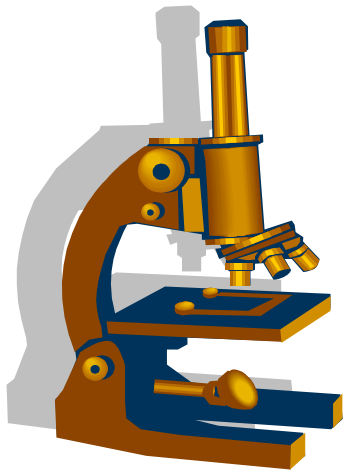
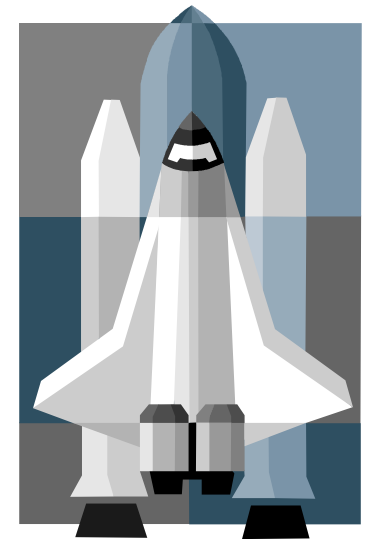




The Centrality of Science, Technology and Innovation to Societal & Economic Transformation



Ahmad Kawesa Sengendo, Ph.D



Introduction

- As the trends in the growth of human population across time shows, there has been a positive correlation between man's ability to tame the forces of nature and his survival rates.



Introduction (cont'd)

World Population

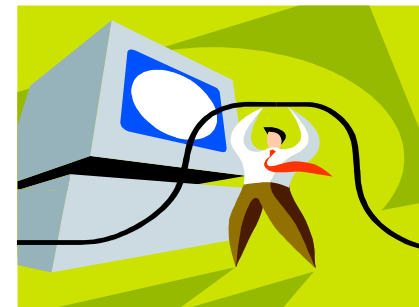
<u>Year</u>	<u>Population (billion)</u>
1	0.30
1000	0.31
1250	0.40
1500	0.50
1750	0.79
1800	0.98
1850	1.26
1900	1.65
1950	2.52
2000	6.06
2050 (UN Forecast)	8.91

Fig. 1

(Source: The Economist: Millenium Special Edition. Dec. 1999)

Introduction (cont'd)

- Developments in S&T and R&D in the last half century have been unprecedented.
- We are now at a time when the rate at which knowledge is created, modeled and reconfigured is far greater than a single individual or society can acquire and fully benefit from all the available knowledge base.



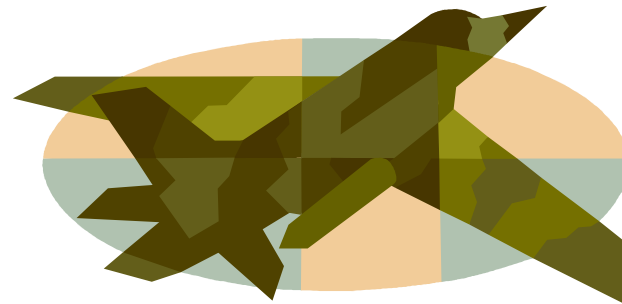
Some S&T Developments

- Impact of the invention of the wheel & its impact on travel
- Advances in genetic engineering & biotechnology
- Control & eradication of diseases
- Advances in S&T and R&D have transformed the human society in fundamental ways that our ancestors if they were to come back, they would completely be bewildered and would probably prefer to have nothing to do with us as the only safe way to protect themselves from “our magic and sorcery”.



THE SOCIAL DILEMA

- ❖ Man now has the ability to destroy planet earth many times & to destroy life as we know it today, thanks to advances in the S&T of war. A 3rd world war could probably end the world or bring about human suffering of unimaginable proportions.



THE SOCIAL DILEMA (cont'd)

- Biological or germ warfare has reached dangerous potentials that one would prefer to assume there will never be one such a war in ones lifetime. The erosion of human morals in the modern times puts the future of human kind in doubts given the fact that dangerous S&T is becoming increasingly easily accessible by the lunatics of the world.
- During the Cold War, the word MAD acquired a new definition – Mutually Assured Destruction. In the warm days after the cold war, the same meaning can still be ascribed to the word MAD

THE SOCIAL DILEMA (cont'd)

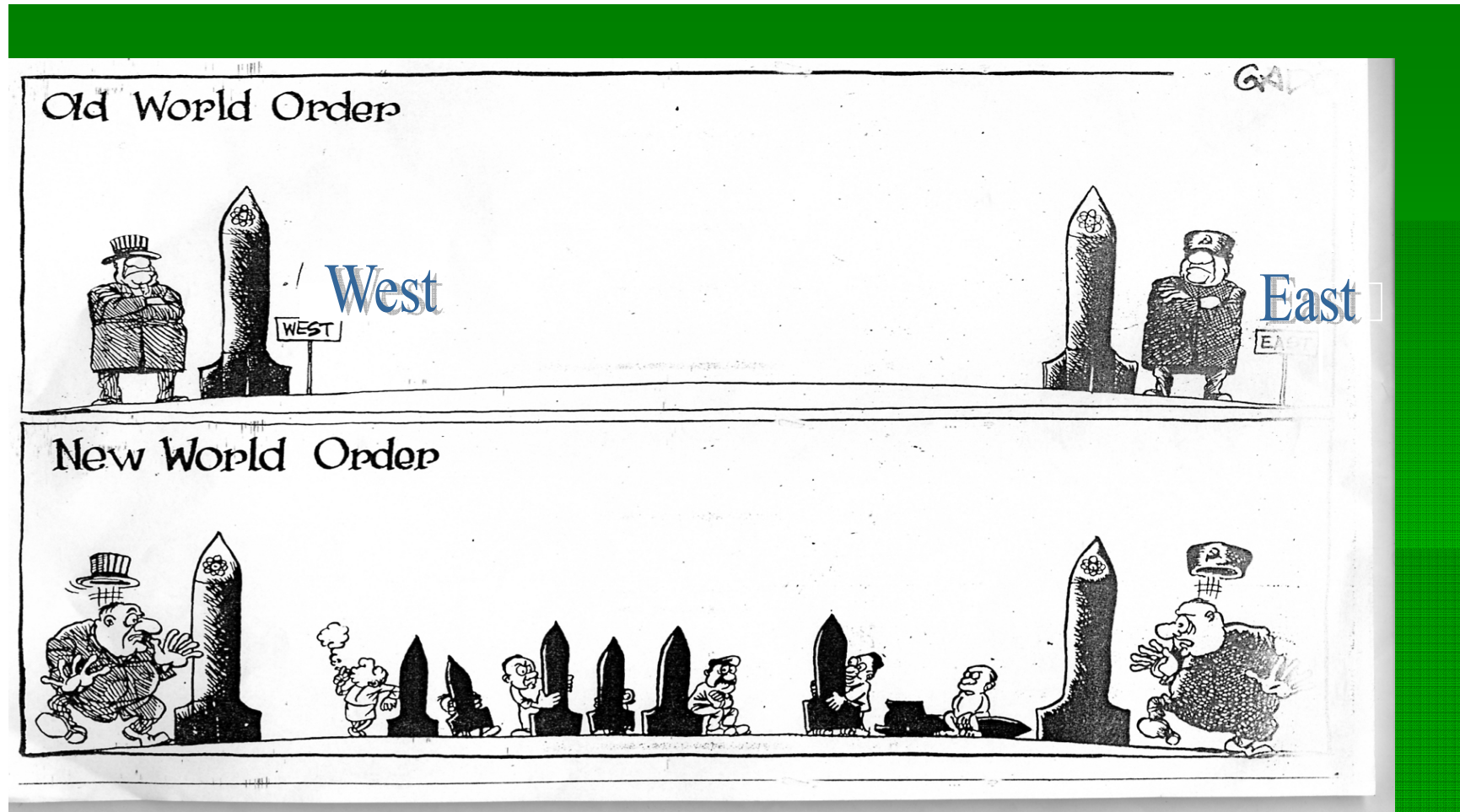
- Material S&T devoid of the restraining influence of the spirit and soul, can be a -ve factor in societal development.
- The negative effects of S&T just affirm what engineers call the **Law of Unintended Consequences**: “*A complex project will always have consequences that are unintended.*” Modern S&T is, indeed, a complex project.



THE CHALLENGE

- The challenge is for us to harness the good side of S&T to continue developing our societies and achieving the development aspirations of our people, while at the same time we tame the -ve influences of S&T.
- The bombing of Hiroshima and Nagasaki by the Americans using atomic bombs effectively ended the Second World War. Today, such a bomb put in action could trigger a chain reaction of nuclear bombardments that could end the world now that there are many players in that field as the cartoon below shows:

The World at Risk



THE CHALLENGE (cont'd)

- For S&T and innovation to remain central to the positive transformation of societies, mankind must focus on only the pursuit of S&T for peaceful purposes.
- ***“We must not ask where science and technology are taking us, but rather how we can manage science and technology so that they can take us where we want to go.”***

Rene Dubos



THE UNBALANCED WORLD

- The world's population increased from 2.5 billion in 1950 to 6.5 billion in 2005. (8.9 billion in a few decades from now).
- **Projections for Uganda - 101 million by 2050 (others have put it at 130 million!).**
- Dilemma: world's resources are being depleted by the increasing population leading to poverty, diseases, starvation, diseases, unemployment, pollution, social violence, war etc. As Martin (2007) put it, "***Many poor countries have become so destitute and violent that the social misery seems irreversible.***"

THE UNBALANCED WORLD

(cont'd)

- Population growth rates in many countries that have significantly advanced in S&T as well as R&D is either very low, or in some cases negative, **that of the poor countries with very low levels of S&T and R&D is high!** Martin (2007) made the following observations:

THE UNBALANCED WORLD (cont'd)

- *“The rich get richer and the poor have more babies. ... Starving populations, strange as it seems, usually grow faster than well-fed populations. A dying plant produces more flowers. Poor people, expecting their children to die, make more children. ... Tragically, [most of the population] increase will be in areas such as shantytowns, with the least capability to feed, care for or find employment for the increase. The terrible conditions of the shantytowns will get worse.”*



THE UNBALANCED WORLD

(cont'd)

- In spite of the advances in medicine and health care, Martin (2007) reminded the world that “*Every year about 3 million children in poor countries die of diseases that could have been prevented by basic health care and vaccinations.*”



THE UNBALANCED WORLD

(cont'd)

- In a knowledge-driven society, many poor countries of the Commonwealth, and other groupings, are still unable to benefit from the opportunities presented by advances in S&T. For instance, the internet has opened up tremendous opportunities for learning, trade, working, and communications, but most people in the Commonwealth cannot access a computer as the figures below indicate:

THE UNBALANCED WORLD

(cont'd)

<u>Country</u>	<u>Internet users</u>	<u>PCs/1,000</u>
Australia	13,000,000	689
Canada	20,000,000	705
Singapore	2,421,800	622
United Kingdom	37,600,000	600

Malawi	46,100	2
Nigeria	1,769,700	7
Pakistan	2,000,000	4
Uganda	200,000	5

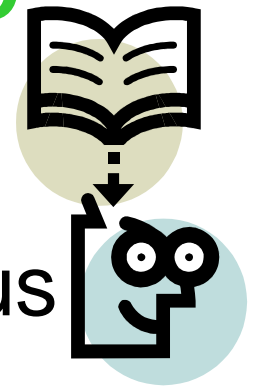
(Source: Commonwealth Year Book, 2006)



THE UNBALANCED WORLD

(cont'd)

- It is therefore no wonder that, as the World Bank (2004) observed, “*Poor nations are not only poor in wealth, they are also poor in knowledge.*”
- How can poor countries transform themselves from their present precarious situation to acceptable levels of development? With greater mastery of S&T, some progress can be made.



THE UNBALANCED WORLD

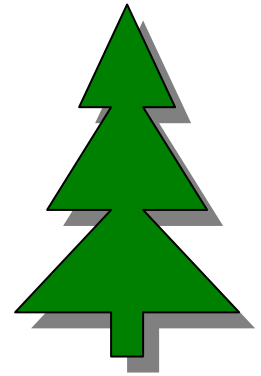
(cont'd)

- Countries like India, Singapore, and Malaysia can serve as models of the centrality of S&T in societal and economic transformation.
- India today provides high skilled workers to companies in the USA without the Indians having to cross their borders. India's 2020 plan aims at having 200 million graduates 300 million trained technicians. Clearly India understands the power of knowledge in the transformation of societies.



MEGA PROBLEMS OF THE 21ST CENTURY

1. Global warming
2. Excessive population growth
3. Water shortages
4. Destruction of life in the Oceans (Only 10% of edible fish remain)
5. Mass famine in ill-organised countries
6. The spread of deserts
7. Pandemics
8. Extreme poverty
9. Growth of shantycities



MEGA PROBLEMS OF THE 21ST CENTURY (cont'd)

10. Unstoppable global migrations
11. Non-State actors with extreme weapons
12. Violent religious extremism
13. Runaway computer intelligence.
Computers will acquire the capability to increase their own intelligence until a chain reaction happens of machines becoming more intelligent at electronic speed.

MEGA PROBLEMS OF THE 21ST CENTURY (cont'd)

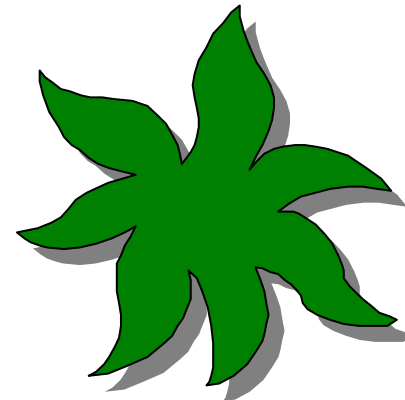
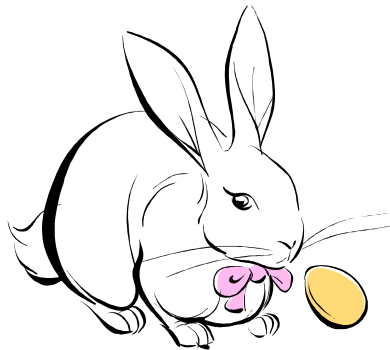
14. War that could end civilization

15. Risk to *Homo Sapiens*' existence. A combination of risks and some scientific experiments with a low probability of wiping out man.

16. A new dark age.- Occasioned by a global cocktail of serious problems such as intolerable poverty, extreme affluence, mass terrorism with nuclear/biological weapons, 3rd world war, religious insanity, etc.

Intervention in Evolution

- Until recently, evolution on earth has been in nature's hands. Now man wants to participate in the evolution process. What could be the consequences of man's intervention in the evolutionary process?



A GLIMPSE INTO THE FUTURE OF S&T AND HUMAN INNOVATIVENESS.

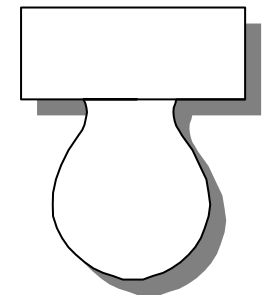
- Technology promises to completely revolutionalise the way think and live. E.g, Steven Connor (2006) in article entitled **“Techno Twist: What Technology has in Store”** made the following forecasts:



- [The Future of the Home](#)
- He urges that the future home electricity will be drawn from the first rays of the sun. Then water from the dishwasher will be recycled into the showers, then to the toilet, and finally to the local water purification plant.

The future of the home (cont'd)

Toilet basins will be fitted with **bio-chips** which will analyse the users' waste for early signs of bowel cancer and other metabolic disorders. Urine markers will sense the blood cholesterol and alcohol levels. Then the intelligent toilet can send a message to the user's medical file. The bathroom sensors detect the lady's presence and organize her favorite aromatherapy programme.



The future of the home (cont'd)

- The intelligent fridge automatically orders for more supply of food items, and gives a calorie readout of what one ate and drank the previous meal.
- The TV will provide all options though verbal question and answer, and reads out the weather to the intelligent climate-control system which calculates the hour-by-hour ventilation required to keep the air fresh and the energy conserved.
- Hydrogen fuel-cell generators will replace the present generators.

2. The future of transport.

- The era of the internal combustion engine will soon come to an end, most likely to be replaced by the **hydrogen fuel-cell**. There are already petrol/electric hybrid cars such as the Toyota Prius. Honda, Mercedes-Benz, and Nissan have tested hydrogen fuel-cell vehicles.
- Satellite navigation will enable cars to “**drive themselves**”, avoiding dangerous routes.
- More people will own their private jets.





3. The future of procreation



- **Louise Brown**, the first test-tube baby was born in 1978.
- It is now possible to consider men as mere sperm producers, and soon women as ova producers.
- Scientists are working on an artificial womb. With developments in IVF, **the first male pregnancy has moved from scientific fiction to possibility!** Through hormonal treatment, men's dormant mammary glands would be triggered to produce milk.

3. The future of procreation (cont'd)

- Such “male mothers” will completely distort the concept of child bearing as we know it today!
- Couples will be able to have children long after their death! All they will need is to have their embryos or reproductive cells stored, and enough money to find surrogate parents – others may simply volunteer.
- Such developments not only transform society fundamentally but will also raise fundamental socio-economic questions.

FACING THE CHALLENGES

1. Heal the Planet

- ✓ S&T must help us to preserve the earth. The ozone layer must be replenished if we are to minimize destructive climatic changes.
- ✓ Our scientists must hasten to produce clean alternative sources of energy to fossil fuel. We need affordable alternatives to wood fuel and charcoal.
- ✓ We have to have innovative ways of using the soil to produce enough food without harming the soil.
- ✓ We need better ways of conserving water and ensuring that we do not deplete or pollute our water resources.

1. Heal the Planet

(cont'd)

Man's actions have severely wounded the earth and the continuous on-slaught impairs its ability to repair itself. If the earth is not healed quickly it must at one time fail to sustain the soaring human population. Catastrophic consequences may eventually become the only available option should S&T fail to address this concern.



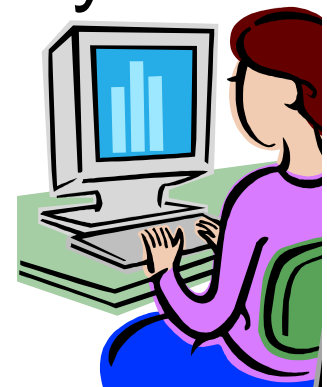
2. Fight Poverty

- ✓ As Jack DeGioia of Georgetown University put it, ***“The moral challenge of our times is to eliminate extreme poverty.”*** Socio-economic transformation remains a mirage as long as the majority of our people continue to live in abject poverty.
- ✓ Poor people have no capacity to benefit from the great opportunities that advances in S&T as well as R&D may put on their door steps.
- ✓ Poverty is dehumanizing & cheats its victims of the minimum positive self-image & self-confidence necessary to face life’s challenges with courage & hope.



2. Fight Poverty (cont'd)

- ✓ Properly harnessed, and with right political policies and support, innovative ways of using S&T can improve people's welfare. E.g. of a success story of one rural business school in India – The Mann Deshi Udyogini, that has turned many rural women into successful entrepreneurs by giving them **technical, vocational and management skills.** (Replicate)



3. Manage the Population

- ✓ The world's population is increasing. Most of these new citizens will be in countries that have less ability to grow enough food, and where illiteracy rates are still unacceptably high, especially among women.
- ✓ **The population growth rates tend to decline significantly where almost all women can read and write.** S&T provides us with the opportunity to expand educational frontiers. We should target women with educational programmes that help to raise their literacy levels.
- ✓ **Population tends to decline where GDP is high.** If we can effectively use S&T in innovative ways so as to improve the GDPs of the poor countries, we can transform those societies and also reduce the population of the world without having to use brutal policies such as “one couple one child”.

4. Prevent Wars



- ✓ Wars create misery and retard socio-economic development. Wars displace people and lead to untold suffering. A 3rd World war could end everything, and effectively wipe out all the positive gains of S&T.
- ✓ With the globalisation of hate and terror, man needs to innovate new ways of sharing the world in order to save himself.
- ✓ If war-mongering nations are not willing to abandon manufacturing weapons of mass destruction, can our scientists innovate an “anti-nuclear weapon”?

5. Domesticating Globalisation

- ✓ The world is shrinking and globalism is for real. S&T have made geography history. The bandwidth is increasing everyday and reaching more families and homes.
- ✓ But because human beings have never been, and can never be, the same, there is need to allow local unique cultures to thrive and survive the globalization pressures. Multiplicity has always been the rule in nature and any attempt to homogenize everything can only lead to unpredictable consequences.
- ✓ We can use S&T to transform our societies but we should try to preserve our unique qualities that make us what we are. The Japanese did everything possible to acquire western S&T but retained the Japanese spirit?
- ✓ We should use S&T to spread the positive aspects of globalisation but at the same time we limit the negative ones.



CONCLUSION

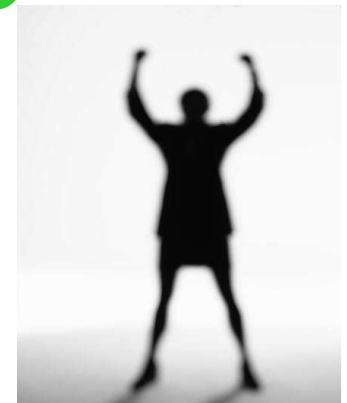
- As one clever person put it, “*Small minds discuss people. Average minds discuss events. Great minds discuss ideas.*” The 21st century is a century of great ideas which increase at a supersonic speed every time.
- The human mind has tamed the forces of nature and innovated creative ways of doing things. As Professor Nazeer Ahmed observed, “*In all of God’s creation, there is nothing as unique, as inquisitive, and as daring as the human mind. It is the seat of rational thought and the monarch of the world of possibilities.*”

Conclusion (cont'd)

- The biggest challenge of the human mind in the 21st century will be how to prevent S&T from spiraling out of control so that it can continue to positively transform human societies across the globe. We are, however, reminded by William Ralph Inge that: ***“There are two kinds of fools: Those who say, “This is new and therefore better” and those who say, “This is old and therefore good.”***

Conclusion (cont'd)

- Given the many great contributions that S&T has given to human civilization, we can hope that the positive influences of S&T will continue to assure man of his survival and prosperity. We must however not be complacent as C.P. Snow remarked, “**Science is the refusal to believe on the basis of hope.**”

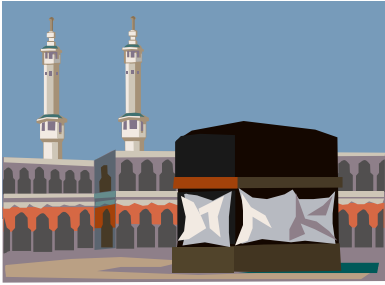


Conclusion (cont'd)

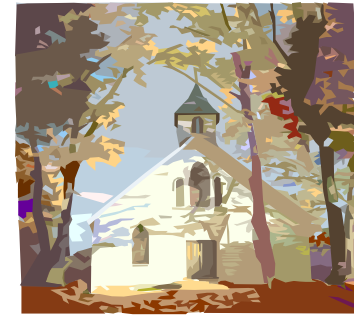


- One of the real marvels of modern S&T is the computer and its capabilities and influences on human lives.
- In this **Silicon Age**, computers have completely transformed the way many things are being done.
- L.M. Mechan warned that ***“In a few minutes a computer can make a mistake so great that it would take many men many months to equal it.”***
- There is a danger that man is becoming over dependant on the computer – to think, learn, live, etc.. Sydney Harris warned that ***“The real danger is not that computers will begin to think like man, but that men will begin to think like computers.”***





Conclusion (cont'd)



- On his part, Voznesensky warned that ***“The future computers will theoretically be able to do everything that man is doing except two things: to be religious and write poetry.”***
- Albert Einstein seemed to agree when he asserted that ***“Science without religion is lame and religion without science is blind.”***



Conclusion (cont'd)

- To my mind, no society aspires to be lame or blind. Hence, no society should waste time and resources seeking for lame science. The great influence of S&T in transforming societies cannot be denied. **What is probably required now is the transformation of science by society so that S&T can take society where it wants to go. I rest my case.**

Thank You