Editorial
Future of Engineering Education

About four years ago I penned an editorial devoted to the future of engineering education by 2050. It was motivated by an interesting and thoughtful analysis of the issue as presented at http://www.newhorizons.org. As an engineering educator I have always been interested in the future of engineering education and research, since engineering profession is intimately connected with wealth creation for every nation as opposed to wealth distribution. It can, if properly nurtured and channeled, increase the size of the economic pie and not simply cut the existing pie into pieces and redistribute it. The global situation in recent decades may give the naïve onlooker the impression that indeed wealth creation is not that important if wealth can be accessed somehow without the hard work of generating it. Indeed, it seemed to have worked at the superficial level with "soft" management or administrative work being rewarded better than "hard" engineering or technical work. This motivated en mass switch from manufacturing to service industries. Indeed, globalization appears to have had an unanticipated negative effect of making global wealth available even to those who had the means to access it without actually producing it. The conservation law of wealth- which I am probably defining for the first time- requires that the total global wealth at any time shall diminish as significant parts of it are taken away for nonproductive (viz. non-wealth-creating) activities. This is probably an over-simplistic explanation for the current downturn in global economy but it does have a significant measure of truth in it.

I believe that strong and rigorous engineering education is vital to a nation's economy. It is also key to innovative R&D leading to enhancement of wealth. To attract the best talent to this "hard" profession the rewards must be commensurate with what the work entails. This has not been the case for decades with interest of young minds in science and technology have declined precipitously all over the world. Service-oriented professions have overtaken hardware-oriented professions to the detriment of wealth creation capabilities of most developed and appreciably developed countries. Talent has understandably migrated towards regions of higher financial returns than in their home countries and alleviated the problem in at least parts of the globe. However, flattening of the globe is making this process increasingly difficult and non-sustainable. Outsourcing of engineering services is a good but only a temporary solution for developed economies. Over the next four decades the globe will look very different, however, and reversal of talent flow directions is certainly likely and is already happening in some disciplines.

In the following I use the word engineering education to include education in applied sciences and technology as well. The current focus on pure sciences, while laudatory, is driven by the need of academic institutions to score high on various ranking exercises done by nonacademic establishments. Each discipline has its optimum sustainable level but this is disturbed by the unfortunate raking agencies around the world. Currently, basic sciences have already generated a huge gap between their state and its utilization for societal benefit. We need some catch-up time in engineering and technology to justify the massive R&D expenses already incurred on basic research. Recall that it is te engineering graduates who are still in greater demand for industrial work and R&D.

Unfortunately, many major academic institutions that influence the emerging direction of engineering education and research are deviating seriously from fundamental strengths in engineering and migrating towards other "non-engineering" areas. The word engineering itself is being widely hijacked e.g. we now have a "financial engineering" discipline as well. Of course, sciences are key to engineering as are humanities and management sciences. However, the focus should still be on engineering, which includes ability to design, build and operate engineering projects, which are becoming increasingly complex. Diluting engineering education to a point where engineering graduates cannot design or work effectively in an industrial setting is a serious matter, which will affect a nation's ability to excel. Maybe it will be necessary to stretch the duration of engineering programs; this will make engineering and applied sciences education even less attractive, however. A major challenge exists for those planning the future of engineering. It needs real visionaries with established track record of success. Also instituions should" think global but act local". Thinking local and acting global has been a major problem with globalization in recent years!

I do not have a solution to offer in a short editorial. Fortuntaley, the time scale of academic educational programs is long so we have time to rectify weaknesses. I see current trends as disturbing and see them as at least a partial cause of problems we see today. Emphasis on "software"(read service) at the cost of "hardware"(read manufacturing or producing hard products) is a worrisome trend, especially if everyone around the world follows this trend. Remember if there is no hardware there is no need for service! Focus on just service industry is a myopic approach. It does not create wealth; it only services it ,by definition. Indeed, a piece of the pie is taken out of the wealth creation part of the pie. Lack of R&D support in time leads to redundant outdated products and leads to the affected industry's demise. There are many huge examples of this already happening around the world. R&D must be considered an investment and not an expense to be recovered and made profit on every quarter.

It is easy to see that energy, environment, economy and ethics (4E) are closely intertwined. Engineers must be taught all 4E's throughout their education program. Weakness in any one of these will lead to disastrous effects that will be global. Failures in engineering education will lead to "de-globalization" –another new word I am forced to coin here. It will be harder to "re-globalize" even a flat world, if that happens as globalization will become the scapegoat in the "blame game" for the current financial tsunami.

In a follow-up editorial I will propose more specific ideas for enhancing engineering and applied sciences education in coming decades that hopefully will make it a valuable asset in the following few decades and attract high quality talent to the profession..

As always, I welcome reader's comments and suggestions.

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