this exciting time, we are required to prepare to respond and survive in a fast-changing world. Individuals are expected to learn soft and transferable skills to remain relevant. To this end education systems, including universities, are expected to address this challenge and prepare society to help them live up to the promises and tests of the 21st century.

Bhutan's Future

Globalisation has woven Bhutan with other economies. It leaves the nation to prepare itself and seize the opportunities that the 21st century has to

offer. His Majesty The King has always been encouraging the citizens to prepare human resources accordingly with emphasis on Science Technology Engineering and Mathematics (STEM) education. Enrolment rate in STEM education programmes at the tertiary level is expected to increase from 35 percent in 2017 to 50 percent in 2027 .

The economic development policy highlights potential areas of growth in Business Process Outsourcing, Knowledge Process Outsourcing, green data centres, software development, and animation. A key message from the Royal address of the 112th National Day was to develop a 21st century economic roadmap that would eventually prepare Bhutan to transit to the technology-driven economy.

The education development policy of Bhutan outlines the national vision as "a green and self-reliant economy sustained by a knowledge-based society, guided by the philosophy of GNH". Attainment of a knowledge-based society requires strong and reliable ICT facilities and capabilities, a strong culture of research, innovation and life-long learning, and high Gross Enrolment Ratio in tertiary education.

The government has been according high priority to the development of ICT infrastructure and capabilities. Already, two flagship programmes on digitisation have been approved for the 12th Five-Year Plan — Digital Drukyul and Digitising Schools. Very soon, most public services will be available online and students would have learned python programming by the time they complete school education.

With all these efforts underway to transform the economy and keep up with the fast-changing world, Bhutan will soon need adequate human resources — qualified teachers for programming, software engineers, cyber security personnel, network specialists, analytics, technocrats, and technopreneurs. Even other sectors will need to have knowledge and skills to leverage ICT as a tool to enhance productivity.

Role of the Royal University of Bhutan

As any good university in the world, the RUB has to serve as:

- a producer of capable graduates generator of new ideas
- a engine of social mobility

- a driver of the economy
- a guardian of our culture
- a foundation of democracy

The RUB, therefore, has to play a crucial role in ensuring that the country has capable human resources by offering relevant academic programmes and imparting more relevant and high quality ICT education.

In addition, the RUB is expected to continuously conduct research so as to generate new ideas and drive innovation to improve technology and contribute to economic diversification. Services, the third mission, need to be expanded to the industry to keep them abreast of changing technology and to stay relevant. New technology and ideas should also influence policies and evidence-based decision-making.

Therefore, as a premier and the biggest university in the country, the responsibility of developing a human resource base, improving technology through research, and updating the knowledge and skills in the industry, rests on RUB.
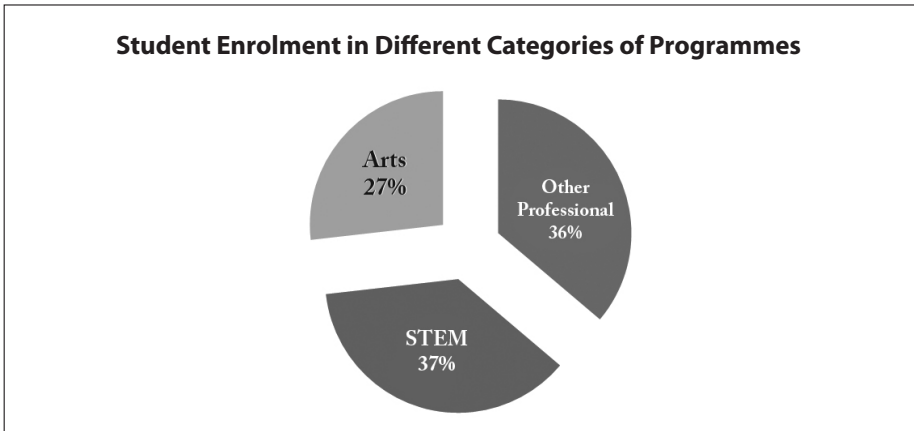
Current Status at the RUB

The RUB has made some efforts, including establishing a completely new college (Gyalpozhing College of Information Technology in 2017) to expand ICT education in Bhutan to develop specialised human resources for the ICT sector in the country.

Currently, through three constituent colleges (College of Science and Technology, Jigme Namgyel Engineering College and Gyalpozhing College of Information Technology), the RUB offers the following academic programmes related to ICT:

- Bachelor of Science in Information Technology, Bachelor of Science in Computer Science and Bachelor of Computer Applications at Gyalpozhing College of Information Technology.

- Bachelor of Engineering in Information Technology, Bachelor of Engineering in Electronics and Communications Engineering, and Bachelor of Engineering in Instrumentation and Control Engineering at College of Science and Technology.

- Diploma in Computer System and Networking, and Diploma in Electronics and Communications Engineering at Jigme Namgyel Engineering College.

Student Enrolment in Different Categories of Programmes

Arts
27%

Other
Professional
36%

STEM
37%

However, it is felt that — with the national aspiration to diversify the economy in the ICT sector — the programmes and number of graduates the RUB currently offers do not meet the changing needs. A labour force survey report shows a possible mismatch between supply and demand, and that the "highest unemployment rate is observed among persons with Bachelors' degrees. The RUB, therefore, needs to review its plan to diversify its academic programmes and produce graduates with diverse skills-sets to serve in different areas related to technology such as cyber security, analytics, and networking.

Further, the RUB has set out a mandatory basic ICT skill development module offered to all its students to equip them with basic ICT skills, ensuring a higher level of information literacy, so they will use ICT as a tool in their work. This will improve ICT literacy among those who would later engage in trade beyond the ICT sector.

The RUB has also been adopting ICT-enabled services for its operations such as administration, teaching-learning, and research. A virtual learning platform (VLE) has been put in place to ensure that staff and students use ICT tools in teaching and learning. This is in line with the aspiration of the Ministry of Education, that 100 percent of students in higher learning should have access to online learning. Administration and management services have been ICTised by developing and implementing integrated Information Management System covering various modules such as human resources, property management, finance, planning, and alumni

management. Its library is also run on KOHA and student selection carried out online. The RUB plans to continue using all these services to integrate ICT not only in teaching but also using it as part of the services. By 2030, the RUB plans to provide all its administrative services online.

The RUB's Future Plan

The RUB is currently in the process of reviewing its strategic plan to align with changing needs. It has been an expressed desire of the university to ensure that RUB continues to develop and offer programmes of study that are relevant and of high quality. Therefore, based on the changing needs and emerging opportunities, the colleges are now planning to diversify ICT-based programmes. Following are some of the new programmes in discussion:

• Bachelor of Science in Cyber Security, Bachelor of Multimedia and Animation, Bachelor of Science in IoT/AI/VR/AR, Master of Science in Information Technology and Master of Science in Cyber Security, at Gyalpozhing College of Information Technology.

• Bachelor of Engineering in Mechatronics at Jigme Namgyel Engineering College.

• Bachelor of Science in Data Science and Analytics at Sherubtse College.

In brief, the Gyalpozhing College of Information Technology will continue to focus on ICT related programmes and will aspire to develop into a centre of excellence in information technology. During the 12th FYP, the college has been allocated with more than Nu 471.449 million by the government to develop necessary infrastructure and facilities, which is 40 percent of the total allocation (1,200 million) to RUB. It will support the college in increasing enrolment in ICT education, from the current 265 to about 1000 students by 2025.

Other relevant colleges, such as Sherubtse, Jigme Namgyal Engineering College and College of Science and Technology, will also include technology-based programmes and, together, they will have increased total enrolment by another 1,000 students in ICT and ICT allied programmes.

Similarly, other colleges will also continue to explore potential use of ICT as a tool to enhance their areas of specialisation. For instance, the Samtse College of Education plans to develop a Master of Education in Information Technology to develop teacher's capacity in teaching ICT subjects in schools and drive the use of technology for effective teaching and learning. The College of Language and Culture Studies, too, will start some online courses and conduct research to explore the use of ICT in promoting national language and culture.

In addition, the RUB will continue to strengthen its existing system, such as Information Management System and VLE to make them more dynamic and interactive. Efforts are underway to develop about 37 free short-term online courses for students and the general public, between now and 2030, like in many other well-known universities. To facilitate this effort, the RUB will continue to increase its bandwidth, with most colleges aiming for at least 100 Gbps by 2030, and develop capacity among its academics on content management.

The Royal University of Bhutan will continue to increase access to various ICT programmes to expand the pool of ICT experts with diverse skills and know-how to meet the needs of the market, with emerging trends on Artificial Intelligence, Blockchain, Virtual and Augmented Reality, IoT, and Big Data. These graduates are expected to provide expert services and leadership to drive the country's digital economy.

Way Forward

Bhutan sees new opportunities, particularly with the expansion of the gig economy, to develop its workforce in the digital age. Expansion of ICT education needs to be increased to have graduates with more relevant ICT skills and knowledge. Bangladesh shows the way by building digital power, and with about 600,000 ICT professionals engaged as freelancers, which is one of the factors that has made Bangladesh one of the fastest growing economies in the world. Bhutan too could follow the path and accelerate its economic growth rate.

The Prime Minister of Bhutan has indicated that the broad framework for the 21st century economic roadmap will be about developing the economy by using wireless and digital prowess. The colleges of the Royal University

of Bhutan have emphasised the importance of ICT education and will continue to strengthen it. Most colleges will continue to help students learn how to use ICT as a tool to enhance productivity in their areas of work, while ICT-based colleges will develop and offer new ICT related programmes. Gyalpozhing in particular, will identify the areas that are in demand and diversify its academic programmes related to ICT, so that Bhutan will expand the pool of ICT professionals, with diverse skills to meet the workforce demand in a technology driven economy.

However, support for the RUB at this juncture will be crucial. RUB will need to develop its own capacity in terms of human resources as well as high-end laboratories with strong Internet connectivity. Colleges are generally young and do not have adequate experienced and qualified academics to develop new academic programmes. The Colleges need to establish linkages with renowned ICT universities around the world and seek their technical support to develop and offer programmes. They also need additional resources to recruit international academics in larger numbers and to send their academics for Masters and PhDs in universities abroad. To this end, funding support to develop laboratory facilities, hiring of external experts, and upgrading the qualifications of our academics, have become urgent.

In addition, scholarship support needs to be provided for various Masters degree programmes, such as MSc in Cyber Security and MSc in ICT, that are intended to promote research and further specialised human resources in the areas of ICT.

It is time that support for ICT education at the tertiary level is enhanced urgently to enable the RUB to produce a relevant and skilled workforce that will lay the foundation for Digital Bhutan. As envisioned by His Majesty The King, ICT is an opportunity for Bhutan's future and RUB will be the catalyst to develop the necessary talent to achieve the Royal vision.

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