On several frequencies, light guides the way to development

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The UN has proclaimed 2015 to be the International Year of Light and Light-based Technologies. Under the leadership of Unesco, hundreds of scientific organisations, industry partners, NGOs and other groups are organising events worldwide to raise awareness of the ways in which light influences our lives and how its applications can solve problems of global importance.

One of the central themes of the International Year of Light is that many solutions to global challenges already exist and are based on practical and cost-effective light-based technologies.

For nearly 1.6 billion people, sunset brings either complete darkness or the dim glow of a kerosene lamp or candle. Poor-quality lighting has a significant negative impact on health and educational opportunities, and an important aim of the International Year of Light will be to promote the use of portable, solar-powered, high-brightness LED lanterns in regions where there is no energy infrastructure. We are hoping that corporates will rally international businesses to drive the costs of solar lights down and to partner with governments to solve the problem of poor lighting.

In agriculture, hi-tech cameras on planes or drones can map soil and vegetation density, and measuring how light from lasers is reflected from crops and soil can be used to monitor evaporation and guide decisions on irrigation. Light-based technologies are also key to understanding and combating climate change, whether it be measuring the global carbon dioxide distribution or the use of solar-based solutions for renewable energy.

An aspect of the science of light that goes largely unappreciated by non-scientists is that the light we see is only a small part of the vast spectrum of light that we use. The global communications network for example runs on invisible light, whether it be the microwaves used by mobile phones and satellites or the infrared lasers that carry signals in the optical fibre infrastructure of the internet.

In developed countries we take access to such communications for granted, but the 2014 annual report of the United Nations International Telecommunications Union makes for sobering reading. Some 4.3 billion people have no access to the internet – 90% of these live in developing countries – and in the world's least connected countries with large rural communities, there are 2.5 billion people for whom access to information technology remains largely out of reach.

Yet the technology of the smartphone promises a revolution that can change this. Mobile phone subscriptions now exceed the world's population and mobile broadband subscriptions exceed 2.1bn – three times higher than the number of fixed broadband connections worldwide. And most of this progress has taken place in developing counties, which accounts for 82% of global net additions of new internet users since early 2010.

Mobile broadband can penetrate into rural areas, aiding schools and social entrepreneurs to provide new routes to education and healthcare. And access to information can increase accountability of local administration to citizens, aiding societal development on a political level.

The smartphone is one of the most advanced technological devices ever made, with state-of-the-art imaging, GPS and communications built-in, and has tremendous potential to revolutionise medicine in low-resource areas. For example, specialised lens adapters enable a smartphone to take diagnostic images of the eye to assess vision problems or can convert it into a microscope for testing parasites in blood or stools. The use of mobile technology may well be pointing towards a democratic future of healthcare in developing countries.

Light-based technologies offer practical solutions to many current problems in development, but getting the technologies to the places where they can be of most benefit is an ongoing challenge. The UN recognition of the International Year of Light is providing a unique opportunity to convene scientists, industry, NGOs and end-users to discuss concrete ways to get the right technologies to the billions who need them.

Also on the agenda is discussing how to train local experts in these technologies without encouraging brain drain, and how to create lasting partnerships in regions where conflict is still part of daily life. Investing in science infrastructure is seen to be an essential part of both training and retaining skilled researchers, and a flagship project for Unesco here is the Sesame synchrotron in the Middle East. Sesame brings together nine governments – Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, and Turkey – and is modelled on Cern to become a facility for researchers throughout the region.

Projects such as Sesame and the International Year of Light demonstrate that science can be a vehicle for progress in many different ways, not only in providing modern technology to developing countries, but also in promoting mutual cooperation and peace.

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