

Coevolution of Science, Technology and Society

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Abstract: Innovations in science & technology have a critical impact in fields related to sustainable development such as health monitoring, energy management, agricultural productivity, pollution control, food processing and many others. Continued national, international and societal efforts are necessary to deliver on the full potential of the researches in science and technology for subsequent growth and development. Growth should be such that it meets the economic, environmental and societal needs of a country. Infact the problems in our social surroundings lead to several technological innovations so we can clearly see the coevolution of the technology and society. However, appropriate safeguards to the society must keep pace with the scientific and technological advances in any discipline be it biotechnology or medical or nanotechnology. These important and sensitive issues are now dealt under expanding and advancing branches of ethics *viz* environmental, biotechnological, industrial or medical ethics.

Keywords: science, technology, society, environment

The recent and continuing development in the life sciences are conforming to the prediction that this will be the century of Biotechnology. Life science research and biotechnology are delivering on better outcomes for health, the environment and for industrial, agricultural and energy production (Thieman & Palladino, 2008). Any kind of growth must meet the economic, environmental and societal needs of countries. For this concerted efforts involving both public and private sectors are required to remove inappropriate barriers and provide opportunities for the transition to a mere biobased enterprise. Also appropriate safeguards to the society must keep pace with scientific and technological advances in biotechnology.

To achieve the economic, environmental, health and social benefits of biotechnology will be a challenge to the government policy, public information, law, education and the scientific and technological infrastructure. This will also affect our societies and many aspects of our life just as profoundly as information technology has already done. Innovative products and services with improved economic and environmental performance will draw on renewable resources and biological processes to meet the needs of society if delivered successfully. They have the potential to help to decouple the industrial growth from environmental degradation and provide a more resilient, more biobased economy – an economy that uses renewable bioresources, efficient bioprocesses and ecoindustrial clusters to produce sustainable bioproducts and new opportunities for jobs and income which will be less susceptible to untoward global events.

Life sciences and biotechnology are making significant contribution to sustainable growth in the medical & health sector. A better understanding of the underlined biology of diseases as a result of human & other genome projects are providing the researchers and health professionals with an opportunity to employ safer & more effective interventions based on biotechnology. It promises a better synchronisation between the supply of effective health interventions and increasing societal expectations for good health and quality life (Robert,1993).

The most recent addition to our science & technology arsenal is Nanotechnology (Drexler,1986) - the study, design, creation, synthesis, manipulation and application of functional materials, devices and systems through control of matter at the nanometer scale, i.e at the atomic and molecular levels. However, despite of the rapid advances of nanotechnology in fields such as consumer electronics and cosmetics there is no coherent program employing nanotechnology to global developmental challenges. There is an argument that nanotechnology will upset export markets of developing countries which rely heavily on agricultural products and raw materials like rubber. The demand for these primary commodities will decrease as nanotechnology produces cheaper laboratory created substitutes and as a result will displace poor

agricultural, factory and mine labourers. Science & technology has brought about the automation of manual tasks which has resulted in decrease in manual labour which may be considered alarming for developing countries but definitely not for the developed countries. Also nanotechnology may be able to create many new materials and a vast range of applications but may also raise concerns about the toxicity and environmental impacts of nanomaterials (Cristina *etal*, 2007). But in both developing and the developed countries workforce has well adapted to the changes derived from successive waves of technology. Local innovations offer the best approach to maximise the benefits of nanotechnology for the developing countries and these significant gains warrant a more appreciative outlook towards nanotechnology's role.

Another important public policy development of the new millennium is the growing recognition of the role of technological innovations in the international communities. Infact advances in science & technology are shaping the character and content of international society. It is evident from the example of how the technological innovations and the associated institutional adjustments in the field of agricultural biotechnology have led to changes in the way nations relate to each other (Fukuyama, 2002). These changes may lead to new forms of technology based international partnerships which will alter the traditional patterns of international cooperation between developing countries. Such developments will also reshape the structure and functioning of international communities by bringing about greater awareness of the role of science & technology among them (Gibbs, 2000).

In early phases of the cold war industrialised countries used their scientific and technical knowledge to solve the problems of developing countries which also extended their strategic influence. Among these efforts Green Revolution was launched which helped to raise food productivity in Latin America and Asia and also stimulated local economical activities. Thus in addition to meeting local food needs and raising farm incomes the Green revolution also helped to integrate participating countries into a global agriculture trade system and created a foundation for food safety. This demonstrates how countries could use scientific and technical knowledge to cope with the developmental challenges. The Green revolution exemplified that it is possible to create long term global technology partnerships aimed at solving local problems. It is important to note that Green revolution took place successfully in the era of decolonisation and political upheavals world over which exhibits the strength and power of science & technology to bring about positive changes in international community partnerships (Jain 2010). Among the significant achievements are large distribution and accumulation of wealth, new food sources, bio diplomacy, new medicines with underlined liabilities such as environmental contamination and degradation of genomes (Tait *etal*, 2001). With the increased efficiency in translating laboratory results in industrial achievements and products, the time between the translating period is clearly decreasing. At this juncture it becomes the moral duty of the biotechnologist to adapt ethical practices (Donal & Mathuna, 2007). The scientist cannot remain ignorant or insensitive to ethical issues affecting the society (Levidow *etal*, 1997). But it would not be appropriate to expect a scientist to be a bioethicist as well. This may be dangerous to put social pressure on the already overburdened scientist and hold him alone responsible for securing the interest of rest of society which finds an excuse to abdicate.. Balanced approach to the solution lies somewhere between 'scientist being ethical experts' and 'society becoming more proficient at digesting and reacting to innovations with expert help'. This would be possible only with a better definition and understanding of the discipline with a more integrated cooperation and exchange between scientist and ethicists. Its an era of co-evolution in a more integrated manner (Fig.1-2) Majority of decisions to be made should focus on the well being of society at large, environment and the quality of life on earth for present and future generations

(Buttel *etal*, 1987). In process of taking decisions technical knowledge is indispensable to find concrete alternatives but an appreciation of ethics and ethical issues is also unavoidable in making choice between the two.

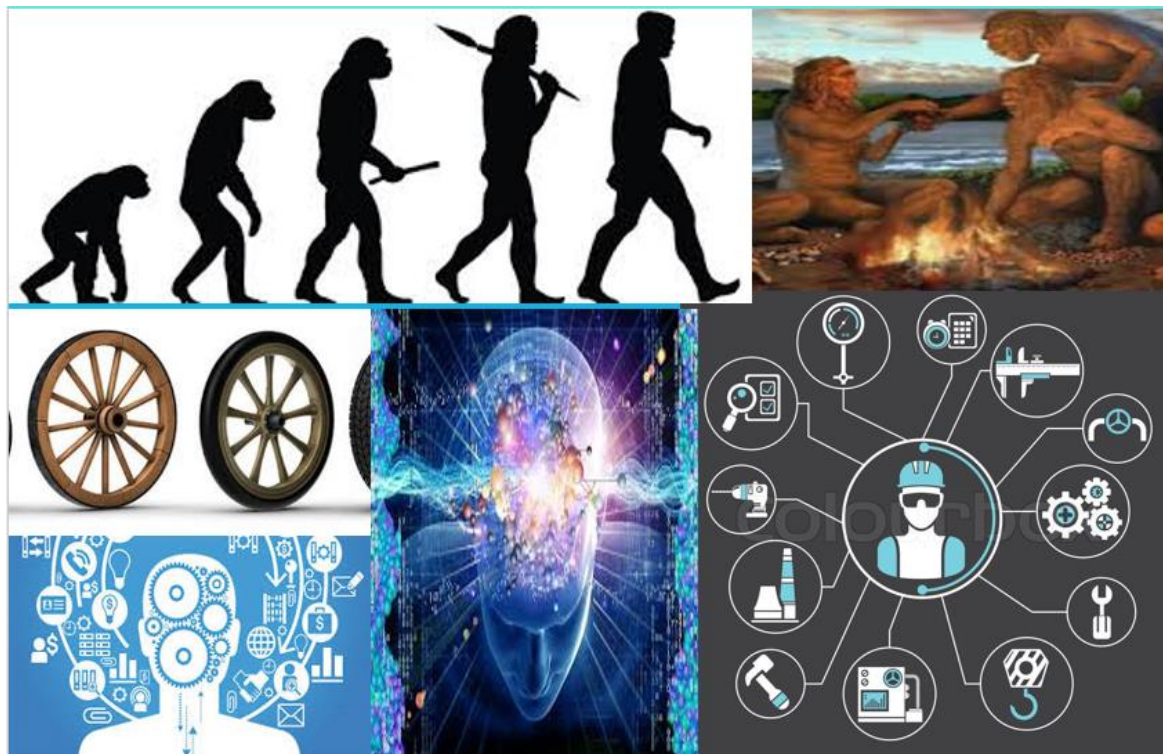


Fig.1

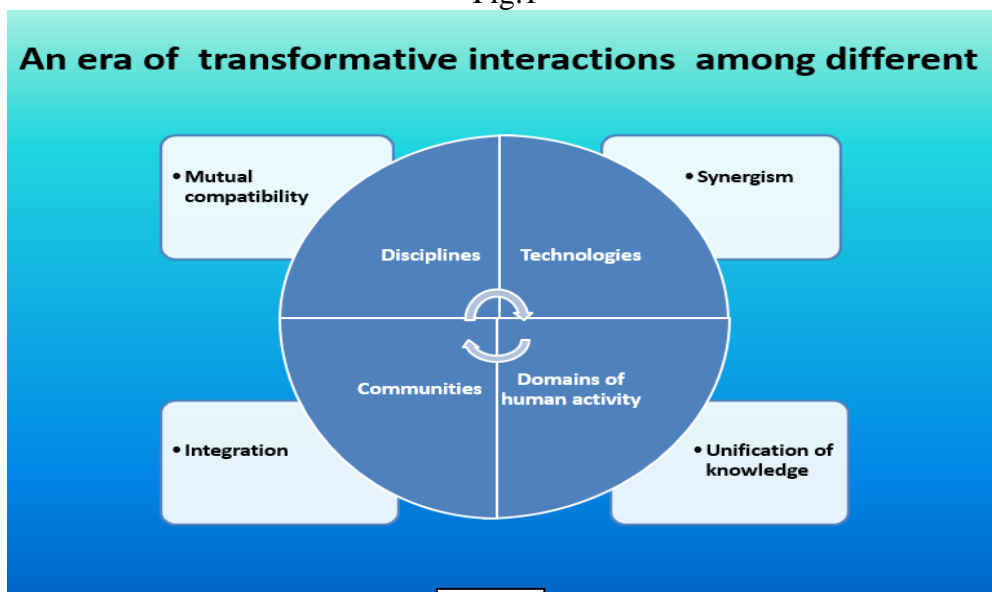


Fig.2

Keeping a balance may at times become quite difficult considering the prevailing social, economical and political pressures. One factor that adds stumbling block to the situation is the tendency of grouping all ethical issues concerned with human life under the label of ‘bioethics’ which in turn -by virtue of the perception of general public and especially the media- is heavily skewed towards ‘medical ethics’. Although these are important and sensitive issues but unfortunately they are approached under the influence of religious and socio-political decisions. By not realising the distinction between biotech ethics and biomedical ethics , the society adversely influence advances in environmental and industrial researches hence hampering the sustainable development process .

Conclusion

To conclude we can say that a better understanding and the positive role of the society with a broader outlook can help in accelerating the development using biotechnological researches. Our social

requirements lead to technological innovations which clearly indicates the coexistence of the two but they also need to co evolve – A more appreciative and accommodative outlook of the society towards technological innovations is necessary to deliver the full potential of life sciences and biotechnology for sustainable growth and development.

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