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**Knowledge economy**

With the advent of the 4th Industrial Revolution, the world has begun to change rapidly as never before. Fantastic developments are taking place in fields such as energy storage systems, next generation genomics, industrial biotechnology, materials science, regenerative medicine and neuroscience.

Objects can be made invisible if coated with ‘metamaterials’ and the technology is now being used for stealth purposes. Gene editing techniques have been developed by which new species can be developed in a matter of weeks, whereas natural evolution took hundreds of thousands of years.

The 2020 Nobel Prize in Chemistry was awarded to Emmanuelle Charpentier and Jennifer A Doudna for the development of a method for genome editing. That method, known as CRISPR, allows scientists to precisely cut any strand of DNA they wish. Such strands can then be inserted into DNA of other species, leading to the development of new organisms that this planet has never known.

Similarly, stem cell technologies are being developed to repair damaged human organs such as heart, kidney, liver etc. Gene and cell therapies are now being developed to tackle various diseases. Perhaps the most profound impact of these innovations will be that of artificial intelligence (AI).

The Pak Austrian Fachhochschule recently established under my supervision in Haripur Hazara will be focusing on the commercial utilisation of such emerging technologies. This wonderful university, in which eight reputable foreign engineering universities will be partnering, has been established with a period of 2.5 years from the date of approval of the project. This historic record established bears testimony to the dedicated group of individuals led by Prof Nasser Ali Khan who have made history by their day and night efforts.

Other similar projects have also been initiated by the Prime Ministers Task Force on Knowledge Economy. New universities are planned in Lahore, Islamabad and Sialkot. The hearts of these universities will be technology parks with a focus on the development and commercialisation of exciting new products. History is indeed being made under the leadership of Prime Minister Imran Khan, while attempts by the bureaucracy to derail his schemes fall flat on their faces.

It needs to be understood by our planners that knowledge has now become the single most important factor for socio-economic development. Research, innovation and entrepreneurship are now the key factors for progress. Countries such as Singapore realized this under the leadership of Lee Kwan Yew, and huge investments were made in education.

A similar story is encountered in Korea. In 1960, only about five percent of the youth in Korea between ages of 17 and 23 were enrolled in higher education institutions, and Korean exports were only about $30 billion in the 60s. This changed dramatically in the next 50 years and by 2010, the enrolment of Korean youth in higher education institutions jumped to over 80 percent, the highest in the world. There was a corresponding jump in its exports of high-value products, which have risen to over $580 billion, 2000 percent higher than those of Pakistan.

To follow the same path as these countries, Pakistan must give the highest national priority to education, science & technology, innovation and good governance. We spend only about 2.2 percent of our GDP on education, a shameful reality. The national priorities in the past were reflected by the fact that we were spending Rs300 billion on a small 27 km strip for the Orange Line, while the national science and technology development budget was less that Rs1 billion. Prime Minister Imran has vowed to change this sad situation. This requires the dissolution of the 18th Amendment as the education sector is fragmented with four provincial ministries and one federal ministry holding different territories.

A similar situation exists for science. When I was the federal minister of science during 2000 to 2002, and later chairman HEC from 2002 to 2008, I managed to persuade then president Musharraf to give a high priority to science. As a result, the expenditure on R&D went up from 0.18 percent of GDP in the year 2000 to 0.86 percent of GDP by 2008. However, after my departure, the expenditure went down again to 0.2 percent of GDP.

However, strengthening science without focusing on its applications on agriculture and industry is undesirable. Science must impact the lives of the common person through facilitating the manufacture and export of high technology goods. This is my present focus. My recent interactions with senior government officials of China are directed to create joint industrial ventures between Chinese and Pakistani companies under the CPEC programme, for the manufacture of high technology products.

Pakistan needs to have a clear National Technology Policy with a strategy and time-bound action plan. There needs to be liberal access to venture capital funding to foster new start-up companies based on new and emerging technologies. These are predicted to have an impact of over 100 trillion dollars over the next decade.

A roadmap for Pakistan was prepared under my leadership in the form of a 320-page document, titled ‘Technology Based Industrial Vision, Strategy and Action Plan for Socio-economic Development’, in 2006. This was approved by the cabinet in August 2007. It clearly lays out what must be done in various sectors such as agriculture, electronics, engineering, information technology, biotechnology, chemicals and pharmaceuticals, textiles etc. It needs to be urgently revived and implemented.

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