

# Optical Communication Technologies

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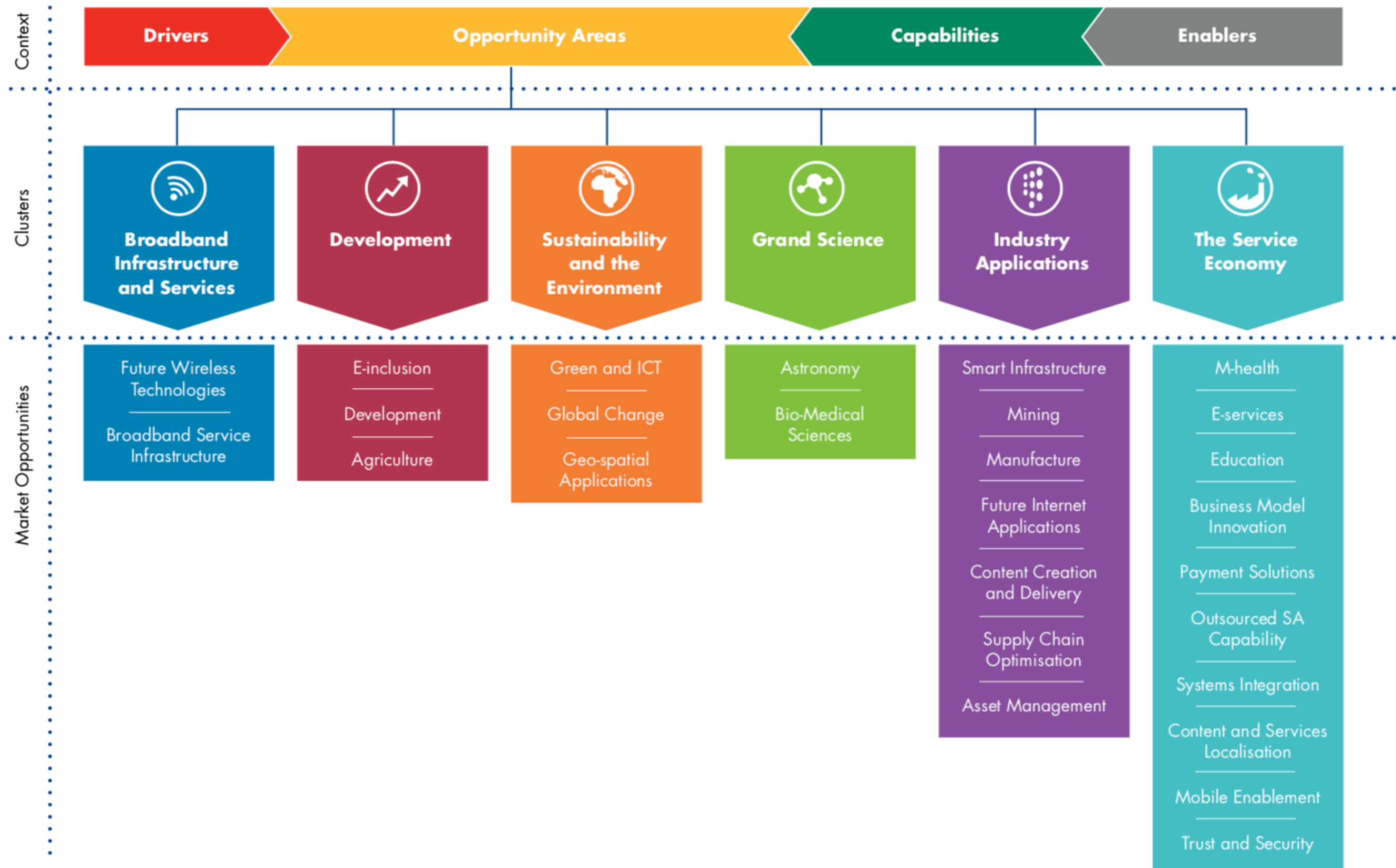


U. Witwatersrand: “Vits”

4 Nobel Laureates



# SUMMARY OF ROADMAP OPPORTUNITY AREAS



## ICT RDI ROADMAP ACHIEVEMENTS FOR THE FIRST FIVE YEARS

### INVESTMENT

**R1.841 billion**

DST, other departments, state entities, industry and international organisations between 2013/14 and 2017/18



**11**

RDI partnerships



### HCD SUPPORTED



**261**

Honours

**482**

Masters

**231**

Doctorates

**14**

Post Doctorates

### RESEARCH CHAIRS

**5**

SARChI chairs



**6**

industry chairs



### NO. OF PROTOTYPES



**424**

prototypes developed by mLab and CodeTribe

**5**

Africa ICT Programmes

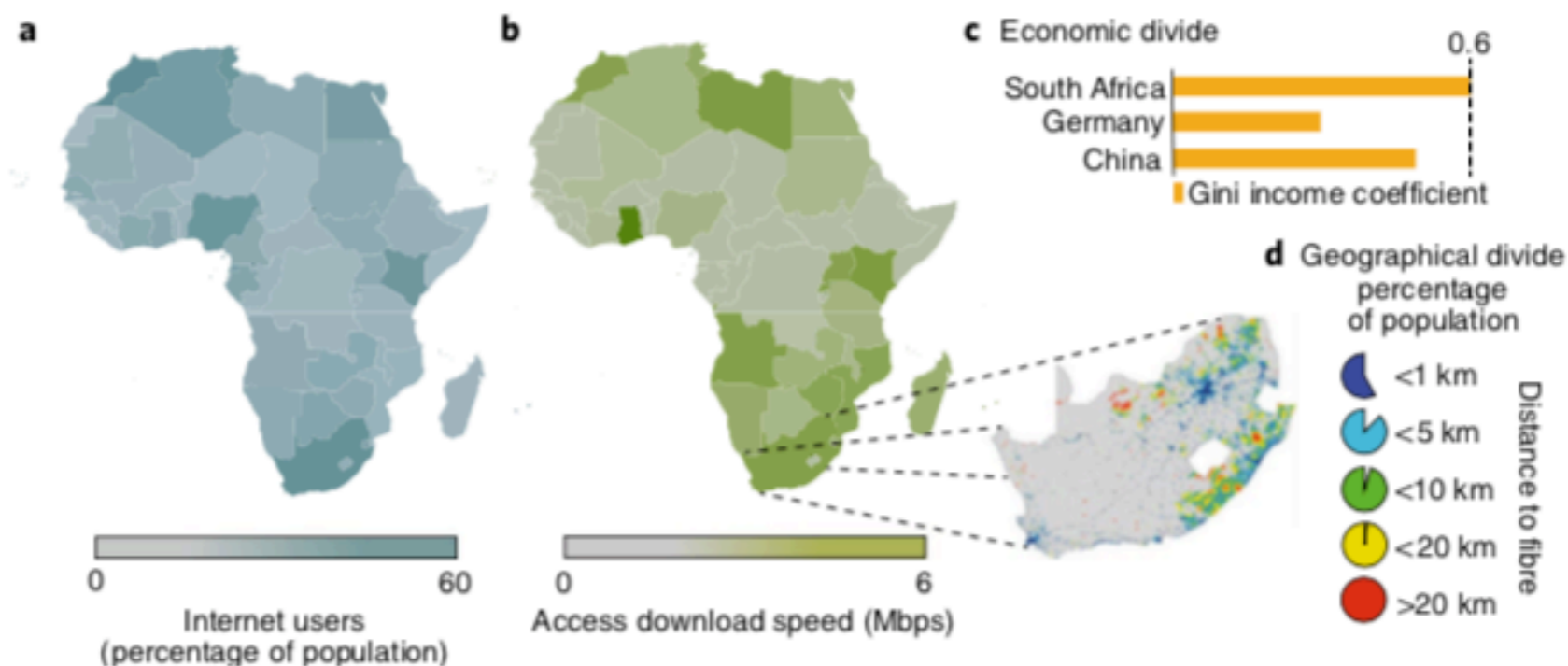


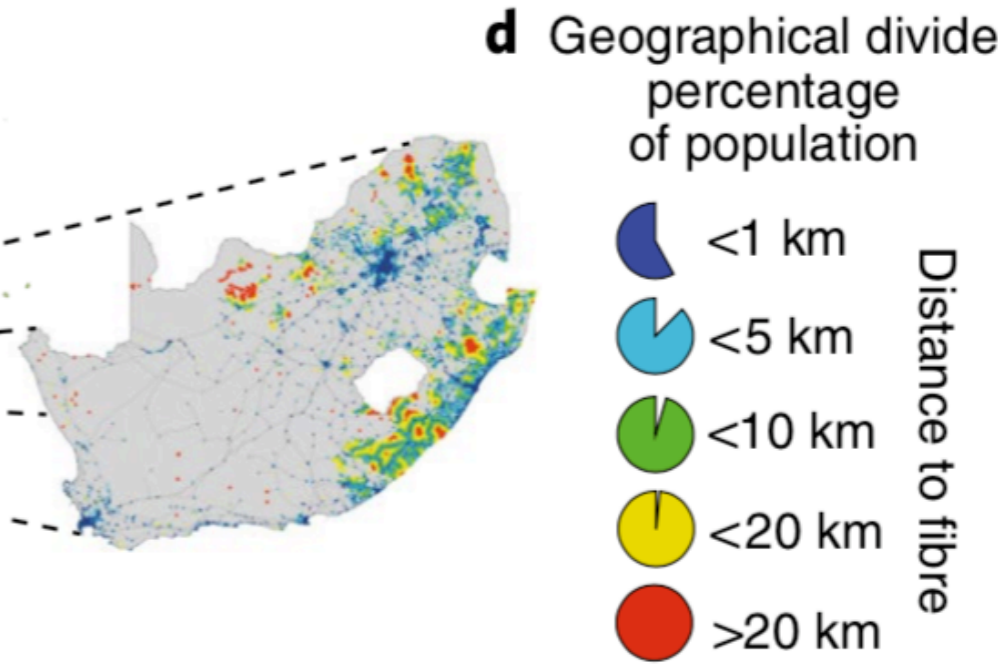
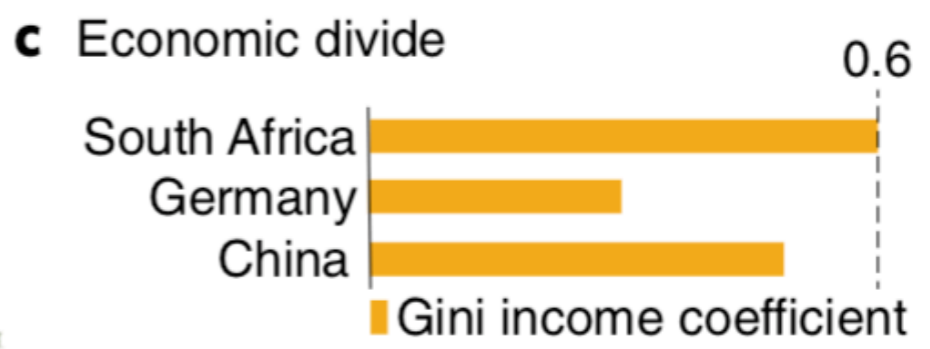
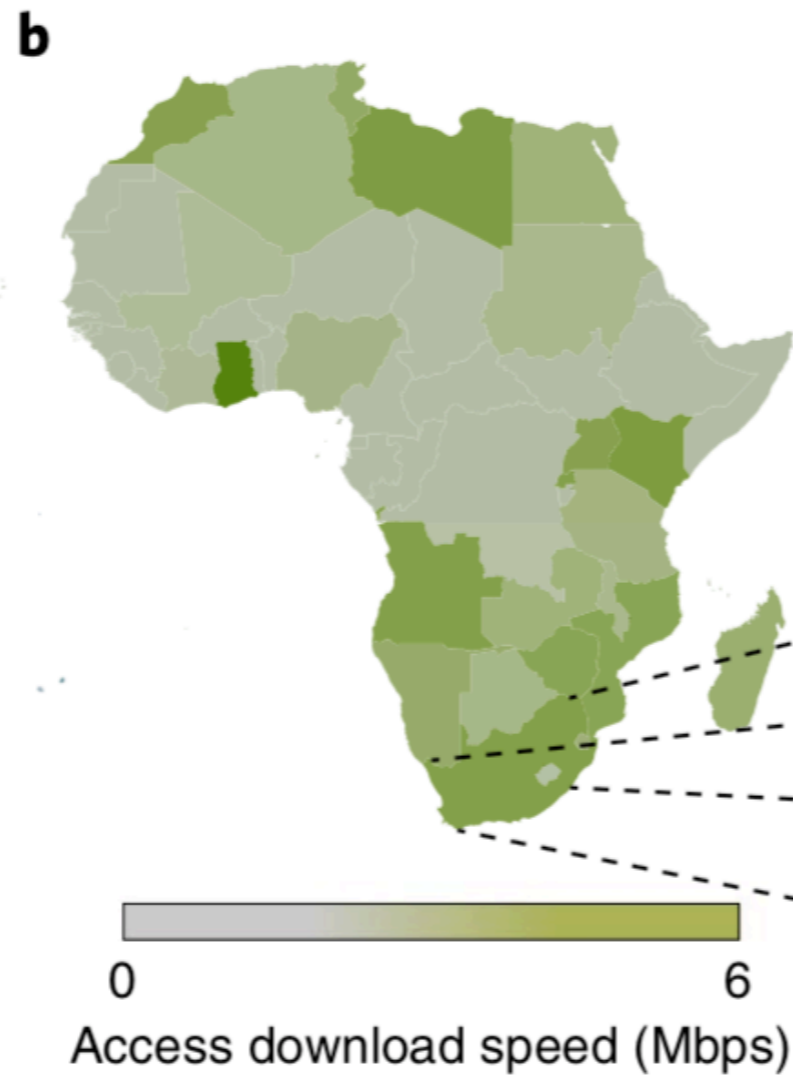
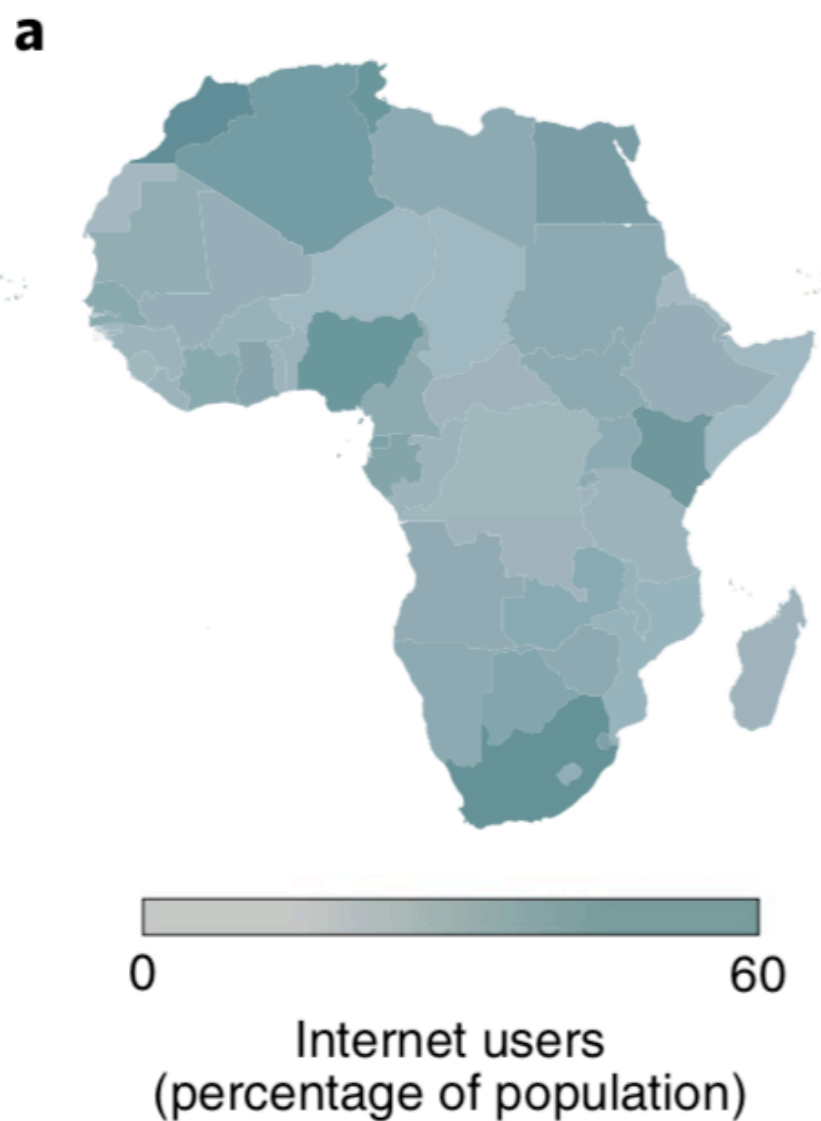
# Tackling Africa's digital divide

Innovations in 'sustainable' photonics technologies such as free-space optical links and solar-powered equipment provide developing countries with new cost-effective opportunities for deploying future-proof telecommunication networks.

Martin P. J. Lavery, Mojtaba Mansour Abadi, Ralf Bauer, Gilberto Brambilla, Ling Cheng, Mitchell A. Cox, Angela Dudley, Andrew D. Ellis, Nicolas K. Fontaine, Anthony E. Kelly, Christoph Marquardt, Selaelo Mathane, Bienvenu Ndagano, Francesco Petruccione, Radan Slavík, Filippo Romanato, Carmelo Rosales-Guzmán, Filippus S. Roux, Kobus Roux, Jian Wang and Andrew Forbes

Photonic technologies are the workhorse of our digitally connected world, with optical fibre communication systems driving the digital revolution of the past 30 years. The immense impact of the invention of the optical cabling led to Charles Kao being awarded the Nobel Prize in 2009 for his ground-breaking research into low-loss silica fibre in the 1960s<sup>1</sup>. In the decades since, the deployment of fibre optic cables has empowered the formation of the modern IT sector that accounts for a large proportion of gross domestic product (GDP) of developed nations. Taking the

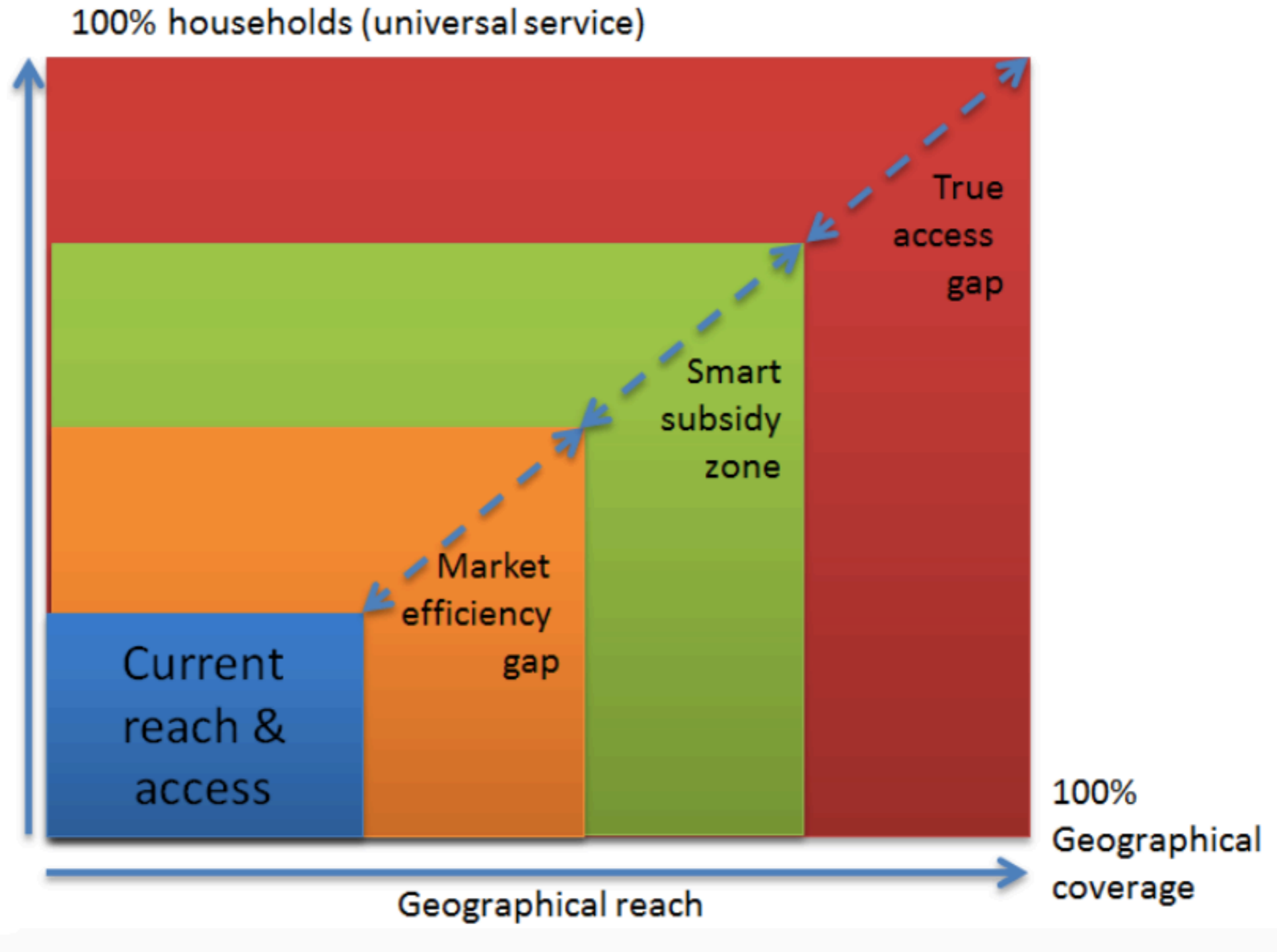




Nature Photonics **12**, 249 (2018)

The digital divide

Geographic and economic



The digital divide

Geographic and economic





The digital opportunity

Energy efficient low cost links



The need:  $\sim 8$  Tbits/s



The digital opportunity

Radio-silent high speed links



Fast and secure

**Integrated highly secure links**



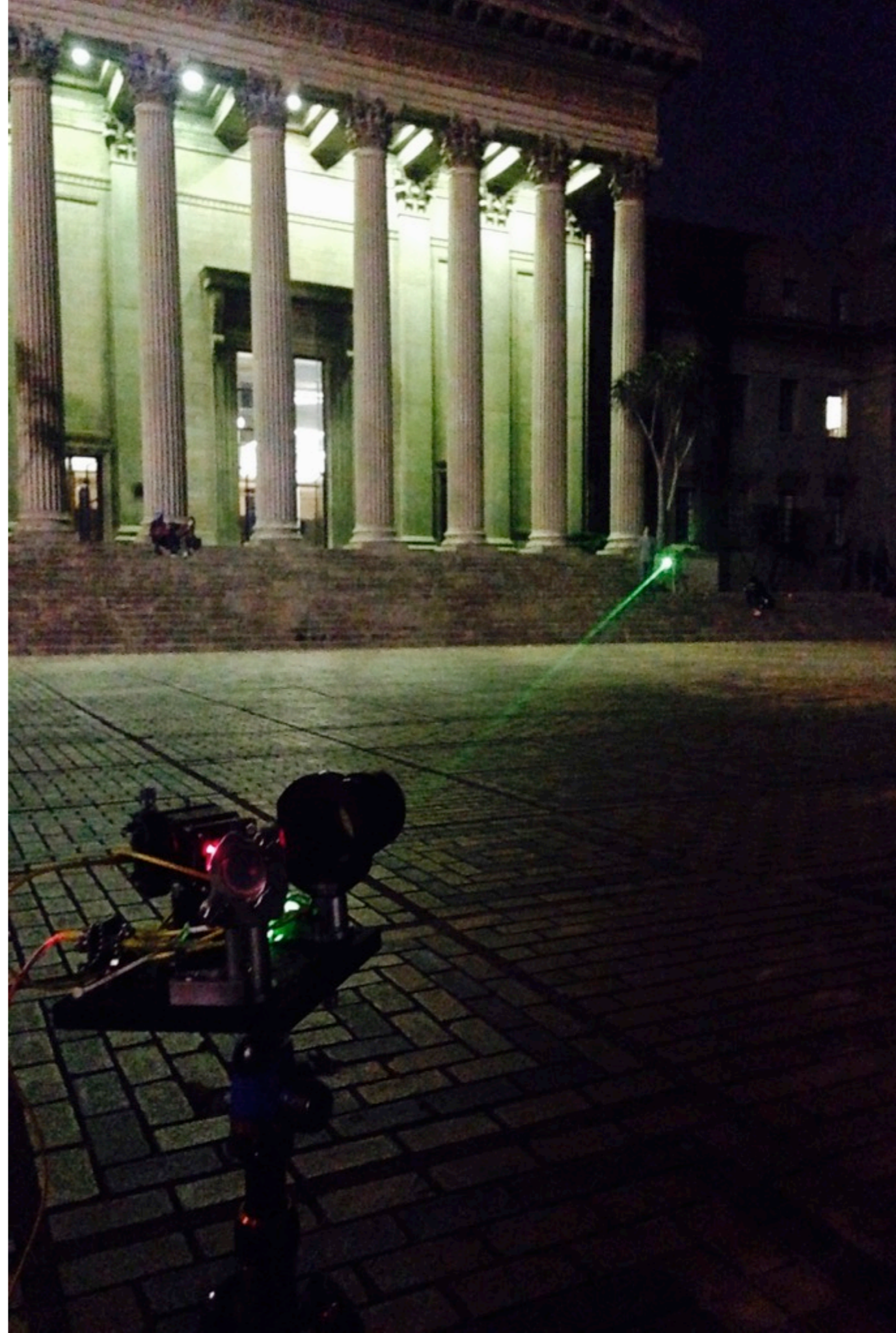
# Optical communication

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Active programmes at  
U. Witwatersrand: wireless, VLC,  
FSO

and

NMU: optical fibre, SKA solutions,  
5G

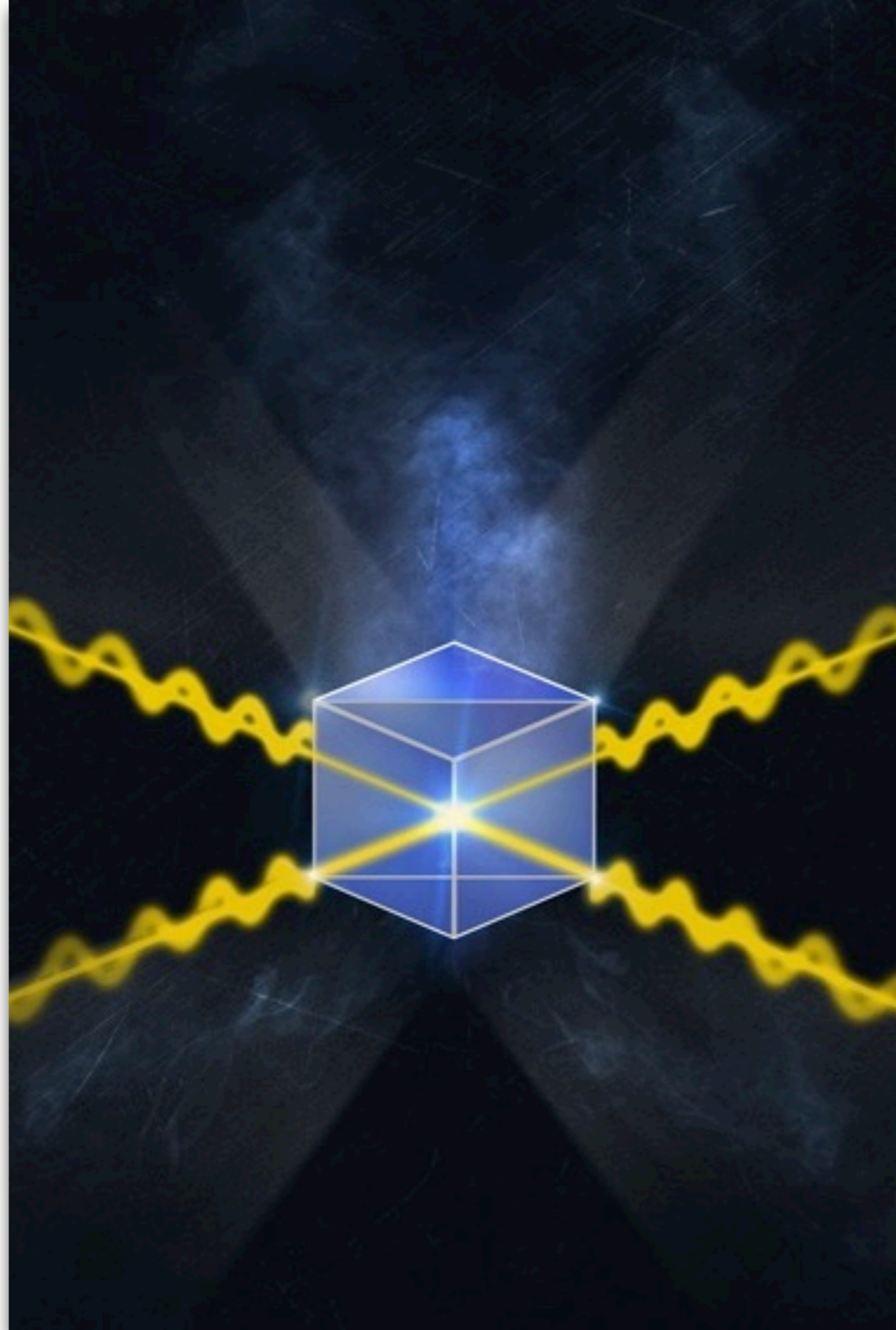




# Quantum communication

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Two main centres for secure communication:  
U. Witwatersrand  
and  
UKZN,  
with other quantum technologies  
at NMISA, US, UJ, CPUT, DUT  
and UP





# Recent Highlights

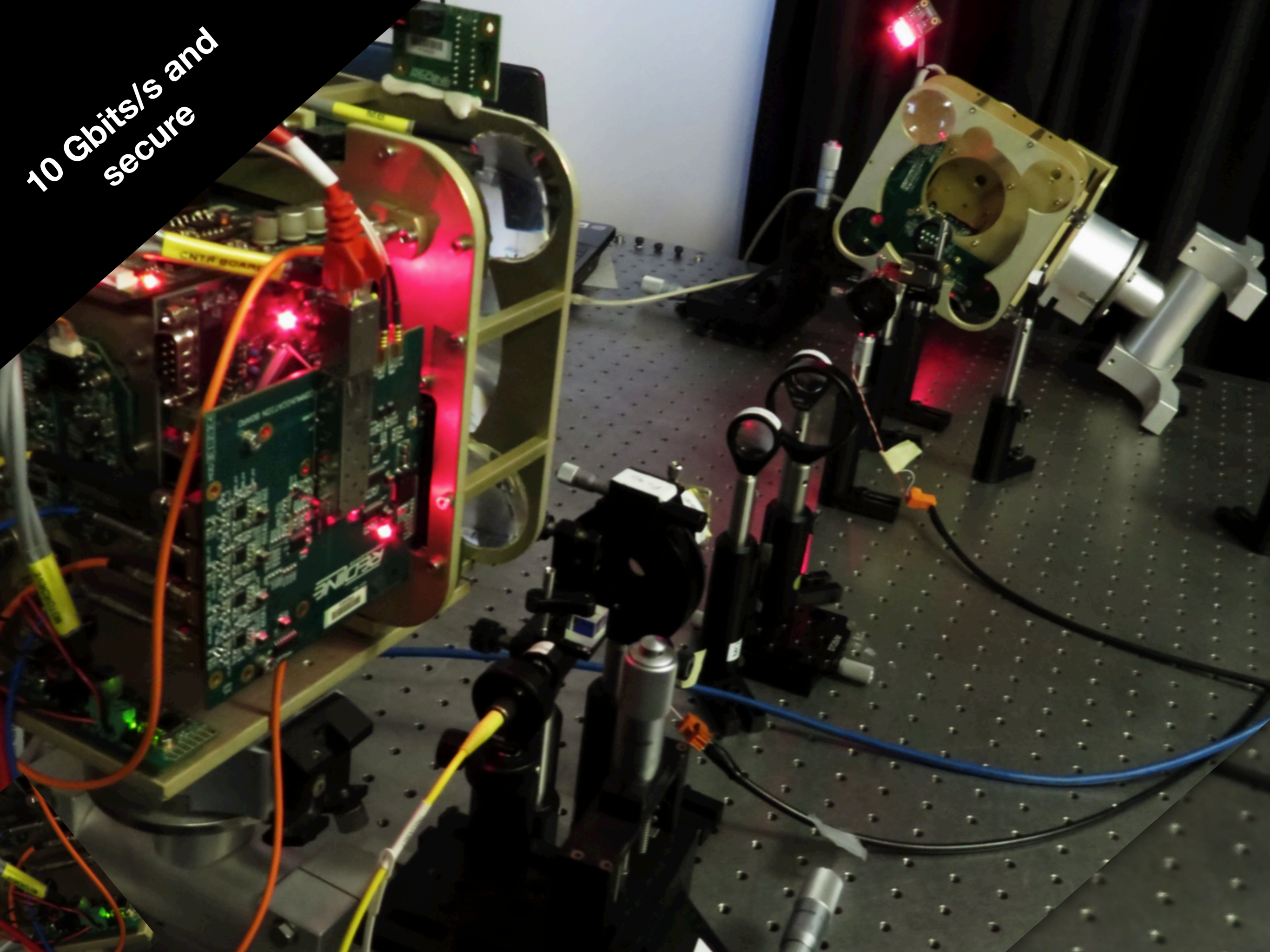
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- SKA time stamping
- 5G roll-out with local technology
- >100 spatial modes in a multiplexed set-up
- High-dimensional entanglement in optical fibre
- FSO classical/quantum link
- Quantum city fibre link
- Teleportation and entanglement swapping





10 Gbits/s and  
secure





# Projects?

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- Last Mile robust and energy efficient free-space solutions
- Radio-silent connectivity
- Mode division multiplexing
- Quantum network
- Satellite-based Quantum Key Distribution

# Thank you

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