Technology and the Global Community

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Technological advances have made life more prosperous, productive and comfortable for most of the people in certain parts of the world and for many people all over the world. Yet, we see enormous suffering everywhere. A large number of children die as infants. Many of those that escape death are condemned to a life of malnutrition, illiteracy and hopelessness. Over a billion people in the world live below poverty line and eke out a living with barely a dollar a day. These people do not have access to basic facilities like clean water, power, nutritious food, schooling, shelter and healthcare.

While access to basic necessities remains a challenge to a large segment of world population, we also see unsustainable consumption in certain parts of the world. Global warming is a real threat leading to climate change, melting of snow caps, and rising of sea levels. The biggest challenge of this century is to ensure the well-being of 7 billion human beings without disrupting the balance of nature.

On the positive side, we, engineers, have technology, an extraordinary power, to make a difference to this world. Technology can achieve this in three important ways:

1. **Bridge the divide** between developed and developing countries and enable us to collaboratively solve our common problems to benefit the humanity as a whole.

2. **Build a sustainable planet** by enabling us to conquer the problems resulting from urbanization and unsustainable demand on natural resources.
3. **Solve problems of social inequality** resulting from the lack of access to housing, nutrition, education, sanitation and financial inclusion for over one billion people in the world.

Let me elaborate on each one of these.

1. Bridge the divide

A study by the World Bank shows that technological progress has helped in reducing poverty in developing countries from 29 per cent in 1990 to 18 percent in 2004. Globalization and rapid advances in technology have brought nations closer. The problems of the poor are more visible on global platforms today than ever before. There is much effort among the developed nations to help the developing countries in their problems.

Take the case of Malaria. Malaria is one of the three lethal diseases on earth. In Africa, a child dies from Malaria every minute. *The World Malaria Report 2011*shows that there are 216 million cases of Malaria and an estimated 655,000 deaths in 2010. Although there are drugs available today to cure Malaria, they are not effective in combating multi-drug-resistant mutant "superbugs". To find a cure to this drug resistant form of Malaria, Scripps Research Institute (SRI) in the US has a project to simulate molecular interactions to design a cure for Malaria. But, performing such complex simulations requires heavy computing power. The World Community Grid (WCG) has helped SRI by providing computing resources**.** WCG aims to create the world's largest public computing grid to provide computing resources to scientific research projects that benefit humanity. The basic idea behind this initiative is to use the unused computing resources of any

registered person. Today, this initiative has over 602,000 registered participants. WCG has provided computing resources to researchers working on human genome, HIV, dengue, muscular dystrophy, cancer, influenza, rice crop yields, and clean energy. It has, till date, accumulated over 652,683 cumulative years of donated computing time. The results computed on the WCG will be made available in the public domain for all scientists.

My next example is on Cancer. A World Health Organization study projects that cancer is a leading cause of death worldwide and accounted for 7.6 million deaths (13% of all deaths) in 2008. Without immediate action, the number of global deaths from cancer will increase by nearly 80 per cent by 2030. A key to cancer therapy is unraveling the genetic sequence of the patient. Using genomic methods, researchers are also trying to find ways to predict and cure cardiovascular disorders, depression, bipolar disorder, Alzheimer's, Parkinson's disease, attention deficit disorders, and diabetes, to name a few. We have come a long way from the first genome project which cost several billion dollars. The search is on for a more cost effective method. *1000 genomes* is a project launched to provide an impetus to this kind of research. 1000 genomes is led by a consortium of 75 companies and organizations to establish the most detailed catalogue of human genetic variation. By 2010, the project had completed its pilot phase. The 1000 genomes, in its current production phase, targets to sequence over 2000 people. It intends to make this compiled genome sequence data freely available for further research. A critical challenge is the quantum of data generated and making it accessible to global researchers. The genome sequence of a person has over 100 gigabytes of data. The genomic sequence data for a million people would require hundreds of petabytes of data storage. Today, with cloud technology and big data analytics, such vast amounts of data can easily be stored, retrieved and analyzed. A gigabase is available at USD 10 for an academic. A gigabase is a billion letters of DNA,

and for that price storage, tools, and visualization, are bundled into one package. With advances such as these, it will not be too far before personal genomics becomes a reality.

2. Build a Sustainable Planet

According to a UN report on global sustainability, the world population will reach 9 billion by 2040. The demand for resources will rise exponentially. By 2030, the world will need at least 50 per cent more food, 45 per cent more energy and 30 per cent more water.The technological advances in combating global warming are well-known. Therefore, I will just take two unusual examples.

The electricity consumption in the US reached 3,856 billion Kilowatt hours (kWh) in 2011 which is 13 times greater than electricity used there in 1950. Stan Cox, a scientist and author of *'Losing our Cool: Uncomfortable truths about our air conditioned world'*, points out that the US uses more electricity for cooling than the total electricity consumption in Africa. Global consumption for cooling is projected to grow to 10 trillion kWh per year. This is half of the world's entire electricity supply today.

To overcome such an unsustainable consumption pattern, energy efficient systems are the need of the hour. Advancements in sensor and grid technologies reduce energy consumption dramatically. Burcin Becerik-Gerber, an innovator featured in MIT technology review, has developed a system which uses smart sensors. The application uses occupant's cell phone to negotiate energy-efficient settings in office buildings. The system asks people how satisfied they are with the temperature, lighting, air quality, and even noise level at the workplace. The system then works with the building's agents to find the most energy-efficient way of adjusting the settings to make the maximum number of people in that workplace happy. System

simulations indicate that it is possible to satisfy 70 percent of occupants while reducing overall energy consumption by more than 30 percent.

Aconsequence of rapid urbanization is the increasing number of cars on the roads. As car-ownership in developing countries becomes more pervasive, the number of vehicles on road will increase from the current one billion. Based on current trends, the World Health Organization predicts the death toll in road accidents to exceed 150,000 deaths a month by 2020. Around 90% of accidents are caused by human error. Driverless cars are a great solution for passenger safety. These cars can also reduce congestion by coordinating their routes, travelling in close formation and enhancing the capacity of road networks. With an array of sensors, ultrasonic detectors, gyroscopes, accelerometers and altimeters, a car can become more aware of its surroundings. Driverless vehicles developed by Google is a good example of transforming car design, redefine car ownership, affect urban planning and provide means of transport for people with disabilities.

3. Solve problems of social inequality

Today, 22% of the developing world's population or 1 billion plus people live below $1.25 per day. A recent report by the United Nations Food and Agriculture Organization estimatesthat 925 million people remain undernourished. UNESCO points out that 796 million people, lack basic literacy skills in the world. [1]

Education is a powerful tool for national development in developing countries as it provides a route to economic prosperity for both individuals and the nation. In many of these countries, government infrastructure for providing education is just not enough to meet the demand. Online educational solutions like Khan Academy rely on basic internet and computers. The

[1] http://uil.unesco.org/home/programme-areas/literacy-and-basic-skills/news-target/literacy/fe7ac3ca6636388c8a10f7d43a2b6a7b/

inherent problem in developing economies is the lack of such infrastructure. This impedes the access to education in such economies.

To overcome this difficulty, *Teach a Class* was founded by Neil Dsouza and Leila Al-Muthashib. The key motivation behind this project was to facilitate education in orphanages. They use technology for "recycling education" by harnessing the power of existing open source courseware and virtual classrooms. *Teach a Class* uses 'Education Hotspots', a self-contained mini wireless network that contains built-in educational content. The organization also collaborates with local educators, partner organizations, community stakeholders and volunteers around the world to enhance the way children learn. Starting off with a pilot project in Indonesia, this initiative has spread to villages of India and Mongolia.

According to WHO, about 39 million people are blind in the world. 90% of visually-impaired people live in developing countries. Blindness and poor vision have a tremendous impact on quality of life, particularly for those living in poverty. Yet, the tools to provide mobility to the blind have changed very little since the 1920s.[2] Anirudh Sharma tackles this problem with a cost-effective and simple solution. *Le chal* is a USD 20 dollar, cheap and unobtrusive navigation aid for the visually-impaired. *Le chal* means 'take me along' in Hindi. The fundamental technology behind these shoes is haptics, based on the sense of touch. Le Chal shoes provide haptic feedback by guiding users towards their destination through vibration. By pairing it with a GPS-enabled Android smartphone, the user can speak a destination into Google maps and then move around using Google's navigation. Four small vibration motors embedded in the front, left, right and back of the shoe mildly vibrate to indicate the correct direction. The vibrations get stronger to indicate that the destination is nearing. In addition, a built-in proximity

[2] http://www.economist.com/blogs/babbage/2012/07/footwear-blind - The Economist article on Le Chal

sensor in the shoe gives feedback to the users on their immediate surroundings.

These examples are just a few examples of the power of technology in solving societal problems. Technology has the potential to vastly improve the quality of lives in developing countries. These countries are tackling their social challenges by innovative use of technologies. China and India rank among the top two in INSEAD's Global Innovation Efficiency Index.

When I see a lot of extraordinary innovations that are taking place around the globe, I feel enthusiastic and confident of the success in applying technology for the benefit of the global community. And I hope every one of these researchers will reflect on this challenge and provide a social purpose to their areas of research.