**Radical Technology 2**

**Is Small Still Beautiful?
Schumacher and the need to reboot our relationship with technology**

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| 1 | * Introduce self
* Very happy to be asked to speak about Schumacher and whether small is still beautiful.
* I want to start off today by looking at what Schumacher actually said about technology in Small is Beautiful back in 1972
* Then I want to move forward 45 years to look at how well our use of technology today deals the problems he was trying to address. Unsurprisingly perhaps I’m going to argue that technology is still not working for us today and that we need to rethink or reboot our relationship with it if we want a sustainable and equitable future for everyone on this planet.
* I’m then going to propose that a new governance approach is needed to make technology work as if people and planet mattered, and finish off by coming back to look at whether Small is, therefore, still beautiful.
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| 2 | * If anyone is interested in exploring some of the ideas I touch upon today in more detail, I have just published this, which is available for purchase as a book or e-book, but also as a free PDF download.
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| 3 | * Fritz Schumacher / chief economist NCB / doubts about concepts of economies of scale & nat resource management / Burma visit and notion that our economic & developmental goals might be wrong
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| 3 | * Set out his thinking in book called Small is Beautiful (economic as if people really mattered) in 1972.

3 important concepts: * **Limits to Growth -** Schumacher starts off *Small is Beautiful* with the argument that the traditional discourse on economics is fundamentally flawed, based as it is on the idea that development relies on perpetual economic growth which, in turn, is based on ever increasing consumption of material resources. He introduced the concept of ‘natural capital’, talked about the finiteness of natural resources and used the field of energy to demonstrate how the consumption patterns of Europe and North America could never be replicated on a global scale. His conclusion was that humanity was on a collision course with nature and needed to take action quickly.
* **Right livelihoods -**

Another theme at the core of Small is Beautiful is Schumacher’s concept of Buddhist Economics – an analytical framework that saw work as having the potential to bring meaning to life and to integrate people into communities. But, according to Schumacher, it has to be the right kind of work – not the single repetitive and unskilled task assigned to a production line, but something which brings satisfaction to the individual and which does no violence to the environment and, ideally, which produces something that is consumed locally in the community in which the producer lives. A Buddhist economy, Schumacher reasoned, would put full employment through the creation of these sorts of meaningful jobs as its central purpose (as opposed to the current model which puts minimising the cost of production so as to maximise consumption as its central goal). * **Technology with a human face -**

In order to establish ‘right livelihoods’ Schumacher believed that technologies were needed that were human in scale and which could be owned, understood and managed by those who used them. He also argued that a theory of economics that put the creation of employment at its heart had to consider the cost of establishing each new workplace as more important than a crude calculation of the productivity of each worker.Schumacher’s idea of Intermediate Technologies was just this – technologies with productivities higher than traditional crafts but with low capital costs that had the potential for high levels of replication and high numbers of meaningful jobs.Schumacher saw intermediate technology as providing a path out of poverty for the developing world. But this was definitely not just a manifesto for the Global South. Schumacher saw the approach being also applicable in the developed world as an antidote to high levels of unemployment, the monotonous repetitive and soul-destroying work of the production line, and as an answer to excessive and environmentally unsustainable levels of material consumption.  |
| 4 | * So where are we 45 years on?
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| 5 | * Well the two grand challenges Schumacher addressed in Small is Beautiful - heading off environmental catastrophe whilst dealing with global poverty and inequality are still there – magnified and, in the case of climate change, in urgent need of attention.
* And we seem to be no nearer being able to bring technology to bear effectively as part of the solution
* Indeed you could argue we’ve actually lost control of technology innovation – or rather abandoned any sense of responsibility for shaping technological progress and instead left that to the vagaries of the market
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| 6 | * And this in turn is leading to ever growing **injustices** resulting from the way we govern, or fail to govern, how technology is accessed, used and how we shape and drive innovation.
* I’d like to look at a few examples to illustrate this. Lets start with how we manage access to technology
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| 7 | * Let’s look at energy. We need energy to…. (talk through…)
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| 8 | * And this is an old technology. Edison patented the incandescent light bulb in 1879.

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| 9 | * So surely its an injustice that, nearly 140 years later, 1.1 billion are still living in the dark with no electricity and 2.9 billion people are still cooking over open fires? How have we not managed to find a way to provide universal access to a technology that’s been around for close to one and a half centuries and that is so essential to a basic standard of living?
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| 10 | * Failing to allocate enough money is one reason. The International Energy Agency (IEA) estimates that we need to spend $44.5 b a year on new electricity supplies and $4.4 b/ yr on access to clean cooking facilities to achieve universal access to energy by 2030, which is now an SDG target.
* But current spending falls far short of that
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|  11 | * And it’s not just the volume of funding that is an issue, but how it is spent as well. Because of the dispersed rural nature of much of the population that lacks electricity, grid based solutions will be very expensive and the IEA estimates that around 65% of all spending will have to be on off-grid solutions to meet the 2030 target.
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| 12 | * Nobody knows exactly how much is currently being spent on off grid, but you can be sure it’s nowhere near 65% of current investments A recent study of the energy loan portfolios of the main development banks probably reflects the actual situation ,with the best performers allocating only 25% of their funds to off-grid and the worst allocating none at all.
* There are a number of reasons why this misallocation of funding happens, ranging from in-built biases in the training of engineers, to the difficulties funding institutions have in engaging with small scale infrastructure, to the lack of voice of marginalised rural populations, to the greater opportunities for corruption offered by larger scale infrastructure.
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| 13 | * But in essence, by going for grid over off-grid technology a choice is being made. A choice to provide more to those who already have electricity over providing new access to those who have none.
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| 14 | * Such injustices are not confined to energy services. The Romans had piped water supplies, as these lead pipes in the Roman baths in Bath attest. They also had rudimentary sanitation.
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| 15 | * So why, 2000 years later, do we still have 750 million people without access to clean water and 2.5 billion still having to defecate in the open.
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| 16 | * Likewise, why is it that 30% of the world’s population still doesn’t have access to WHO’s list of essential medicines?
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| 17 | * Or that the vast majority of farmers in the developing world have no access to technical advice to help them improve their productivity?
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| 18 | * Or, given the rising importance of digital identity and access to information, that 60% of Asia and over 70% of Africa cannot access the internet?
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| 19 | **PAUSE*** Clearly we still have a long way to go to achieve universal access to the basic set of technologies necessary to achieve even a basic standard of living for everyone on the planet
* Technology injustices are not limited to issues of access though. The way technology is used by some today can itself impact on the ability of others to live the lives they value, either today or in the future.
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| 20 | * The most obvious example of this is our current addiction to fossil fuel technologies and the hugely negative impact that climate change is already having today, and will continue to have on future generations.
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| 21 | * But there are many other, less obvious examples. In the health sector the misuse of antibiotics is one.
* We persuade our doctors to prescribe them when we shouldn’t be using them.
* In the developing world their cost leaves many unable to afford a full course of treatment and so to under-dose.
* And in the field of agriculture, antibiotics are used with abandon in animal feed not just to prevent infection but also as a growth promoter. 80% of all antibiotics used in the US are administered to animals as prophylactics or growth promoters.
* As a result of the over and improper use, bacteria are becoming increasingly resistant to existing antibiotics.
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| 22 | * Alarmingly, the hey-day of antibiotic discovery was in the 1940s and 1950’s. Only 3 new classes of antibacterial drugs have been discovered in the last 40 years, with a complete discovery void since 1987.
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| 23 | * Unless this dearth of discovery can be reversed, it’s predicted that global deaths from antimicrobial resistant bacterial infections could grow from 700,000 a year today to 10 million a year by 2050, exceeding annual deaths from cancer.
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| 24 | **PAUSE*** The agriculture sector provides another example of the use of technology leading to injustice – notably the long term impact of industrialised farming technologies and techniques on the genetic base for our food system.
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| 25 | * The Green revolution’s focus on wheat, rice and maize and commercial breeders’ focus on soybeans, alfalfa, cotton and oilseed rape has pushed other traditional food crops into the margins since the 1960s. But the focus on yield has also meant that even within the world’s leading crops it’s estimated that genetic diversity has been decreasing by 2% per annum since the 1990s and that perhaps three quarters of the germplasm pool for these crops is already extinct.
* This severely limits the genetic pool we can draw on to develop crops that can cope with new climatic conditions and new pests and diseases in the future.
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| 26 | * The same issue faces us in the livestock sector where the search for uniformity and productivity have led to a focus on a very narrow range of breeds globally – On average just 5 breeds dominate commercial production in each of the 5 main species of livestock around the world. Although the result has been an increase in productivity, the narrowing of the gene pool carries with it real risk. Avian influenza and Mexican swine flu (H1N1) are just two recent examples of global pandemics largely provoked by extreme genetic uniformity in commercial breeds raised in confined spaces.
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| 27 | **PAUSE*** Clearly, although we need to promote access to technology to achieve a universal minimum standard of living, we also urgently need to find a better way to govern the use of technology.
* Electricity only became widely available in domestic households in the UK after the 1930s. Antibiotics were first used in the 1940s. The green revolution in agriculture only started in the 1960s. Yet today there is a very real danger that some of the key technological advances that have enabled rapid improvements in the standard of living for billions of people could be rendered unusable just 50 to 80 years after their first introduction.

**PAUSE*** So what about technology innovation? Is that helping with these twin great challenges of environmental sustainability and ending poverty? Can we see technology justice here in terms of innovation process finding solutions to pressing social problems? Sadly the answer to that question is also, often, a resounding “no”!
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| 28 | * Let’s take a look at technological innovation in the health sector as an example.
* 90% of the global spend on health research takes place in the developed world.
* But according to the Lancet, only around 1% of that $214 billion a year is spent on research on neglected diseases of poverty – diseases such as HIV AIDS, Malaria, Tuberculosis, Diarrhoeal disease etc.
* The interesting thing to note here too is who is making the investment. The Glaxo-Smith Klines of the world account for 60% of global health R&D spend, but only 15% of the spend on research into the diseases primarily affecting populations of the developing world.
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| 29 | * As Bill Gates noted in 2013 - There is no market incentive to develop drugs to treat the poor.
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| 30 | * But market signals are not just weak drivers of innovation for diseases of the poor. They are pretty weak drivers for research into any genuinely new medicines.
* For example, over the 10 years from 1993 to 2004, only 14% of the drugs approved by the US’s Food and Drug Administration were classed as priority new molecular entities (NMEs).
* That is to say only 14% of the drugs produced in that period represented a significant step forward as completely new medicines. The remainder were mostly minor variants on existing medicines, for example the same drug repackaged in different dosages.
* What is more, only 25 per cent of the New Molecular Entities could trace their origins back to research by private corporations. The remaining 75% originated in the publicly-funded National Institute of Health’s laboratories.
* So in a funding environment dominated by the private sector, the dependency on market forces not only tends to focus research on products for markets with more buying power in the developed world, but also, within that market, for the majority of the time delivers ‘innovation’ that is of only marginal value: drugs that offer little additional therapeutic value but provide a good financial return because their development costs are relatively low.
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| 31 | **PAUSE*** I’ve focussed on the health sector here, but similar stories around technology innovation pointing in the wrong direction exist in other sectors too. In agriculture for example, the richest 22 countries in the world together spend around twice as much on R&D than 117 developing countries combined.
* And once more private sector investment dominates R&D in the former but is almost entirely absent in the latter, meaning that the global innovative effort focuses mainly on the greatest financial return rather than the greatest poverty or environmental need.
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| 32 | * Similarly in the energy sector the public investment to advance renewable energy options is dwarfed by public subsidies to support fossil fuels, whether the comparison is made using the IEA’s estimate of direct fossil fuel subsidies or the IMF’s estimate that includes the costs to the public purse of fossil fuel environmental damage.
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| 33 | **PAUSE*** Humanity has lost control of technology, or rather relinquished it to the vagaries of the market, assuming its ‘invisible hand’ will ensure the most efficient development and dissemination of technology that best meets people’s needs.
* The result is failure. Failure to provide universal access to a set of basic technologies that are key to achieving a basic standard of living and a minimum social foundation. Failure to control the use of technologies to avoid the risk of breaching planetary boundaries. And failure to guide technology innovation in a direction which addresses the massive challenges of global poverty and environmental sustainability that the world now faces.
* We have to reboot our relationship with technology. This is not incremental change but a radical shift in the way oversight and governance of innovation and access to and use of technology is provided.
* To do that we need a clearer picture of what it is we are actually trying to do, or at least need to do, with technology.
* One starting point for that picture is ex-Oxfam Economist Kate Raworth’s doughnut economics
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| 34 | * Raworth used the 9 planetary boundaries set out Johan Rockstrom of the Stockholm Resilience Centre to define a ceiling for human resource use, beyond which lies unacceptable environmental degradation and potential tipping points for earth systems.
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| 35 | * Onto this she superimposed a social foundation consisting of the 11 top social priorities identified by the world’s governments in the run up to Rio+20. Below this foundation of resource use lies unacceptable human deprivation such as hunger, ill health and income poverty. Between the social and planetary boundaries lies an environmentally safe and socially just space in which humanity can thrive.
* What’s also interesting though is that both planetary boundaries and the social foundation can be examined from the perspective of technology.
* If we take planetary boundaries first, there is clearly a very direct relationship between threats to exceed the safe limits and our use of technology.
* If we look at our use of fossil fuel technology for energy supplies for example, we can see a direct link with climate change, ocean acidification as CO2 is absorbed into the seas, the massive use of freshwater for both cooling processes in power stations and for hydro electricity production, and massive land system changes resulting from a whole range of factors ranging from the construction of reservoirs for large hydroelectric dams to the mining of coal or oil shale for fuel.
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| 36 | * To take another example, if we look at our food production systems and technologies we can see how the massive application of fertilisers has contributed to breaching safe boundaries for biogeochemical flows, or how irrigation impacts on freshwater use, how clearance of forests for agriculture leads to land-system change, how that in turn releases CO2 that contributes to climate change, and how that, and industrialised monocropping, impacts on biodiversity.
* You could also look at the relationship of the use of technology in industry to these boundaries, or our adventures in synthetic biology and the processes associated with novel entities, and so on.
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| 37 | * Moving on to the social foundation, its fairly easy to show that, although establishing such a foundation is by no means simply a technical exercise, access to technology is an essential precondition for achieving it.
* We need technology for clean water supplies,
* We need technology to provide clean and useful energy.
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| 38 | * We need basic medical equipment and access to drugs to provide a health service.
* We need access to equipment like ploughs and sprinklers to produce food,
* And we access to communications technologies for everything from education to financial services, to remote health diagnostics, to digital identity and voice in political processes.
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| 39 | * Given all of this we can recast Kate’s doughnut.
* The inner circle can also represent a minimum set of technologies that have to be accessed universally in order to achieve the social foundation.
* The outer circle can represent the controls we have to exert on our use of technology to remain within safe planetary boundaries.
* And the core of the doughnut then represents not just a safe and inclusive space for development, but also a space for Technology Justice…
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| 40 | * A space where everyone has access to the technologies that are essential for a basic standard of life, in a sustainable way that doesn’t prevent others now, or in the future from doing the same.

PAUSE* This lens of Technology Justice then has to be used to recognise that some choices are more likely to lead to that safe and equitable space for human development, whilst other choices are more likely to lead in the opposite direction. Responsibility needs to be taken for those decisions rather than hoping market mechanisms can make them by default and without intervention.
* This is a massive undertaking. Systemic change on a global scale. Daunting to think about.
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| 41 | * So against that back ground, coming back to the original questions – is small still beautiful?
* Well lets get some things straight before we answer that:
* Firstly Schumacher wasn’t wedded to the idea of small to the exclusion of anything else. Rather he was standing up for and promoting what he felt was under-represented in the overall balance of things. He didn’t actually even like the title of the book, but deferred to the publisher who thought it was a good seller.
* Secondly things have changed since 1972. Schumacher wrote small is beautiful when the UK still had a manufacturing industry and the mindless repetition of work on the production line was still a common experience. Today 80% of our GDP is derived from the service sector and employment patterns look very different.
* Thirdly environmental catastrophe is no longer a distant threat but an immediate one – we’re told we now only have a decade left in which to act before climate change potentially spirals out of our control.
* We are faced today with problems that can only be dealt with by collaboration on a global scale – such as climate change and getting the incentives right to shift subsidies and investments from fossil fuels to renewables, or tacking the anti microbial crisis or dealing with the sustainability of our food supply.
* We need global mechanisms to help us with this. In a time of BREXIT, the US presidential elections and signs of increasing populist politics and nations turning inwards, we need the post WW2 idealism and internationalism that created the UN and other global institutions more than ever.
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| 42 | * Take technology access as an example. We need agree what the social foundation is and what the key technologies needed to support it are
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| 43 | * The Sustainable Development Goals, as an internationally agreed vision of a different future, might be a good place to start.
* We need to explore what could be done to highlight better the role of technology in achieving these goals and, at a national level, provide really useful data to stimulate public debate on some of the technology choices that will need to be made, for example the grid vs off-grid investment decisions referred to earlier for energy?
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| 44 | * We also urgently need to improve our understanding of what influences the success of innovation and technology transfer in developing economies.
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| 45 | * There is a lot of research and a good understanding of how national innovation systems work in the developed world. This is an example of a UK systems map produced by the UK Government as part of an assessment of relative strengths and weaknesses the national innovation system compared to competitor nations.
* But there is almost no research available on national innovation systems in the developing world, how they work and what the best approach to strengthening them, both to build national capacity to innovate but also to absorb and make best use of technology transfer.
* Given that trillions of dollars’ worth of clean technology transfer is envisaged under the climate change negotiations alone, isn’t it time we attempted to understand how those systems work and how they could be strengthened to cope?
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| 46 | * And we need to change the terms of debate around finance
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| 47 | * We know that not enough finance is being drawn into provision of services for the poor, as I demonstrated with the case of energy.
* The prevailing narrative is that there is not enough public finance to bridge the gap and we have to use what is available to lever private investment. In some cases that may be true, but then we need to be re-examining the market rules because they are clearly not sending the right signals at the moment
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| 48 | * In other cases though we need to have a serious conversation about reassigning the massive subsidies that are available to the right technologies
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| 49 | **PAUSE*** Moving on to think about use. We need to foster public debate and consensus on how to manage the risks associated with technology development and use
* There is a growing academic literature on what’s known as Responsible Research and Innovation but we need to work out how to tap this quickly to help with the enormity of some of the choices facing us at the moment, choices that could well have profound and as yet unanticipated impacts.
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| 50 | * Choices like the what the right future energy mix is
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| 51 | * Or whether to allow large scale experimentation with technologies such as carbon capture and storage or geo engineering
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| 52 | * Or the technological basis for our future food systems
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| 53 | I’d also argue that we should be paying much more attention to alternative economic models as a way of providing stronger incentives for the positive use of technology |
| 54 | * We should, for example, seriously look at whether a circular economy model might be a good way of aligning market signals with environmental sustainability objectives to provide good governance of the use of technology more by default than by regulation
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| 55 | **PAUSE*** And finally, considering innovation
* We have to identify the mechanisms we could use to get global agreement on the most urgent technology innovation needs to make best use of the limited time and resources we have to find solutions
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| 56 | * There are a number of global mechanisms that are supposed to play this role, including a Technology Facilitation Mechanism and a Technology Bank envisaged under the SDG’s. None of them have much teeth or power at the moment compared to, for example, international regulators such as the WTO.
* We need to make up our minds either to really back some of these mechanisms, allowing them to be much more radical and providing them with the resources and power to do the job, or to find another more effective approach
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| 57 | * In the face of all the problems associated with weak market signals and the ineffectiveness of intellectual property rights as a driver of useful innovation, we need to explore and increase backing for collaboration rather than competition to make the best use of scarce resources and time
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| 58 | * There are a growing number of open and crowd sourcing initiatives now seeking to foster innovation in everything from the maintenance of genetic diversity in seeds, or further exploitation of the human genome map to the spread of 3 d printing technology or the development of new drugs to treat malaria and tuberculosis. We should be backing these more.
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| 59 | * And we should be looking for a genuinely new symbiotic rather than parasitic relationship between the private and public sectors.
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| 60 | * That would require a change in the dominant narrative of today. A shift away from seeing the role of the state as primarily to regulate and de-risk the environment for the private sector, to a new recognition that the State has an important role to aggressively act, invest and take risks where the complexities or costs are too high for the private sector to act alone ….
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| 61 | * Intermediate technology does not feature much in today’s literature and policy debates around technology innovation and technology transfer needs. But technology development in the years since Small is Beautiful was published has only made the need to rethink technology and scale more urgent. The agricultural sector is a clear example of this, where the industrialization of food production has led to a massive increase in the amount of energy used per unit of food produced, widespread pollution of the environment from fertilizer and pesticide use, and a loss of genetic variety in livestock and crops which puts the future of our global food supply in jeopardy. Another example is the impact of the rapid scaling up of automation on whole classes of jobs and employment.
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| 62 | * Interestingly, though, while developments over the past 40 years have made the reintroduction of human scale into technology even more urgent, they have made it more possible, too. Innovation in solar photovoltaics has made household-level power production, both for self-consumption and sale, not just possible but also economic. We can all now become independent power producers. Improvements in information and communications technologies, including the internet and mobile telephony, have opened up free access for individuals to vast amounts of technical knowledge and also provided a marketing mechanism for small-scale producers that used only to be in the hands of large corporations with massive advertising budgets. The introduction of 3D printing will further revolutionize what can be produced locally and on a small scale. Meanwhile, better understanding of agroecology offers new opportunities to improve the competitiveness and economics of small-scale food production while addressing environmental risks.
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| 63 | * The need for us to organize on a scale that crosses national boundaries to deal with conflict, poverty, environmental degradation, and sustainable and fair use of natural resources has not diminished. And there will still be forms of production and economic activity that lend themselves to large structures.
* Human wellbeing is about more than just access to material goods and services. Wellbeing also requires a sense of being in control of one’s own life and destiny and of having a say in decisions that impact on that ability. **Today we increasingly have technological options that allow us to choose to return ownership of some of the means of production back to individuals and, in so doing, strengthen this aspect of wellbeing**. Where such options are also likely to deliver real and significant poverty and environmental benefits, we should take them. In that sense, small is still beautiful.
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