



*Editorial*

## **Integration of Science, Technology and Entrepreneurship to Capture the Power of the Nanoengineering Wave**

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Nano in its various formats (or allotropes to borrow the term from the chemistry of carbon) has changed the social landscape not only for electronics, but also for human enterprise in planning the future of a community, state, country and the planet Earth. Nanoscience, nanotechnology, nanoengineering and nanobusiness are all moving targets, creating new start-ups among unlikely partners. The complete nanoensemble, by its very nature, is a multi- and inter-disciplinary venture. Perhaps there is a need for engagement of not only scientists and engineers, but also of thinkers, ethicists, lawyers, theologians and politicians. Engineering, a process of synthesis, is an engine of innovation, invention and growth. To quote Theodore Von Kármán, the California Institute of Technology's Provost, who said during the formative years of the institute, "Scientists discover the world that exists; engineers create the world that never was." In other words, science is about being driven by curiosity to understand the world. Engineering is about using science to transform the world. A mature researcher must remain curious, adventurous and engaged to derive the joys arising from creating a new device, venture or educational paradigms, as ideas from disparate groups are synthesised and communicated through journal articles.

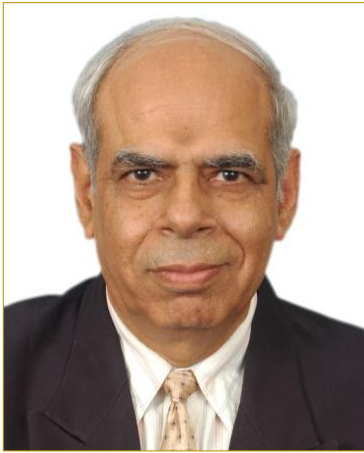
As Malaysia's neighbours India and Sri Lanka join the elite Washington Accord (WA), project- and problem-based learning will take increasing importance in training the workforce for tomorrow. Seventeen countries are now members of the WA (arranged alphabetically with year admitted in parenthesis): Australia - Represented by Engineers Australia (1989); Canada - Represented by Engineers Canada (1989); Chinese Taipei - Represented by Institute of Engineering Education Taiwan (2007); Hong Kong China - Represented by The Hong Kong Institution of Engineers (1995); India - Represented by National Board of Accreditation (2014); Ireland - Represented by Engineers Ireland (1989); Japan - Represented by Japan Accreditation Board for Engineering Education (2005); Korea - Represented by Accreditation Board for Engineering Education of Korea (2007); Malaysia - Represented by Board of Engineers Malaysia (2009); New Zealand - Represented by Institution of Professional Engineers NZ (1989); Russia - Represented by Association for Engineering Education of Russia (2012); Singapore - Represented by Institution of Engineers Singapore (2006); South

Africa - Represented by Engineering Council of South Africa (1999); Sri Lanka - Represented by Institution of Engineers Sri Lanka (2014); Turkey - Represented by MUDEK (2011); United Kingdom - Represented by Engineering Council UK (1989); and United States - Represented by ABET, the Accreditation Board for Engineering and Technology (1989). One aspect of this globalisation is that English is de facto the international language in which to publish new and noteworthy results. Some WA countries struggled with this issue and accepted the fact that the globalised humanity of planet Earth appreciates creativity and innovation (C&I) only through the medium of English. Good communication skills in the English language have become of paramount importance.

*Pertanika* journals diversified into three specialised journals as the *Journal of Tropical Agricultural Science (JTAS)*, *Journal of Science and Technology (JST)* and *Journal of Social Sciences & Humanities (JSSH)* to provide multidimensional strengths to put nanoengineering in broader perspective with focus on science and engineering in JST. JST is dedicated to the unification of science and engineering, covering a journey from quantum physics to nanoengineering, including peripheral topics of mind-body integration in training the mind to create brain conducive to integrative forces of nature for C&I to flourish. Science is adventure, a mix of curiosity and play. Only with curiosity about the unknown and exploration of the unfamiliar, can there be discovery. A researcher must remain steadfast in his/her adventure of discovery and ultimately, transformation. As new materials appear on the world stage, nanoengineering captures the attention of strategic planners in search of C&I for betterment of humanity. One aspect of this integration is that biology is an essential ingredient to derive the benefit of nanoengineering, in addition to physics, chemistry and mathematics. In general, nanoengineering arises from the vigour of curiosity, tempered by the rigour of reason. This interplay of curiosity and reason gives science its robustness, enhanced further by dynamism, imagination and the drive to understand the natural world.

Technology is science responding to life's necessities, and the many demands of the human conditions. Technology gives us devices and inventions to make our lives better. Curiosity interplaying with reason gives us science; science interplaying with necessity gives us technology. The interaction of science and technology is what helps bring about understanding of the world, connecting with the world, thereby contributing to the transformation of the world. By integrating curiosity, reason and necessity, *Pertanika* will play its part, hopefully a big part, in the global knowledge community, dedicating to transforming our world into a better place.

As we usher in the new year of 2015, I envision *Pertanika* becoming a powerhouse of transformative science and technology not only for Universiti Putra Malaysia (UPM), but also for Malaysia, the ASEAN region and beyond. *Pertanika* will be a place for the creative interplay of curiosity, reason and necessity. With the engagement of its readers, *Pertanika* will be a wellspring of ideas and innovation, overflowing with benefits for the global economy.



**Vijay K. Arora:**  
*Distinguished Professor & noted international educator and IEEE-EDS Distinguished Lecturer*

Professor Arora, noted international educator and IEEE-EDS Distinguished Lecturer, resurrects nanoengineering integration in his most recent book entitled *Nanoelectronics: Quantum Engineering of Low-Dimensional Nanoensembles*, soon to be released by CRC Press: Taylor and Francis Group. Professor Arora obtained his Ph.D from the University of Colorado. He has held distinguished appointments at the University of Tokyo, National University of Singapore, Nanyang Technological University, University of Western Australia and Universiti Teknologi Malaysia (UTM), in addition to several short-term visiting assignments around the world. Presently, he is a distinguished visiting professor at UTM on leave from Wilkes University, U. S. A. where he holds tenure as a Professor teaching electrical engineering, physics and engineering management. Professor Arora was accorded Leading Educators of the World 2005, Leading Scientists of the World 2005 and Man of Achievement 2005 by International Biographical Centre of Cambridge, England. He is listed in a number of Who's Who biographies. He has been invited to give keynote lectures and presentations internationally. His publications include more than 100 papers in reputed journals and many uncounted publications in conference proceedings and numerous invited/keynote lectures. Professor Arora serves on the editorial board of a number of journals. He was chair of NanoSingapore2006, NanotechMalaysia2010 and EscienceNano2012 conferences. He can be reached at [vijay.arora@wilkes.edu](mailto:vijay.arora@wilkes.edu).

