What will be the major drivers of technological change in the 21st century and how should we address the opportunities and risks it could bring?

When looking at the impact future technologies will have on our lives, it's easy to be dazzled by high-tech 'top down' visions and grand schemes where scientific advances are 'applied' to our world to create a radically different way of life. We're told the advantages of the new technologies and how everyone will benefit; experts are interviewed, and pronounce their enthusiasm or scepticism. In reality, however, it is forces outside the lab which determine how new technology is applied and used.

Among the major drivers of technological change this century, the world's growing population, rising economic and quality of life aspirations in the developing world and the resulting enormous energy, environmental and social pressures are sure to feature very heavily. New technologies will be scrutinised heavily for ecological and community impact, whether by more enlightened governments or by a liberal, diversified media comprising many millions of citizen journalists and bloggers from all around the world alongside more traditional press and broadcasters.

So many technological advances in the last century—from semiconductors to genetics—have had unforeseen applications. The famous—though probably spurious—quote from IBM's Thomas J. Watson that "there is a world market for maybe five computers," supposedly spoken in 1943, encapsulates the issue: technology often offers us many more possibilities than we could have conceived prior to its development. The 21st century will be no exception: relationships

between technologies will also open up entirely new avenues, and these interactions will create vast new areas of opportunity and risk.

Nevertheless, new technologies need users to adopt them. We could all be driving flying cars by now, but we're not, even though pioneers have solved many of the engineering problems. This is something Brunel (and other railway pioneers) understood: the railways, by presenting passengers with freedom of choice, to explore their country, to make their own itineraries, to go where they wanted within a designed system, opened up a new level of public enthusiasm and participation in using technology, as well as great economic and industrial opportunities.

Public participation in this century's technologies will be even more important. A positive attitude towards energy-saving, and a responsible attitude towards consumption and waste will be more easily fostered by widespread understanding and appreciation of new technologies and the reasons for their use, than by grand schemes seen to be imposed through a tyranny of the expert. Engineering, technological and scientific education is important now: it will be even more so in the years to come.

For the first time in history, we have technology which allows worldwide participation on an individual level, in the form of the internet. Anyone can learn from, and teach others, and disseminate knowledge and opinions. This way of thinking will be key to engaging the public with new technologies, and, indeed, making the links between them to develop the technological interactions and new applications to address the issues we, as a planet, are facing.

A democracy of innovation, where users really can interact to develop and contribute to new technologies and applying them to solve problems, locally or globally, is already developing. Large-scale collaborative projects, most notably on open-source applications and knowledge resources, have already had a major effect on software and the way the internet is used; projects now gaining

momentum, including MIT's 'One Laptop Per Child' and 'Fab Labs' are applying the same kind of thinking to physical engineering and hardware. Advances in rapid prototyping and small-scale manufacturing techniques will allow engineered machines and devices, from agricultural tools to renewable energy systems to be developed and replicated anywhere around the world by individuals and communities rather than solely by large companies.

This century will be see technology developed and applied extensively by decentralised innovation; there will be risks, but also great opportunities to solve worldwide problems by learning from the ideas being implemented by others. We need to address those opportunities and risks by encouraging and facilitating an attitude of inclusiveness in science and technology—in education, industry and society generally.

The next generation of innovators, those who will shape the future, are among us now, around the world, and through the power of participation, we have the opportunity to respond to global problems in a way never before possible.

The 21st century offers us unprecedented opportunities to help ourselves, and the generations to come; we must make the most of them.

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