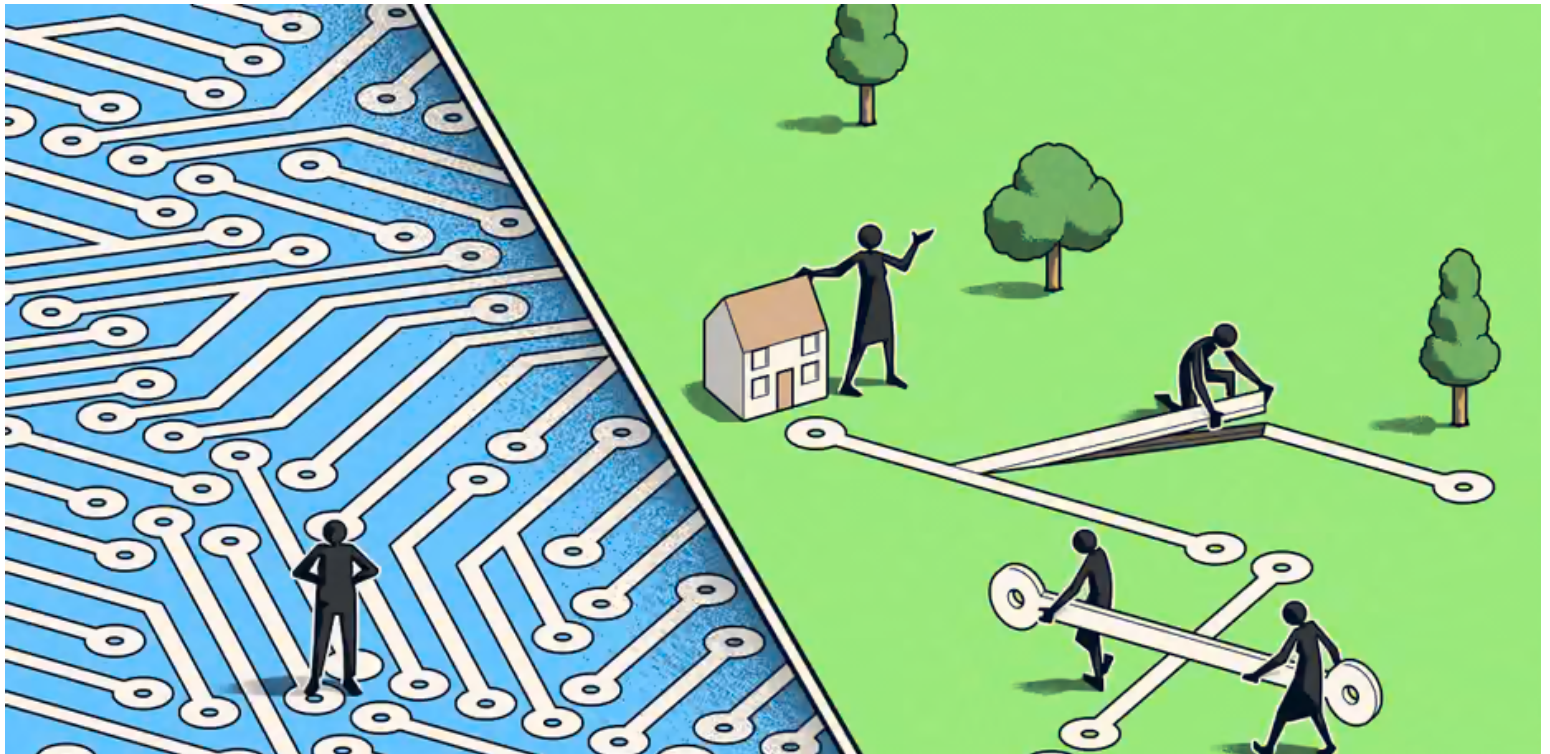**Opinion**

Enough of the billionaires and their big tech. 'Frugal tech' will build us all a better world
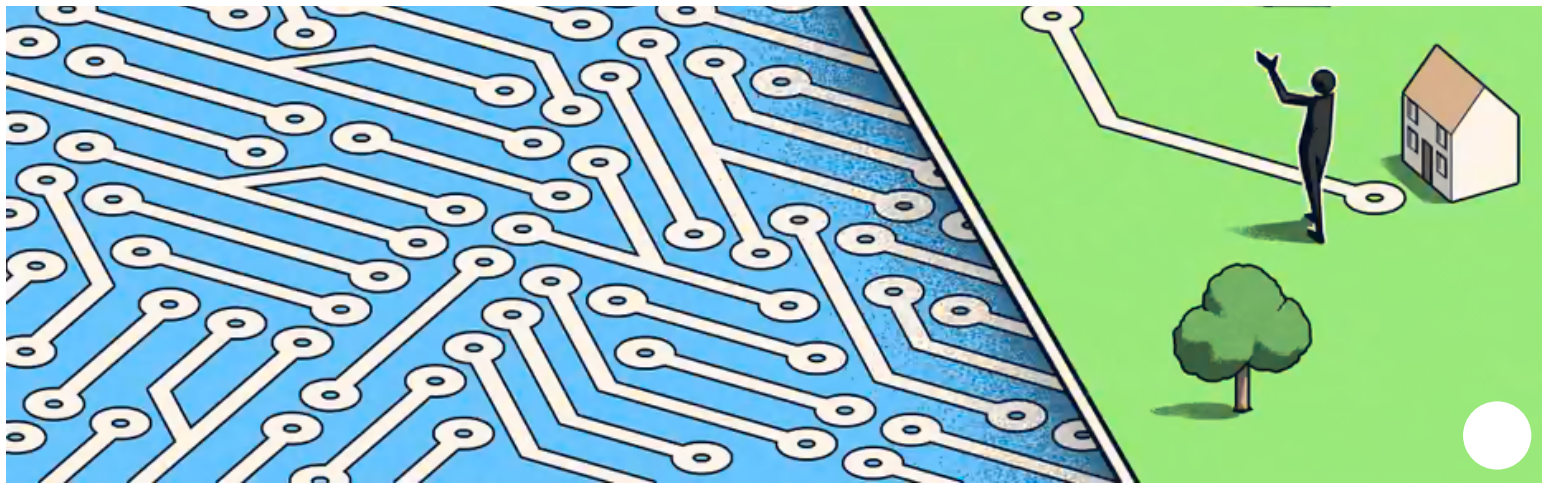
Eleanor Drage

Titans like Musk would love us to believe innovation means top-down solutions that only enrich the wealthy. In fact, we all have the power

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There's a common misconception that state-of-the-art technology has to be expensive, energy consumptive and hard to engineer. That's because we have been persuaded to believe that innovative technology is whatever bombastic billionaires claim it is, whether that's commercial spacecraft or the endless iterations of generative AI tools.

As the Canadian technologist and engineer Ursula Franklin once said, fantasies of technology would have it that innovation is always "investment-driven, shiny, lab-born, experimental, exciting". But more often than not, in the real world, it is "needs-driven, scrappy, on location, iterative, practical, mundane". The real pioneering technologies of today are genuinely useful systems I like to call "frugal tech", and they are brought to life not by eccentric billionaires but by people doing more with less. They don't impose top-down "solutions" that seem to complicate our lives while making a few people very rich. It turns out that genuinely innovative technology really can set people free.

Last month at Berlin's once hippy, now increasingly corporatised Re:publica conference, for example, I met researchers from the Association for Progressive Communications (APC), who are using technologies such as software-defined radios and spectrum sensing to allow people in low-resource environments to stay connected despite limited bandwidth, power, hardware and communication infrastructure. These technologies are the basis of the local community networks that supply coverage to the 2.5 billion people globally who lack internet access. In the Niger Delta, which suffers from toxic levels of air pollution from its oil industry, APC is setting up connections and deploying low-cost sensors that monitor the environment. These play a crucial role in how locals can advise children when to stay inside and which areas to avoid playing in. This infrastructure is managed for and by the municipality, serves a pressing need and can be installed and built by the people who deploy it. Unlike, say,

ChatGPT or a Blue Origin space rocket.

The fact is, while generative AI is lauded as the technology of the minute, iterations such as Dall-E 3, Google Gemini and GPT are irrelevant to those who don't have enough internet bandwidth to use them. The new digital divide is the gap between the top end of the global population – who have access to these power-intensive technologies – and those at the bottom, whose internet access, or lack of, remains static. That's why some of today's most brilliant minds are working out how to manage the trade-off between internet range and bandwidth, and whether there are obstacles in the way such as mountains and foliage.

📷 Elon Musk at the Axel Springer award in Berlin, Germany, 1 December 2020. Photograph: Hannibal Hanschke/Reuters

The fact is that good innovation also often involves lobbying for good. So while big tech poured hundreds of millions into watering down the EU AI Act, good tech lobbies for better internet provisions for all. Policy and innovation go hand in hand, meaning that the consequences of good technology far exceed the technology itself, extending to governance and social welfare.

At Re:publica's "maker space", I fiddled around with DIY solar-powered sensors that can be built using a Raspberry Pi computer and off-the-shelf components such as humidity sensors. I lost my partner, an engineer by training, to a microscope designed by the OpenFlexure project that was made from 3D printed materials. Microscopes are crucial for diagnosing infections but can cost millions of pounds, making them entirely inaccessible for many people across the globe. This one is lightweight, costs next to nothing and is open source, meaning that anyone can reproduce the design by 3D printing parts and cobbling them together with shop-bought motors and circuit boards. A bit like a cheap Ikea wardrobe, except that all the bits you need to assemble it can be bought inexpensively from a local electronics shop. Manufacturers from Ghana and Wales to Chile and Australia are all using OpenFlexure's designs to give people everywhere access to low-source microscopy. We might think generative AI has invaded all corners of our lives, but this couldn't be further from the truth. What is actually prolific and relevant to the majority are low-cost technologies that solve day-to-day business and social problems.

While most of what we consider to be "hi-tech" is closed off behind proprietary algorithms, the open-source technologies above all require community involvement. This can be immensely empowering, and can improve public trust: it's hard (and unwise) to give yourself over to a technology that won't tell you how it works, particularly when its predefined settings allow only for meagre approaches to "user privacy". As I ask my students, if you could develop an AI at your own home, and programme it to reflect your values and prioritise your safety, wouldn't you trust it more? Well, the idea isn't so outlandish – it only feels impossible because big tech firms want us to think it is.

What is most outstanding about frugal innovation is not just that its technologies are impressive, but that it might actually prompt systemic change by showing people that tech can be developed locally, and not just imported from Silicon Valley. When farmer Chris Conder dug her own fibreoptic cables on her property in Lancashire, she set out "to prove that ordinary people could do it … it wasn't rocket science". By demonstrating that fast internet could be connected with fibre-optic cable, a digger and the desire to just get on and do it, she spawned an organisation called B4RN, which promotes community fibre partnerships.

Tech bros may want you to believe there is no point in making something new unless it is difficult, inaccessible and exclusionary. But technological innovation is about collaboration as much as it is about competition. For many people across the world, a product's value isn't in a sky-high valuation, or in it being impossible to take apart (as

with impenetrable iPhones). Often, the smartest technologies are those that distil a problem down to its bread and butter components in order to disseminate a solution to the masses.

So, while innovative individuals and communities around the world quietly get on with improving their lives and those around them, it's high time the rest of us stopped being passive recipients of technology, and started asking ourselves what kind of world we want to live in and how to create it. Must the setting for innovation be £1bn-plus buildings like Google's new London offices in King's Cross, located in nations that can afford to stomach eye-watering training costs and compute power requirements? Or might we instead be able to steer innovation from within our very communities – or households?

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