



NEW DIRECTIONS

Ideas and innovations

Tired of consuming?

Personal action



Jobs

Open to all

Driving change

TUNZA

the UNEP magazine
for youth. To view current
and past issues of this
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**Partners for Youth
and the Environment**



UNEP and Bayer, the German-based multinational involved in health care, crop protection and high-tech materials, are working together to strengthen young people's environmental awareness and engage children and youth in environmental issues worldwide.

A partnership agreement, originally signed in 2004 and renewed in 2007 and 2010, runs through 2013. It lays down the basis for UNEP and Bayer to implement the projects under the partnership. These include: TUNZA Magazine, the International Children's

Painting Competition on the Environment, the UNEP Tunza International Youth and Children's Conferences, youth environmental networks in Africa, Asia Pacific, Europe, Latin America and the Caribbean, North America and West Asia, the Bayer Young Environmental Envoy Program and a photo competition, 'Ecology in Focus', in Eastern Europe.

The long-standing partnership between UNEP and Bayer has become a public-private partnership that serves as a model for both organizations.

EDITORIAL



Scientist James Lovelock was the first to think of the workings of our planet as one. He called it Gaia. The wider scientific community prefers to call it the Earth System, describing it as an interactive whole, vulnerable to the ‘butterfly effect’ – when even an action as small as the beating of a butterfly’s wings can have major and often unforeseeable consequences.

Think about your food. What we do on our farms affects not just the soil, but water, air and the atmosphere, biodiversity, and the whole supply chain that gets the food to your kitchen. Then there’s the energy you need to cook, and waste-disposal and refrigeration systems to deal with left-overs. And all these things – including what’s in your food and has been added to it – affects your health as well as the planet’s. Although most of us prefer to separate our thinking into topics – energy, pollution, water, biodiversity, health – the Earth System doesn’t work like that.

To squeeze the maximum from every productive square centimetre, we apply fertilizers and pesticides. But what are we doing to the bugs on which other organisms depend? As we pick up every last grain and kill the plants we don’t want, what happens to the birds that live on them and play a vital role in spreading their seeds? And what does poisoning the fungi that thrive on recycling natural wastes do to the whole Earth System?

Increasingly, we live in towns and cities and pay scant attention to the Earth System that supports us. Food comes from stores, energy is just a switch away, and for many, but no means all, water comes from taps while wastes just disappear. Are we grateful for an ever easier life? Do we stop to wonder what effect our demands have on the Earth System?

Perhaps ever-increasing specialization means we only consider the question that is being asked. Biodiversity or the effects of air pollution on health aren’t really a priority for an agriculturalist asked to increase food production, a transport expert considering how to speed up deliveries, or a finance ministry whose main concern is ensuring economic well-being and growth. But they should be.

As everything we do impacts the Earth System, we can’t just leave it to others. We have the tools to make our voices heard – whether by having a ‘right to vote’ or by using Twitter, Facebook and other social media. But we also have to open our minds and lives to change. Most changes won’t seem big, but together they will be fundamental. Try living the change – it’ll be exciting.



Driving change

Water shortages, air pollution, deforestation, toxic dumps, exhausted soils... you name it, we've got it. We've been talking about it for half a century, and trying to do something about it, too. Treaties and agreements abound...

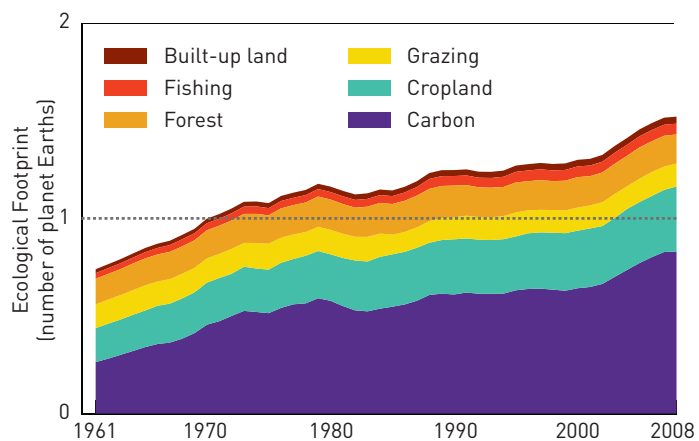
C. Fournier/UNEP/Topham

BUT for every environmental success – such as the mending of the ozone hole over Antarctica – there seem to be ever more disasters. For every target reached, there are dozens left unmet. UN Secretary-General Ban Ki-moon recently announced that three of the Millennium Development Goals – on poverty, slums and water – have been achieved three years ahead of schedule. But this year UNEP's fifth *Global Environment Outlook (GEO-5)* found that of 90 of the most important international environmental objectives, significant progress had been made in only four.

So are we going about it the wrong way? Are we looking at the immediate causes of the problems – for example mining leading to soil contamination, or excessive water use making rivers run dry – when we should be looking at the underlying causes, the real reasons for environmental change?

UNEP's *GEO-5* thinks so. It suggests that until we are prepared to examine

Figure 1 The world's rising footprint



WWF Living Planet Report 2012

'We are using 50 per cent more resources than the Earth can provide, and unless we change course that number will grow very fast – by 2030, even two planets will not be enough to provide for the 9 billion people who will then inhabit Earth.'

Jim Leape, Director General of WWF

the primary drivers of environmental degradation and then do something about them, humanity will just be running to catch up with itself. *GEO-5*

identifies these drivers as the rising global population and the linked drive for growth, commonly expressed as consumption and production.

Population growth

JUST 40 YEARS AGO, 3 billion people lived on Earth. Now there are more than 7 billion, and the most optimistic UN projection suggests there will be at least another billion by 2040. There could even be 10 billion by then.

Considering how rapidly we've expanded, it's amazing that we didn't run out of food decades ago. Actually, we've more or less managed to keep

up, doubling agricultural production since 1960 without increasing the amount of land being used. But can we continue to keep up, given the expected population growth and the new demand for biofuels? How do we reconcile our demand for food with the need to preserve the natural ecosystems on which we and the rest of the natural world depend?

And where will all the extra people live, or get their water? Both land

and freshwater are finite, and the same is true of practically all the other materials the Earth provides. Anyone can see that things can't go on as they are.

So what can we do? We know that education and economic opportunities for women are vital for reducing family size. Urbanization, too, can help. But the key to reducing population growth – as Professor Malcolm Potts, the first Medical Director of the International Planned Parenthood Federation, knows from experience – is the simple, and relatively inexpensive, universal provision of contraceptive services. All women, he says, whatever their

'Family size plummets when consumers are offered a range of appropriately priced contraceptive options through convenient channels.'

Professor Malcolm Potts

level of education or economic circumstances, understand that dividing meagre resources amongst an ever-growing family means that nobody flourishes. The World Bank calculates that up to 26 per cent of people in developing countries have no access to contraception, so addressing this unmet need could have a huge impact on our ability to live within our means.

We all have to make responsible population choices, not only about what is best for us, our partner and our families, but also for our planet and future generations.

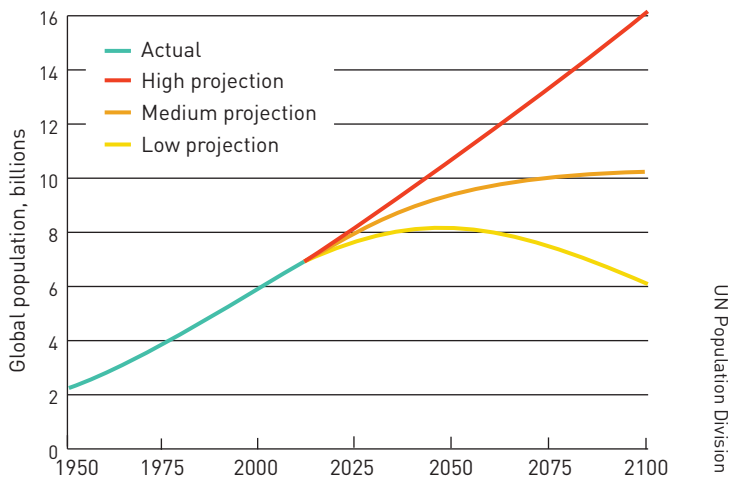
Consumption and production

THE WAY WE LIVE is also crucial. It is not only our numbers, but our lifestyles that drive the growing demand for resources – food; shelter and clothes; energy to keep warm or cool and for lighting and cooking; water; transport; and gadgets like washing machines and mobile phones. But we never seem able to say ‘enough’. Even in developed countries, people continue to want more.

Politicians emphasize that economic growth is the only way forward. But that seems to mean ever greater use of resources just to keep our economies going. And with almost half of all people living on less than \$10 per day, how will it be possible for everyone to attain a reasonable standard of living without totally depleting the Earth’s resources?

Moving to a green economy seems a promising approach. It implies, for example, enhancing public transport and introducing more renewable-energy technologies. It means raising building standards to reduce the energy used for cooling or heating, setting standards that encourage industry to get more from less, and improving technologies to reduce the use of valuable and finite materials. These changes will involve investments with long pay-back times, so they may generate complaints from both business and tax payers and could be politically

Figure 2 The world’s rising population



‘Sustainable development cannot be successful if the increase in global population continues to put pressure on the world’s non-renewable resources.’

Dr Fred Sai, UN Population Award Laureate and President of the International Planned Parenthood Federation

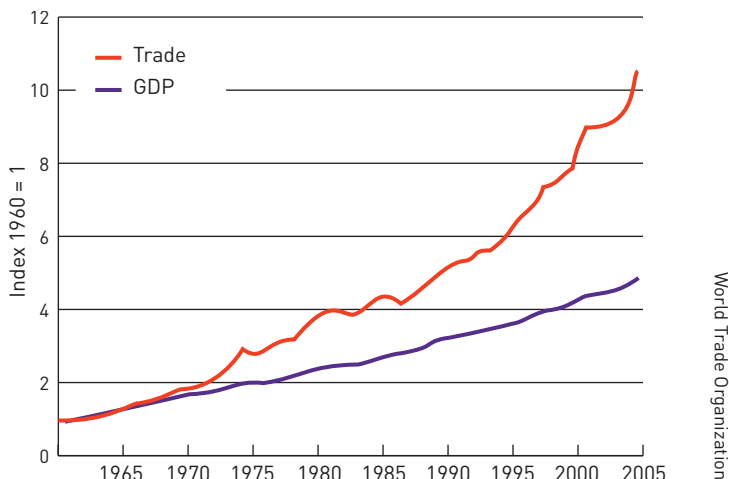
unpopular. But we need sustainability awareness in *everything* we do – and in everything we *all* do. We can’t just leave it to others.

Rather than just satisfying our immediate, and often transitory wants, we must think of the longer term. Instead of grabbing the cheapest products, or what we think we fancy, we must try to choose locally sourced and quality goods. What’s so bad about having fewer clothes that last a bit longer? Or why not use the bus or the train, and only hire or borrow a car when you really need one? Or compost your food wastes

for your own or your friends’ home-grown vegetables rather than buying chemical nutrients?

Sounds simple? Well it could be, but it is also fundamental. It means changing the deeper attitudes and habits developed over two generations of rising life expectancy and affluence. It means thinking differently, changing our minds and allowing them to change, then acting on it – and getting others to do so, too. Are you up for that? An increasing number of people, including business leaders, realize there is no alternative, no Plan B.

Figure 3 The world’s rising trade



We, the people



When Thomas Robert Malthus, an 18th-century English priest, noticed that over a period of three years, he'd performed rites for 57 births but only 12 deaths, he theorized that agricultural production couldn't possibly keep up with such population growth, and that the resulting starvation and disease would bring human numbers back to sustainable levels. Malthus may have been surprised to see the way scientific and technological advances have resulted in ever lower mortality rates – contributing to a staggering 7 billion people on the planet. Meanwhile, according to WWF's *Living Planet Report 2012*, we are already using up 1.5 planet's worth of resources.

Debate rages about how to approach this dilemma. Some, such as Canadian environmental thinker David Suzuki, say that population itself isn't the problem, but overconsumption and waste. If more people learn to make do with less, there would be enough for all. Many believe education is the answer, as educated women in all cultures tend to have fewer children. And some thinkers, such as TUNZA contributor Fred Pearce, point out that global fertility rates are already dropping – half the world's women are having two children or fewer – and believe the world's population will begin to fall.

But should we be making a more concerted effort to reduce our ecological footprint, not just by consuming and wasting less, or by investing more in education, but also by taking personal responsibility for the population problem? What do young people think about having children? We put the question to you to find out how environmental considerations are factored in to your plans to start a family. Here's what you said.

Victoria Wong, UK and France

'At first, the decision to have a baby seemed like the natural next step into womanhood. But while the idea appeals to me, I've realized my child will become another resource-using person, and might want to have many children as well. And the thought that I'd be bringing life into a crowded world with already limited resources terrifies me. There's still not enough awareness about the environment, food stocks, or how to properly use what we have still available. I worry my descendants won't have enough to eat, that we'll leave them a world where apples and broccoli are only a distant memory.'



Victoria Wong

Tribute Birdie Mboweni, Bayer Young Environmental Envoy (BYEE), South Africa

'Born and raised in multicultural South Africa, I've grown to realize that, despite our differences, certain values are shared across cultural groups – including the expectation that a woman will get married and have children. I love children, but I don't plan to have my own. Every week there's news of a child being raped or killed, and I get nervous just thinking about raising a child in a society where I will constantly worry about its safety.'

'I also worry about the pressure on natural resources by the ever-increasing human population. The high demand for food and other resources means we are continually working on ways to produce more. Are these ways always healthy? Having children might contribute to this not so healthy supply-and-demand cycle.'

Tribute Mboweni



María Rosa Reyes Acosta

Aswin Chandrasekharan, India

'Children bring joy and meaning to life. I think I'd settle for two – simply because I'm an only child and always yearned for a sibling. I believe that if all families practised the principle of two children per couple, at least in developing nations such as India, then we'd see a net reduction in energy consumption and maybe even an increase in per capita energy allowance. But the only way to prevent environmental damage due to overpopulation is creating awareness across nations, cultures and classes.'



Aswin Chandrasekharan

A doctor's view



Renzo Guinto

TUNZA asked **Renzo Guinto** – contributor, BYEE and newly qualified medical doctor – about his thoughts on population.

‘Populations with optimal size are better prepared for adapting to climate change: environmental education is easier to conduct, and health systems catering for smaller groups are less burdened when natural calamities strike.’

‘For 14 years, my country, the Philippines – now a nation of 94 million and one of the most populous in the world – has been stuck in a longstanding debate on whether to pass a Reproductive Health Bill. The proposed legislation – which aims to make reproductive health information and services accessible, especially to the poor – has been criticized by Catholic groups. Meanwhile, the positive relationship between a bigger population and economic development has long been debunked.’

‘The UN’s *Human Development Report 2011* identified reproductive choice as a way to avert environmental degradation and ensure sustainability. While the Reproductive Health Bill was originally designed to prevent unnecessary pregnancy-related deaths, a closer look at its environmental benefits reveals a convincing argument that population management protects Earth, too.’



María Rosa Reyes Acosta, BYEE, Ecuador

‘We are witnessing the destruction of our biosphere every single day. Knowing I am part of the problem encouraged me to seek solutions since I was little. Once I became a mother, my perspective changed, because I realized this is a legacy we leave to our heirs. As a consequence, I’ve stopped searching for solutions and decided to become one. The contribution of each human being is the key to achieving balance between humans and nature. This is the message I must transmit to my son.’

Alonso Lizaraz, Tunza Youth Advisory Council (TYAC), Venezuela

‘Having a child is a biological call we all feel. I think I will procreate when I’ve settled down and am in a strong position to give my child the best, knowing that he or she will face challenges in a constantly changing world. I grew up loving nature even when the “green boom” wasn’t as strong as it is now – I thank my parents for that. Their values are always with me, and I try to inculcate them in others. They will also be the basis of my child’s education. It’s a way to thank nature, and thank my parents.’



Alonso Lizaraz

Linh Do, TYAC, Australia

‘If I ever have children – and I doubt I will – it would only be two at most, only because I wouldn’t want an only child. Adopting might be an option. Having a baby is one of the most high-impact things you can do environmentally, especially in the developed world. But aside from environmental impact, there are bigger life questions to consider first.’

Transhumanism

The transhumanist movement asserts that we have the technology to extend human life indefinitely, eliminating aging. TUNZA asked biogerontologist and transhumanist **Aubrey de Grey** what he thinks the consequences might be if everyone decided to live forever.

‘People often fear that progress in medicine will have serious demographic consequences, increasing the burden of health care as more people live longer and are kept alive in a debilitated and expensive state of health. However, the truth is that the more we succeed in postponing age-related ill health with medicine, the more this risk will be averted. Women the world over are already having fewer children on average, and are having them later; as these trends accelerate, population increases will be curtailed and the environment will benefit.’



Yaiguili Alvarado García

Yaiguili Alvarado García, Panama

‘Being environmentally conscious, I’ve always had an internal conflict about having children. But the moment came, and I had my daughter. I’m raising an environmentally active girl. She’s almost two, loves nature more than anything, and helps to separate waste for recycling! Will we have more children? Adopt? I’m not sure, but whatever the size, my family will live in the greenest way possible.’

‘I do believe it’s necessary to break taboos that work against having fewer children. Most low-income families don’t know much about world population and family planning, so they tend to have many children and not enough resources. It’s not only about the environment but quality of life, for us and all the world’s species.’



Linh Do

What WE really, really want

TUNZA asked what attitudes and values guide you, young people, in dealing with the pressure to consume and the need to develop independent lifestyles. Here's some of what you told us.



What do you value more, things or experiences? How does this affect your career choices?

'Any new experience makes me happy. Travelling has always impressed and humbled me. It's so interesting to see people tackle problems differently. I need to meet new people, from different backgrounds. I also need to contribute to making a better world, whether environmentally or simply making it happier. If my career allows both, you'll find me "working" long after retirement.' *Chucky Bartolo, Tunza Youth Advisory Council (TYAC)*

'I am most excited about social entrepreneurship. For too long we have separated philanthropy from for-profit companies. Many, however, are beginning to see the need to create self-sustaining (meaning not grant-dependent) enterprises that create social and environmental change.' *Lisa Curtis, TYAC*

'Going freelance gave me undreamt-of opportunities – helping a Scout camp in Swaziland, Africa; leading a humanitarian effort in Sikkim, India; running turtle conservation projects in Terrangganu, Malaysia... It was the best decision I ever made. I tell friends "the best job in the world is one that you go to without thinking it is work. That way, you will not have to work a single day in your life."' *Tan Sijie, Scout*

'I want to develop projects involving communities in planning the proper use of natural resources, taking advantage of ancestral knowledge and improving the quality of their lives. I want to educate youth and children so that they can have opportunities to make society fairer.' *Maria Boa, TYAC*

'I cherish experiences. They characterize purpose in life. I try to ensure every job I take allows me to express myself and fulfill my dreams. If that means taking lower pay, that's OK. What excites me is being able to sow seeds for a bountiful future, not toiling pointlessly to reap immediate gains that have no meaning.' *Titus Wei Ren Loh, Bayer Young Environmental Envoy (BYEE)*



Titus

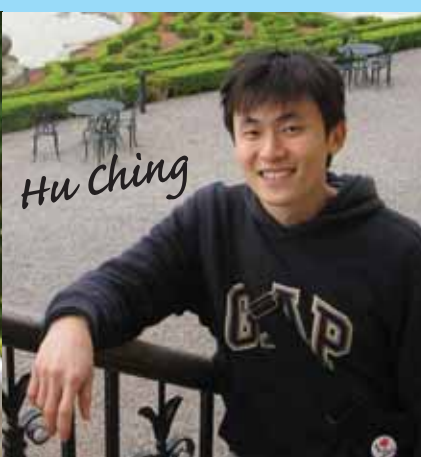
What's the difference between need and want?'

'Unfortunately, these lines have been blurred by consumerism. Wants are no longer confined to seemingly un-touchable luxuries, but have evolved into common statements of need: "I need a smartphone, I need an iPad." Really? Absolutely not! If we don't clearly redefine needs and wants, present and future generations will grow up in a make-believe world of irresponsible living, insensitive to the real world, where millions whose real needs aren't being met live in poverty.' *Titus Wei Ren Loh, BYEE*

'Distinguishing between want and need can be difficult, especially as shops advertise "must haves"! As a young person there's a limit to what I need to survive, although we all battle to have the latest clothes and gadgets. There's no harm in wearing the same outfit or looking for less expensive, recycled goods. It's up to the individual, but often the things we really need in life are right in front of us.' *Emily Keal, Tunza*



Maria



Hu Ching



Rama



Gracia

What do you think about the morality of total human domination of the planet?

'If we take a largely anthropocentric worldview, then it's OK, but I take a more eco-centric perspective. We are all part of a biophysical system where all inherent rights to exist should be taken into account – including the rights of Mother Earth, and the systems and processes that sustain her. Thinking it's all just for our benefit has led to today's environmental crisis.' *Phindile Mangwana, BYEE*

'Human domination implies the right to do whatever we please. We evolved from the Earth; the reason we are even able to think we can "dominate" is thanks to the way we developed, so why do we feel it is ours to ruin? It's a bit like growing up, graduating top of your class in university, and then burning down your parents' house, even though it's the place where you grew up and learned to be who you are.' *Chucky Bartolo, TYAC*



Danesto



Phindile



Emily



Sijie



Chucky

Should we value everything in economic terms ... or should we measure development differently?

'When we fail to measure the things we value – clean air and water, healthy communities – we fail to properly manage and improve those aspects of our society. We must put numbers to the things that we value so we can make sure that they're adequately managed.' *Lisa Curtis, TYAC*

'Economics is mostly used to value tangibles, but development is an holistic term. It's a culmination of various socioeconomic, cultural and political factors – most importantly, it includes the role of environmental sustainability. Economic terms can put figures to gains or losses, but are not representative of everything around us.' *Ramanathan Thurairajoo, BYEE, Tunza*

'Let's begin to seriously consider development as the conservation of a nature reserve rather than the construction of a shopping centre, or the preservation of clean air rather than accepting pollution from vehicles and factories.' *Hu Ching, BYEE, Tunza*

'Even sustainable development is measured in economic terms. However, the key may be the equitable distribution of economic gain. We could create a "cap" so that the benefits of economic progress can be distributed fairly – "I've enough, I'm now considering the needs of others." Such policies could be implemented, but it boils down to personal values and ethics.' *Danesto Bacdayan Anacio, Tunza*

Should we envy the rich?

'We'd all love to be financially well-off. But what are we willing to sacrifice? Time with family and friends? Spiritual well-being? Health? I'd rather be rich in my general well-being. I can't take money to my grave, but I can die happy, without regrets.' *Tan Sijie, Scout*



Lisa

'Development is more important than economics, and it can be measured by life skills, social values and environmental responsibility. Economic development is important, but would be more valuable and sustainable if we correlate economic, social and environmental aspects.' *Gracia Paramitha, TYAC*

JOBS

We all need one, don't we? Most of us need the money, and all of us need the self-esteem that comes from contributing. Today, we all seem to want ever more stuff, instantly and cheaply. And we only measure development in terms of economic output. That's brought ever more mechanization, fewer jobs, and a global market that feeds its demands from the cheapest source. Jobs are getting scarcer, no matter your qualifications. Can it change? It needs to. And perhaps the growing emphasis on young social entrepreneurs can help to usher in a green economy.

Thomas Langreder/Visum/Specialist Stock



Be the Change Academies

They're barefoot business academies – one-stop business training, creation and incubation centres. As long as you're under 30, all you need is a business idea to get free training covering what you need to start a successful small business – financial management, IT, customer relations, market research, quality assurance and one-on-one counselling in business plan development. The best plans are presented to business leaders who select 10-15 for a loan plus continued mentoring.

The first academy has been running in Kisumu, western Kenya, for two years now, and has invested an average of \$7,500 in 24 budding businesses. The largest loan went to Harrison and his Catering Co-op, which provides quality food for events such as weddings and funerals. 'It allowed us to buy vital equipment that we'd previously had to hire,' said Harrison Oyugi, 'which meant we could make significant savings.' Simon Oriko, who used his loan to buy professional juicing equipment,

commented: 'the training was great, and I now have a real understanding of my market. Customers come back because my juice is best – just watch my business grow!' Rhoda Akinyi, who makes and sells beautiful children's dresses, learned how to research her market and improve her financial management. 'My mentor Katrina has really helped. Before she came along, I really struggled with this stuff,' she told TUNZA.

'All these businesses have faced potentially crippling problems,' added project coordinator Michael Ogweno. 'Simon's equipment, for example, was stolen – but our training and mentoring taught him how to save in good times so that he could keep going when life got tough. We trained 80 young people in 2011 and, so far in 2012 a further 150, with another 200 people starting in September. Each of the trainees can be the change.'

Plans are in hand for further academies in five West African countries, and

in Egypt, the Occupied Palestinian Territories, Afghanistan and India. 'We're working closely with UN organizations, national governments and international aid agencies,' reports Alpha Bacar Barry, who incubated the idea while working at Peace Child International (PCI) and is now developing an academy in Guinea. PCI President David Woolcombe adds: 'The academies allow youth to train youth to set up successful small companies. They are incredibly cheap to run and, with youth unemployment rates running at over 50 per cent, I believe these academies are a big part of what is needed to train and support young entrepreneurs, even in highly developed economies.'

Be the Change



Go for it!

Just three years ago, Richa Bajpai was studying engineering and business management. Now she is one of two partners in NextGen – The Energy and Environment Company, which employs more than 50 people. NextGen's first corporate client was Intel India and today its progressive portfolio includes two banks, food processing and packaging giant Tetra Pak, and the Bangalore Royal Challengers IPL cricket team, part of the Mallya family's empire, one of India's largest conglomerates.



'It was while doing research into the carbon market as part of my studies,' Richa told TUNZA, 'that I realized companies were not developing strategies to reduce their or their products' carbon footprints. That gave me the determination to help businesses measure, manage and mitigate carbon emissions, develop low-carbon strategies and reap the benefits of becoming greener businesses. There was a real opportunity as the Indian government had decided to reduce the country's carbon intensity by a quarter by 2020.

'The push to go green, or at least greener,' explains Richa, 'comes from



four directions. First there is compliance with regulations, but customers are also pressurizing companies to become more environmentally responsible. Peer pressure is a factor, too, as you have to keep up with your competitors. And then there are the companies themselves – often the drive for sustainability comes from within, something that people often overlook.

'There is an enormous number of opportunities out there. The satisfaction



L. Prossor/UNEP/Topham

you get from running your own business is huge. I would encourage anyone who's interested to invest their energy, enthusiasm and hard work in starting their own enterprise. Pick your niche, persevere, and you will succeed.'

Richa should know: today India, next year Sri Lanka, the Gulf States and the UK for NextGen.

European job creation

Faced with increasing youth unemployment, the European Commission has set up a youth-led initiative across its 27 Member States. Dutch graduate Janne Geurts is coordinating this: 'One answer to youth unemployment,' she told TUNZA, 'is the creation of jobs by young people themselves. Our project will establish a network of young people and experts committed to ending youth unemployment. We'll learn from them about what works, and the vital ingredients for a free online training scheme that we are developing.

'Currently we are building a pan-European network of job creation schemes and young entrepreneurs interested in working with us. We're planning a seminar for later in the year where the most active, interesting and prominent thinkers and doers will develop a Job Creation Handbook capturing best practice and advice on how to start your own business.

'The next stage will be pilot training courses for three groups of youth eager to start their own business. Each trainee will create a business plan, for which we will seek investment. A thorough evaluation of these pilots will provide input to the online training modules.

'If you know of effective youth job creation initiatives, or if you have set up your own green business, or have any experience of creating jobs for youth, please join our network and help spread best practice across Europe.'

Contact Janne at jobcreation@peacechild.org



Janne Geurts

Personal action



You CAN make a difference, and even save lives. These winners of the 2012 Volvo Adventure – held annually in Gothenburg, Sweden – are inspiring examples of how young people can take environmental problems into their own hands and, in an astonishingly short period, change lives for the better. Each winner offers simple solutions to universal problems and all are eminently replicable. How did they do it? Could YOU do it too? Read on...



Grupo Escoteiro Tupinambás



Karen Eng



www.inpev.org.br

Pesticide packaging in Brazil

<http://projetokarajas.blogspot.com.br>

Brazil's Grupo Escoteiro Tupinambás, a scout troop in southern Brazil, works with farmers on proper disposal of pesticide containers – a hazard to both the environment and human health. Their project won the Tunza Small Beginnings award for a very simple idea with a potentially huge impact. We spoke to the troop about their activities.

'Over the course of two years, we saw empty pesticide containers and dead fish in the River Suzana in southern Brazil, which supplies water to two cities. We work with the source of the problem – the farmers – to teach them about the dangers of handling and disposing of pesticides and pesticide packaging.'

'Mishandling pesticides is common here because our agricultural economy is based around small farmers who

do not really understand the instructions on the packaging. They don't understand that empty bottles must be washed thoroughly, then returned to the shop where they were purchased. Instead, bottles containing residue are simply thrown into the river or over the fields, or used to store food and water. The farmers also don't realize that protective clothing and equipment, including respirators, should be worn when handling such toxins.

'So we print pamphlets explaining the dangers and proper procedures, and visit farming communities to explain them. We also produce plays for children, and use broadcast and print media, too, to spread the message.'

'More than 30 rural properties have adopted safer handling processes in the last 22 months, saving hundreds of improper disposals and improving health. We intend to keep expanding, and plan to partner with two other scout groups.'

How they did it – could you?

All of these projects followed the same basic steps, which can be applied to similar problems where you are.

1. Identify the problem, research possible solutions and develop action plans.
2. Present your plan to local authorities, schools, community groups, media and other stakeholders, enlisting their feedback and support.
3. Put your plan into action – hold events, visit communities and schools, and broadcast your activities and successes through the media.
4. Offer support and advice to others who will be inspired by your work: make information available via the internet and social media.
5. Where possible, use the evidence of your success to lobby government for laws supporting environmental health.





P2D2



Karen Eng



P2D2



Prescription drugs in the USA

www.p2d2program.org

The USA's P2D2 is a student-led organization that educates the public about the dangers of improper disposal of pharmaceutical drugs and initiates authorized disposal sites. Jordyn Schara, one of the originators, told TUNZA how a simple idea grew into a nationwide environmental campaign.

'I'm from a small farming community in Wisconsin. Three years ago, when I was 14, two things startled me: a teenage boy in my community died from an overdose, and I also discovered that many prescription drugs – antibiotics, acne medication, anti-convulsants, mood stabilizers and sex hormones – are flushed down the lavatory or buried in landfill, only to enter the water supply, harming humans and wildlife alike.

'It's a global problem. In the USA, prescription drugs contaminate the drinking water of at least 40 million people, yet there is no standard for proper disposal or legislation to back it up. I decided to start a collection programme, but when I contacted the Drug Enforcement Agency (DEA) to find out how, they told me it wasn't their priority.

'However, during the course of my research, I found that science teacher Paul Ritter, from Pontiac, Illinois, had addressed the problem and his students ran collection events. We joined forces, and P2D2 (Prescription Pill & Drug Disposal) was born. Through public events and the web, word spread, and the programme has now reached 21 states, and rising.

'Pharmaceutical collection differs according to the situation in each community. Generally, young people present a plan to the city council and call for support from the community, the police, pharmacies and hospitals. We spread the word with flyers and posters, T-shirts, and as much media coverage as we can get. In my town, a permanent locked collection box was installed at the police station for people to drop drugs off, no questions asked. These are then incinerated – the safest method of disposal – either by certified companies or onsite. And in Illinois, energy from the incineration process helps power homes and buildings.

'We're not only spreading the word: students are also drafting legislation and submitting it for consideration. In Illinois, for example, House Bill 2056 (the P2D2 Bill) – which was written by civil and government students and makes it easier for police departments to pay for the programme – has become law.'



Grupo Scout Mangore



Karen Eng



Grupo Scout Mangore



Dengue fever in Paraguay

gruposcoutmangore@hotmail.com

Paraguay's Grupo Scout Mangore from Ciudad del Este tackled dengue fever, a fatal disease spread by *Aedes aegypti* mosquitos. These insects breed in stagnant water and piles of rubbish, so the scouting troop work to clean them up. Leader Katerina Guerin spoke for the troop.

'As dengue fever is a significant threat, we started a project to help protect our neighbourhood. First we talked with the municipality, and enlisted the help of the Paraguayan Red Cross as well as the National Service of Malaria Eradication. We got the support of neighbours, teachers, students and the local paper, which published posters.

'We began by teaching people in our neighbourhood to clean the area around their own homes and how to handle rubbish – covering it and then disposing of it properly instead of letting it pile up, exposed. We asked the city to extend its rubbish collection service and collected funds to manufacture rubbish bins, recycle material found in waste, and distribute free refuse bags to the public. We also ran school workshops and went on TV and radio, spreading the message that it's not enough to take action in our own homes – everyone must carry on teaching those around them.

'Mosquito breeding sites and outbreaks of dengue have been reduced – since we began the programme no one has died from the disease in our city. Now we're reaching out to others; maybe we'll even get to the capital.'

Ideas and innovations



Around the world, young people are identifying environmental problems and taking matters into their own hands, reaching for innovations that offer long-term solutions.



S. Muller/Wildlife/Specialist Stock

Whale whisperer

A FEW YEARS AGO, marine biologist Asha de Vos first saw an unusual gathering of blue whales feeding off the coast of her native Sri Lanka. She was entranced, and immediately looked for information on what these blue whales – which normally feed at the poles – were doing in tropical waters. To her surprise, there was almost no information on this highly unusual colony of whales, so she has made it her mission to study the animals, their environment and their behaviour – and her efforts are the first long-term endeavour to study the Sri Lankan blue whale. The PhD candidate gathers data on the salinity and temperature of the water, GPS positions of the whales, and records their behaviours. She also takes photos for identification and is building a long-term database of whale vocalizations. Asha is also an activist, using her excitement about the science to inform readers about threats to the whales – shipping lanes and careless whale-watching operations – on her blog, *The Unorthodox Whale*. She was the youngest member of the Oceans Panel at Rio+20, alongside such marine luminaries as Sylvia Earle and Jean-Michel Cousteau.

<http://whalessrilanka.blogspot.co.uk/>



Paperazzi

Paperazzi

IN CHINA, 350 million tonnes of paper are consumed annually, and a third of it is thrown away. In Shanghai, about 50 per cent of waste paper is recycled and re-used. A group at the Shanghai Foreign Language School decided to help make paper recycling easy, beneficial and enjoyable. They created a system under which people could bring their recyclable waste paper to a drop-off point and, in return, receive free products made from recycled paper, which are typically quite expensive in China. The project, called Paperazzi, collects waste paper at school and sends it to paper factories, which use it to make high-quality recycled-paper notebooks. The notebooks are then distributed for free at the drop-off point. So paper donors receive an instant reward with high-quality paper products, while the factories benefit from the free material. They also print their logo on the notebooks as an advertisement, promoting their green credentials. The programme has been so popular that the idea has been introduced to other schools in the Shanghai district, and is now in operation in 13 high schools, three universities and two international schools.

www.volvoadventure.org/projectsFinalists.aspx?year=2012



Protei

Wave force

WHEN French-Japanese inventor Cesar Harada heard about the 2010 oil spill in the Gulf of Mexico, he recognized the need for more efficient ways to clean oil from the oceans. Inspired, he began developing a sailing craft that could move easily through water while dragging oil-absorbing cloth behind it. He thought it should be unmanned so that it could undertake long clean-up missions. He started with a basic sailboat design, which tacked back and forth in the water, but discovered that the motion lost pulling power and direction. In a series of experiments, Cesar moved the rudder to the front of the boat, which made the craft much more manoeuvrable. Then he tried rudders at both ends, and from there developed a craft with an articulated hull that flexes in order to capture wind from both sides of the boat.

This open-source project is still in development, with teams around the world contributing and experimenting with different designs. And Harada has been raising funds for prototypes and testing on kickstarter.com. If he succeeds, Cesar hopes to use his sailing drones not only to clean up oil spills but also to help gather plastic debris from the oceans, measure radioactivity, monitor fisheries and coral reefs, and more.

<http://protei.org/>



SaveLightSaveEarth

Bright lights, big savings

SAVE LIGHT SAVE EARTH is a group of teenage friends from Sadat City, Egypt, who have come up with a simple but ingenious idea to save electricity. The core idea is to change lamp design to make them more efficient. The group is researching various solutions, including the use of a concave mirror acting as a frame around a bulb. This collects light, concentrates the rays and reflects them on to a convex mirror. The design makes one lamp as effective as two.

Save Light Save Earth has approached a factory to assist in gathering data on the light efficiency of their designs and create a prototype. In the meantime, the group has applied the same idea to existing lamps in homes around its community, using aluminium/kitchen foil as reflectors in place of the mirrors. The group has monitored electricity bills before and after the systems were installed – and found that bills were cut by an average of 50 per cent. This encourages them to carry on with their lamp design and to continue to educate people about this method of saving energy.

www.savelightsaveearth.page.tl/



Mobius

Auto innovator

ACROSS AFRICA, 320 million people have no access to appropriate transport. Minivans and utility vehicles are expensive, rickshaws and motorcycles are low capacity, and unpaved roads turn into impassable mud when it rains. To help address this need, British entrepreneur Joel Jackson's company Mobius Motors is designing and manufacturing the Mobius 2 – a robust, stripped down car with good suspension and ground clearance and room for passengers or cargo. At \$6,000, the vehicle will be affordable to Africa's middle-income consumers, and Joel hopes it will be used as a platform for such entrepreneurial enterprises as delivery and transport services.

<http://mobiusmotors.com>

Let's hear it for nature

Innovators are ever more aware that we rely on Earth's complex, natural systems for our well-being, so they are tuning in, finding ways to meet human needs while working with – not against – our planet's self-sustaining natural systems.

B. Buranabunpot/UNEP/Topham

Bringing the outside in



Elaine Ng Yan Ling

'THE MAGIC of the natural world is all around us,' says designer Elaine Ng Yan Ling who develops textiles and furnishings that explore the connections between the environment and design. 'Look at a pine cone, it closes in the wet, but when it's dry, it opens.'

Elaine's eco-conscious furnishings and textiles are a hybrid of natural materials like wood, metal and wool, manmade materials including polymers and alloys that change

shape in response to their environment, and electronics. Her objects mimic the movement of the natural world: clusters of fabric blossoms move like the leaves of a tree as they sense movement outdoors; delicately carved wood panels expand and contract according to humidity levels and changes in temperature.

Elaine's goal is to reconnect urban people with the natural world: 'I want to weave the behaviour of nature into urban landscapes,' Elaine explains, 'using interactive tapestries and furnishings in urban buildings, with indoor pieces that respond to outdoor environments such as rain, sun and wind.'

Stuff that could make itself

NATURE CONSTRUCTS ITSELF, a process that fascinates architect and computer scientist Skylar Tibbits. 'There are no sledgehammers for proteins; there are no screwdrivers for DNA. So maybe there's another way we can build,' he says. Skylar is investigating the use of natural energy sources – heat, sound, waves and even gravity – to assemble pre-designed components to make furniture, construct buildings and even develop infrastructure.

To demonstrate his thinking, Skylar, along with molecular biologist Art Olson – who studies viral self-assembly – created the Self-Assembly Line, a rotating chamber which,

when turned by hand, tumbles pre-shaped pieces that come together to form seats. Of course, this is just



Skylar Tibbits and Arthur Olson

demonstrating the beginnings of an idea while challenging people's notions about how things could be constructed. 'Techniques for self-assembly,' Skylar explains, 'could make accurate construction much easier. Components can be designed so that they dictate where the next one fits, disallowing wrong placement.'

Skylar's ultimate vision is much larger: he hopes self-assembly will enable us to build multi-storey structures or infrastructure more



Elaine Ng Yan Ling



James Durcan Davidson/TED

efficiently and sustainably. He dreams of structures that could be dropped and would unfold before they hit the ground, or that could be assembled underwater using wave energy.

To see it how works go to: www.youtube.com/watch?v=3vjQ-jWPgNs

The teaching woods



Art is Open Source

WHEN URBAN PEOPLE walk into a wood, many don't see it as an abundant source of food, energy and medicine, much less how to use these respectfully and sustainably. Yet they often have access to the knowledge of the world through their smartphones.

An innovative workshop in Italy's Monte Mai woods, organized by Societing (www.societing.org), is linking local knowledge with an information network embedded in the environment – making information directly accessible from the woods themselves. Led by Italian organization Art is Open Source – which promotes creative practices in digital technologies – participants at the workshop will be joined by local woodcutters who really know and understand the workings of the forest.

The group is building a meshed network, made up of a variety of connected devices using small routers, switches and hubs, in the woods. Sensors, powered by small solar cells, will pull information from the environment and transmit the data into the network, which is readable by smartphones.



Once the system is set up, anyone walking through the wood will be able to connect. They can point their smartphone at a bush and discover its medicinal uses, or at a tree and learn how to harvest it sustainably. And importantly, the network will also hold information on how to recreate a similar network anywhere in the world.

To find out more go to: www.artisopensource.net/2012/08/04/knowledge-is-natural-a-workshop-about-diy-energy-and-augmented-reality-in-natural-environments/

A new leaf

SOLAR ENERGY is the basis of life on Earth. All over our planet, plants photosynthesize, using their amazing and complex ability to harvest sunlight and channel it to convert carbon dioxide and water into oxygen and energy-rich carbohydrates. Our bodies get their energy from plants, so you could say that humans and other animals are solar-powered. The energy in fossil fuels is also a result of photosynthesis because fossil fuels are formed from the remains of plant and animal matter.

But what if human beings could mimic photosynthesis and use sunlight, water and carbon dioxide to produce fuels that generate electricity or power our cars and aeroplanes? It could provide a source

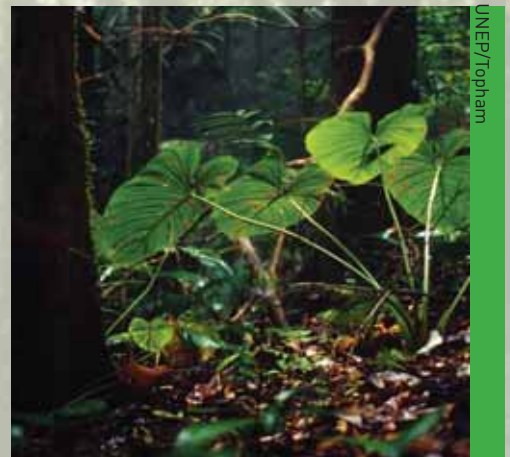


K.Ferullo/UNEP/Topham

of clean fuels for transport and also mean that we could store solar energy for use around the clock, not just when the sun is shining.

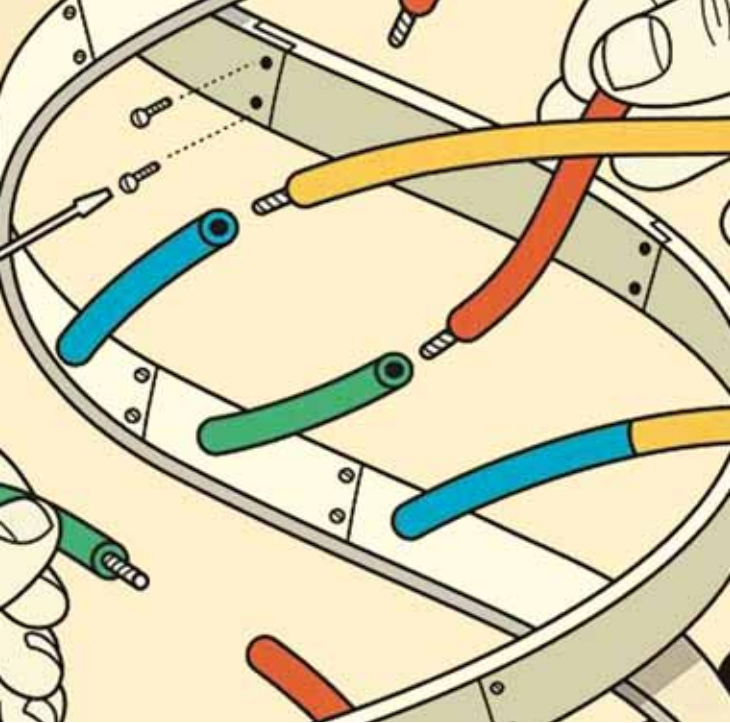
Scientists have already come up with several ways of making solar fuels in the laboratory. One is called artificial photosynthesis, where a manmade device – sometimes called an artificial leaf – carries out all the steps of capturing and channelling sunlight to produce the fuel. Another approach is using organisms, such as bacteria or algae, to produce fuels like hydrogen. The challenge is to move from laboratory prototypes to a widespread, commercially available technology that is affordable, durable and efficient. This requires tremendous research effort into everything from the discovery of new materials to the development of cheaper catalysts and more.

There are now research centres in Asia, Europe and the USA dedicated to making solar fuels a reality for the next generation. Some have even enlisted the help of young people: Professor Harry Gray, a pioneer in the field, has created a Solar Army of high-school students



UNEP/Topham

doing research to find the best new materials to make artificial leaves. And the US Department of Energy has created a dedicated artificial photosynthesis research hub that includes simultaneous research, engineering and product development in order to accelerate the process. No one knows when we'll be flying and driving on solar fuels, but most researchers hope for a big breakthrough in the next 10-15 years.



<http://genspace.org>

Open to all

In the last two decades, the open-source movement – the free sharing of knowledge – has grown across the worlds of software, hardware and beyond. But what does the term really mean, how does it work and how does open sharing help people and business? TUNZA asked Catarina Mota – who’s finishing a PhD in the social impact of open and collaborative practices in technology development – to give us an overview.

‘OPEN SOURCE means choosing to give away information such as the designs and instructions for making products, as well as data and skills. This challenges current concepts of intellectual property rights.

‘The last decade has seen the rise of open-source software – software that is free to use and modify – and a growth of open-source hardware. People have always built, modified and repaired their machines, gadgets and implements – the technology was transparent, and people were familiar with it. But over time, technology has become less transparent, with things made to be used and then thrown away. Devices, from cars through cookers to computers, are becoming proprietary black boxes. We can’t see how they work, and some don’t even allow us to change the batteries!

‘However, with the help of the internet, people are now uploading designs and instructions, making it possible for others to learn how to repair and make all sorts of things themselves. People source their own parts, create their own designs or modify others, and share the information.’

Free R&D and market research

‘I’m often asked how open-source hardware and software can work

economically. After all, don’t companies make their money by securing information, and then re-invest it in further research and development (R&D)? The open-source movement doesn’t seek to overturn established business: it’s an alternative model where the originating business benefits from sharing information.

‘Typically, open-source licences allow free copying and modification as long as the revisions are in turn shared and the original inventor is credited. This gives the originating company free market research and R&D – both traditionally very expensive. “Hackers” modify their gadgets and publish their designs, crediting the original manufacturers, who can then work any popular improvements into subsequent iterations of their product – effectively accelerating innovation.

‘Open source can help create employment, too: not everyone wants to make their own stuff, which means that entrepreneurs can take advantage of open-source designs, modify and manufacture things to meet local needs, and grow their business by training others, creating local jobs. The environment can benefit from the shift to economies based on locally sourced materials and the emphasis on repair, which promotes longer product life cycles.’



William W. Ward 2012

A shift in values

‘People ask why open-source advocates are so passionate. Whether we like it or not, technology shapes the way we think, communicate, act and learn. People used to understand their tools and, unlike today, understood how they worked. But if we can’t alter or even understand our technology, it will shape us rather than the other way around.

‘We live in an information society, and are told again and again that information and knowledge are the most precious things available to us. Indeed they are, and that’s precisely why we should be prepared to share them. It’s the only way to progress as a society.’

The Kinect phenomenon

IN 2010, the Kinect – a gesture-based videogame controller for the Microsoft Xbox 360 – was a breakthrough device, allowing players to control a game by moving their bodies. It incorporates an infrared-based motion sensor that allows the measurement of three-dimensional objects. Recognizing the potential of this technology, electronics kit maker Adafruit Industries offered a reward of \$1,000 to anyone who could produce drivers for the Kinect that would enable devices other than the Xbox to interface with it. Within days of the product's release, the deed was done, and developers were working out modifications that Microsoft never intended. The Kinect has since been turned into a device allowing blind people to navigate, help researchers map the surfaces of glaciers, perform 3D scanning, enable surgeons to manipulate onscreen images during keyhole surgery, and more. Microsoft initially threatened legal action, but it soon became clear that hackers were taking the technology in powerful new directions, contributing to Kinect's skyrocketing sales. Now Microsoft actively encourages innovative development of the Kinect and is being praised for being such a forward-looking company.



<http://realdoctorsto.com>

Open resources

ANYONE can upload or download user-created digital design files – instructions for making real-life objects – for free from **Thingiverse**. It's a vast resource for anyone who wants to experiment with digital design and 3D printing, as well as people looking for tools and objects or instructions for repairing things.

www.thingiverse.com

The Open Architecture Network provides an online platform to exchange designs so that post-disaster reconstruction can be based on the most appropriate approaches on the ground, rather than materials or solutions selected by donors.

<http://openarchitecturenetwork.org>

Project Gutenberg makes the full texts of more than 40,000 books – mostly in English and in the public domain, which means books at least 50 years



old – freely available. The project was started to encourage the creation and distribution of ebooks.

www.gutenberg.org

Wikipedia, the world's largest reference work, is not only freely accessible for anyone; anyone can contribute to it and edit it. But this doesn't make the online encyclopaedia a chaos of mad ideas! Content policies, guidelines, and a vigilant regular group of volunteers keep the material reasonably accurate and consistent.

www.wikipedia.org

The Khan Academy offers free educational videos on, well, nearly every-



www.thingiverse.com

<http://genspace.org>

thing – maths, biology, chemistry, physics, finance, history and more.

www.khanacademy.org

Genspace is the world's first community biology lab, open to anyone wanting to do a biotechnology project. It offers space, equipment, training and mentoring, and is open to all ages and people of all backgrounds. Learn to extract and analyse DNA, engineer yeast to detect pollutants, or explore your ancestry.

<http://genspace.org>

Open access to source codes

THE SOURCE CODE of open-source software is freely available to the public. Users who modify it share the improvements they make – finding and eliminating bugs, for example – accelerating its evolution. People have created all kinds of different service models around open-source software, using it to make tailor-made IT solutions to meet specific needs, or offer free software and use the opportunity to sell the hardware it runs on. Did you know, for example, that the giant websites of Google and Amazon run on the Linux open-source operating system, while famous apps like the WordPress blogging software and browsers like Mozilla Firefox are based on open-source technology?

When consumers become creators

What happens when craft collides with technology? In North America, Europe and beyond, people are rediscovering the satisfaction of making things – but with a technological twist. This new trend – known as the Maker movement – builds on the idea of do-it-yourself (DIY), along with a fascination with all things mechanical, digital and electronic, once just the province of geeks and nerds.

Magazines like *ReadyMade* and websites like Instructables.com showcased and shared instructions for all sorts of DIY designs and projects, enabling and encouraging a new spirit of hands-on innovation. In 2005, the launch of *Make* magazine – from which the term Maker was coined – offered a resource for making and repairing things, but with a strong emphasis on 'hacking': taking apart and modifying existing technology. Its strong online presence turned once-isolated people working alone at home into a community.

Recognizing a growing interest, in 2006 *Make* started organizing Maker Faires – gatherings where people exhibit everything from textiles, robots and furniture to electronic gadgets and handmade toys. The Faires also offer an array



Maker Faire Africa

of low- to high-tech workshops, including woodworking and welding, mushroom cultivation and pinhole photography, and 21st century skills like robotics and laser cutting.

Faires are not just in the USA: they happen from China to Canada, and from Italy to the UK, and the independently organized Maker Faire Africa began in 2009.

The Maker movement has also spawned independently run hackerspaces – open-access community workshops where people gather to tinker and share skills, tools and ideas. Hackerspaces typically make available such tools as computers and software, tools for electronic fabrication, darkrooms, kitchens, sewing machines, saws, soldering stations, 3D printers – and more.

Maker Faire Africa

TUNZA spoke to Jennifer Wolfe, co-organizer of Maker Faire Africa.

'Making things in Africa, processing our own raw materials, is one of our continent's most formidable challenges. Maybe the tech-influenced DIY philosophy – design it yourself, make it yourself, then sell it yourself – could help create jobs, especially for young people, and allow raw materials to be converted into products at home, whether cocoa from Kenya or coltan from the Congo.'

'Maker Faire Africa seeks to help inventors understand and access the entire innovation landscape, from electronics to food processing and metal work to biotechnology. Most participants have already identified a need and may have spent at least a year working on it; others are students seeking to apply what they have

learnt and create employment. Anyone who has an idea, invention or product can come, get feedback and advice, get help in bringing their invention to market, and meet and collaborate with others.'

'Local and international businesses come, too, looking for new ideas and inventors to work with. This can help build networks or lead to apprenticeships and internships with large corporations. In Nairobi in 2010, for example, General Electric awarded a cash prize and internship to one of our makers.'

'We began in 2009 with just 40 makers in Accra, Ghana. In 2010, Maker Faire Africa Nairobi had more than 70 exhibitors, then in Cairo

in 2011 we had nearly 100 makers and ran workshops on DIY biology and product development. There was also a hackerspace complete with a Makerbot 3D printer. This year, we'll be in Lagos, Nigeria.'

'Maker Faire Africa is determined to encourage individual invention and provide a platform for communities to push for policies for productive environments. It's still in its infancy, but we're seeing an increasingly enthusiastic response, especially from youth. Across the continent, from Cairo to the Cape, large numbers of people are unemployed or underemployed, especially young people. From a purely economic point of view, it's absolutely essential we give them what they need to become productive.'



Making ... being the change?

The Maker philosophy, while still growing, is a shift to a culture of creation rather than consumption. It promotes peer-to-peer skills sharing and face-to-face, community-based problem solving. And making your own stuff, whether clothing, food or gadgets, encourages looking around for locally sourced, possibly recycled, materials. Making also confers a sense of ownership – we're much less likely to dump our own creations, unthinkingly! And its emphasis on repairing helps increase the lifespan of products, too.

But it also has the potential to help people earn a living. While Making currently isn't really about profit,

people are increasingly turning their hobbies into businesses. Maker Faires and hackerspaces offer an opportunity to learn new, potentially profitable skills, while online marketplaces like Etsy offer a platform for selling handmade products to a worldwide market.

So far, mass production has done little more than approximate the skill of a crafts person: it may be faster and cheaper, but some quality gets lost in the process. Perhaps the Maker movement will reintroduce us to concepts of excellence.



Paul Granjon



3D printers

How about a machine that builds – layer by layer – three-dimensional objects from plastics, metals, nylon, recycled paper, ceramics, chocolate and even living tissue? The technology has been around since the early 1980s, but has until now typically been used by industry and design for prototyping. Recent developments have now made small, consumer-friendly 3D printers accessible for around \$2,000.

The Makerbot Thingomatic, for example, works with spools of plastic that move through an extruder that melts it. Guided by a digital computer-aided design (CAD) file, the Makerbot deposits the material in layers that instantly solidify. You can design your own objects, or download (and upload) designs from such online sites as Thingiverse.com.

Why would you want one? You can produce parts to replace broken household items, tools, jewellery, toys and more. Schools use them in teaching engineering, design and technology. But you don't have to own your own to experiment – you can join a local hackerspace to access one, and services like Shapeways.com allow customers to order objects in a choice of materials.



Exciting kit

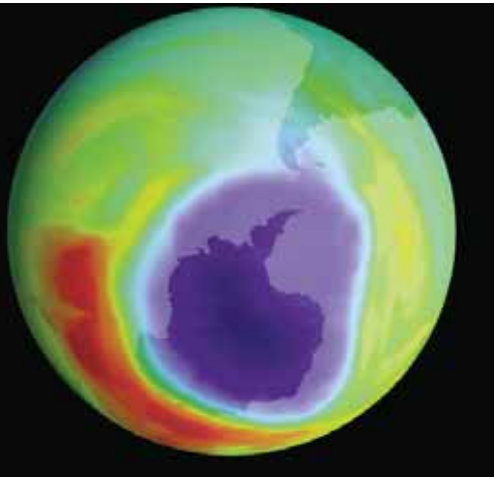
Arduino micro-controllers

Arduino micro-controllers are simple, single-board computers that allow anyone – hobbyists, artists, designers – to build programme-responsive electronic objects: anything from doorbells through water tank depth sensors to gadgets for gamers. There's even a device that tweets when your houseplant needs watering! Invented by an Italian electronics firm, the Arduino costs about \$30 preassembled, and the programming software is free, but the purist DIYer can build their own micro-controller using downloadable CAD files, available with an open-source licence.



7 global changes

Trying to effect positive environmental change sometimes feels like pushing a very large rock up a very large mountain. But good things DO happen. Here are a few examples of how, when awareness, an optimistic mindset and political will come together, the health of the Earth – and our own well-being – can reap the rewards.



NASA

The ozone layer

In 1985, scientists from the British Antarctic Survey observed that concentrations of atmospheric ozone, especially near the South Pole, were thinning. The culprit: organic compounds called chlorofluorocarbons, or CFCs, widely used as refrigerants and propellants in aerosols. When CFCs are carried into the atmosphere, they break down the ozone molecules that make up the stratospheric layer that shields Earth from ultraviolet rays. Without it, humans are more vulnerable to skin cancer and cataracts, rates of malaria and other infectious diseases increase, and the life cycles of plants and animals are disrupted. Under the leadership of UNEP, the nations of the world signed the Montreal Protocol of 1987 – the world's first major international environmental agreement – which is phasing out the manufacture of CFCs and other compounds, cutting the use and emission of ozone-depleting substances by 95 per cent. The ozone layer is now recovering and will return to pre-industrial levels by around 2070.

Unleaded petrol

In the early 1920s, chemists added lead to petrol to help vehicle engines run more smoothly. Though it was a known toxin, the risk to health was considered minimal. Decades later, with increasing numbers of vehicles on the road, the dangers became apparent. Engines emit fine lead particles that contaminate soil and can be inhaled and ingested by people. Children are especially vulnerable to lead poisoning, giving rise to such health problems as diminishing IQ, organ damage and hearing loss. In the 1970s, the USA began restricting the amount of lead allowed in fuel, finally banning it in 1996 with the Clean Air Act. Other countries rapidly followed. Elevated blood lead levels in children went from 88 per cent of children in the 1970s to 1 per cent in 2006. Now, only a few countries still use leaded fuel, and UNEP is aiming for global eradication of leaded petrol by 2013.



M. Vincent & E. Studlet/Biosphoto/Still Pictures



Chensiyuan/GNU-FDL

National parks

National parks haven't been with us long. In 1864, US President Abraham Lincoln signed over to the State of California the care of what would later become Yosemite National Park. Soon after – in 1872 – Yellowstone became the world's first established national park. Today, merely 140 years later, the world has 6,555 national parks under the Category II protected area standard of the International Union for Conservation of Nature (IUCN). Each Category II reserve must be a large natural area that preserves biodiversity and ecosystems and must also serve as a public resource for research, education, inspiration and recreation. National parks – which cover a vast range of ecosystems, from rainforests or deserts to glaciers and beyond – are also just a small part of the massive network of protected areas worldwide: in 1911, the globe's cumulative protected areas covered 250,000 square kilometres, which has risen to 8.1 million square kilometres today.

Ecolabels

It's not easy for environmentally conscious consumers to work out the relative impact of their choices. But ecolabels – which typically indicate independently certified standards of production – help customers make fairly reliable decisions at the till. The world's first ecolabel, Blue Angel, was created by Germany's environmental agency in 1978, establishing standards for eco-friendly products. Now ecolabels are ubiquitous: the global directory www.ecolabelindex.com tracks 431 of them across 246 countries and 25 industry sectors – covering everything from energy ratings to organic foods to building standards to sustainable fisheries and carbon footprints. Recently, General Motors launched Ecologic, the auto industry's first third-party certified ecolabel. Consumers need to pay close attention to what ecolabels promise, but it's worth the effort. Even small stickers can help add up to big improvements for the planet.



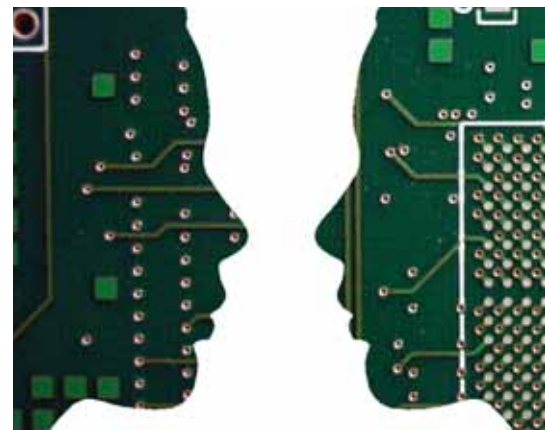
James Gathany/ODC

POPs

Chemicals known as persistent organic pollutants, or POPs, include pesticides such as DDT, industrial chemicals such as polychlorinated biphenyls (PCBs), and dioxins and furans – by-products of industrial processes or waste incineration. As their name implies, POPs stay in the environment for years, can be transported over great distances by wind and water currents – accumulating especially in the polar regions – and enter the food chain, posing a hazard to human and planetary health. DDT became the most famous POP due to Rachel Carson's 1962 book *Silent Spring*, which led to its withdrawal in the USA. Still used to fight malaria, DDT causes abnormalities in wildlife and is found in human breast milk. The international community is working to eliminate POPs under the 2001 Stockholm Convention on Persistent Organic Pollutants. The treaty has eliminated or restricted the use of 12 specific POPs, but continues to research other chemicals, adding new ones to its banned list as necessary.

Electronic communication

Fewer than 20 years ago, email and videoconferencing had us imagining a future with paperless offices. Today, we may still use paper, but take instant, global communication for granted. So how green is computer-driven communication? The jury's still out. True, email saves cutting down trees, using water and chemicals to manufacture paper, or sending letters on a fossil-fuelled journey around the world, where they end up incinerated or in landfill. But electronic communications require resources, too. One study claims that sending a 4.7 megabyte email attachment results in greenhouse gas emissions equivalent to boiling a kettle 17.5 times. Why? Electronic data infrastructure demands computers, servers and buildings – all of which require materials and energy to manufacture, store, run and cool. We CAN make e-comm greener: ask your service providers to run their server farms on renewable energy, empty online email storage caches regularly, send smaller attachments – and do more social networking face-to-face!



Ecological footprint

What's your footprint? Nearly everyone understands this term as a general indication of each individual's impact on our planet's resources. A statistical method originally developed by Mathis Wackernagel, the Ecological Footprint analyses and compares human demand on the Earth's ability to regenerate resources and absorb our wastes. It lets us examine and compare lifestyles between individuals, businesses and countries, helping us to assess the sustainability of all our choices. In the last three decades, ecological footprinting has entered mainstream consciousness thanks to WWF's Living Planet Report. It uses Wackernagel's analysis to present exactly how and where humanity's demands exceed the Earth's capacity to sustain us. According to the 2012 report, the last time humans lived within the regenerative capacity of the Earth was 1976, with the latest figures indicating that we're currently using one and a half planet's worth of resources.



WWF Living Planet Report 2012

Tired of consuming?

Why not build your own civilization? Polish-American farmer and technologist Marcin Jakubowski abandoned his original field of study – fusion energy – to create the Global Village Construction Set (GVCS). The set consists of 50 robust, low-cost machines made from local and recycled materials that will allow anyone to build all the infrastructure a community needs. At Factor E Farm, just 12 hectares in rural Missouri, Marcin's organization Open Source Ecology has been designing and building the GVCS, as well as developing a prototype self-sufficient village. He tells TUNZA how it works, and how it's going.

What do the 50 GVCS machines include?

'We're in the process of building every piece of infrastructure we rely on to provide a decent standard of living. First, you need to produce food. So we start with a tractor. For water, you need a well-drilling rig. For housing, we have a rammed-earth brick-making machine and a cement mixer – and for renewable energy we have solar concentrators and wind turbines. For transport, we're designing a renewable-energy car that runs on a modern steam engine.'

'So far, we've completed designs for four machines: a tractor, brick press, soil pulverizer and power unit. We also have around 15 prototypes, including computer-controlled devices for producing electrical circuits and cutting metal, a cement mixer, a sawmill and a heat exchanger. Our designs are modular – for example you can easily detach the wheels from the tractor and use them on a truck or bulldozer, and the steam engine can power a house as well as a car – saving materials and maximizing flexibility.'

'The GVCS is open source: we publish the designs online so that anyone who needs these tools can build their own.'

Where do the materials come from?

'At the moment, we use standard materials. But the GVCS includes an induction furnace and hot metal rolling processes, allowing you to recycle scrap steel. Pelletized biomass runs the steam engine. You can make glass from sand, and extract aluminium from clay.'

What's your goal?

'While developing the GVCS I'm building a real, autonomous community that will rely on this technology. We've got eight people at the farm, including a construction director and a farm director. The goal is a total of 30 worker-residents.'

'It's about setting an example. I want to demonstrate that industrial productivity can be achieved on a small scale, showing how far 30 people can go in creating a modern standard of living – including things like superconductors and metals – from onsite materials. GVCS lowers the barriers for any enterprise: people can produce almost anything, adapted to any purpose – whether you want to build a similar community or just want a solar condenser for your school or an affordable micro-tractor for your farm. We'll also evolve into a production and education model, teaching people the skills to use the technology to support any enterprise.'

Inspired? We were. Take a look at what you CAN do, and find out more: http://opensourceecology.org/wiki/Global_Village_Construction_Set

