Issue 5, Autumn 2011

A Global Village

WHERE POLICY AND POLITICS MEET SCIENCE AND ENGINEERING

The Right to Health
The Financial Burden of Health | Patent Pool Politics | WHO Reform

Researching Development
Randomised Trials for Development | For-Profits & Global Health

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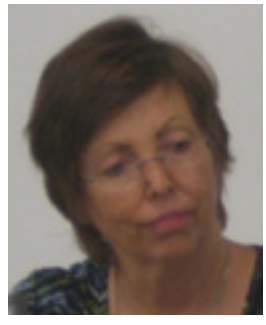
Foreword



This edition of *A Global Village* explores various social, economic and political issues associated with the right to health, its definition and realisation. Its content underlines that, even though many health-related gains have been achieved in the last fifty years, the right to health remains unobtainable for millions of women, children and men in our global village. Through its wide range of subjects, this edition also illustrates that, though health is an essential human right, health is only a part of human dignity and security. Dignity and security, like health, are in turn critically determined by many interrelated forces. To address these forces in a way that leads to optimal health, dignity and security, the full panoply of human rights must be realised.

But in 2011 it could be argued that human rights have become even more inaccessible in a globalised world where individuals are increasingly affected by financial, political and technological regimes that they have little capacity to influence or even understand. A number of these are discussed in this issue: the costs of healthcare driven in part by technological advances, the unhelpful extremes in the debate on agricultural development, the patent system of the intellectual property law, the relationship between luxury goods and intractable ethnic conflict and civil war, and the human impact on our global climate.

On the one hand, the world is increasingly driven by complex forces that transcend the boundaries of the nation state, the fundament on which human rights have been built – as human rights govern the relationship between a State and its citizens. These complex forces place knowledge and power in the hands of fewer and fewer people and institutions which appear less and less accountable to anyone, certainly not the woman on the street.

Yet we have also recently seen the dramatic power of people when they take to the streets to demand their human rights – witness, the Arab Spring where thousands have risen together to overthrow corrupt and oppressive dictatorships. Certainly, human rights are very much alive in 2011, and those who man the barricades, often risking their lives, know their rights and demand their realisation.

On the global health front, for the first time in the history of vast health inequities across the globe, something like a pact of solidarity has occurred in the response to the HIV epidemic, whereby high-income countries are transferring large amounts of resources to meet the health needs of those in low-income countries. Though this pact and its system of accountability are insufficient and fragile, they bear testimony to the power of people living with HIV who have pulled down their human rights into the form of concrete demands and seen them realized – at least in part.

The formal recognition of human rights in international instruments occurred after World War II, and it sometimes seems that each generation must have their importance reconfirmed in their own lifetime by dramatic events. And yet it appears that human rights have become a fundamental backdrop to human experience providing the foundation and the impetus for individuals to demand change, even in the complexity of our times. More global villages with *virtual banyan trees* are what we need to increase awareness of these global challenges and their incredible connectedness, more willingness to speak truth to power through the framework of human rights that obliges those who have power to share it.

Susan Timberlake

Susan Timberlake is the Senior Advisor on Human Rights and Law at the UNAIDS Secretariat in Geneva where she and her team promote a rights-based response to HIV.

Identity Crisis?

A Global Village grew out of a void: many Imperial College students and researchers are interested in the world around them, and using their skills and knowledge to tackle global challenges – and, as we saw it, there seemed to be an opportunity to bring this knowledge and experience to a broader audience. We had no idea at the time, however, the sweat and tears that it would entail to grow into a serious publication, and the financial and logistical challenges we would continue to face. Now, over a year later, it is time to reflect on where we came from, and where we are going. What does the future hold for *AGV*?

The answer is simple. As the world looks to government and academia to tackle impeding global crises in food distribution, population size and climate change, evidence-based policy-making must increasingly form the basis of action. At the centre of translational science, the Imperial College community is ideally placed to be at the forefront of this movement. *AGV* has evolved to lie in this niche: we aim to fuse real science with debate on how we should tackle those big issues in a global context, and this is where the future lies.

Issue 5 focuses on the very essence of global health, our Right to Health as a human right. Our contributors argue for reform of the medicines patent system, enabling access to essential drugs for all, and look at the challenges in delivering trauma care in developing countries. As the aid debate continues to rage, we ask can randomised trials offer an evidence-based solution to determining what *really* works? And, can a *shared value* approach supersede corporate social responsibility in driving development for-profit?

As extremes dominate the agricultural debate, our contributors question whether the middle ground is not more constructive. Uncertainty in climate change projections, and the need to build flexibility into responses, is the theme of two articles: the first focusing on water resources, and the second on parallels with business innovation. We ask the big questions, and challenge our contributors to answer them – they have truly delivered for Issue 5.

Last, but not least, many thanks go to Imperial College Union for their logistical and financial support during the past year – we now officially exist, and that's all down to you!

Neave

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A Global Village

WHERE POLICY AND POLITICS MEET SCIENCE AND ENGINEERING

Submissions for the January Issue

A Global Village focuses on key areas where politics and policy meet science and engineering from global health to climate change and energy, food security and development. Article lengths should be within the range 1000-2500 words.

deadlines for issue 6

November 1
short abstract/word count

November 20
final article deadline

Theme for Issue 6: 'Vision 2050' – What does the Future hold?

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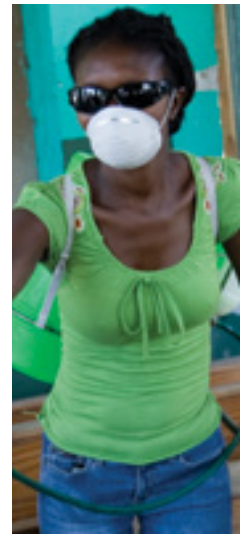

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Uncertainty & Risk

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Reforms for a Healthy Future?
WHO in Critical Negotiations

Rob Doble, London School of Hygiene and Tropical Medicine

Reforms can sound dull but this one isn't. The World Health Organisation (WHO) is considering reforms which WHO Director-General, Margaret Chan, says will bring the biggest changes to the agency in its 63 year history. Spurred by serious financial difficulties, the organisation is currently having an identity crisis with a need to redefine itself and how it operates in order to ensure it is *fit for purpose* in the new global health landscape of the 21st century. But what reforms are being proposed? What have the reactions been? And what are the next steps?

Since the early 1990s, the WHO has faced *sustained concerns* over what its role in global health should be and how it should best do this. Despite having the constitutional mandate 'to act as the directing and coordinating authority on international health'[1], this has been challenged and complicated in recent years by the emergence of new, often issue-focused, global health initiatives (e.g. Global Fund to fight HIV/AIDS, TB and Malaria, and the GAVI Alliance), bilateral programmes (e.g. US PEPFAR) and philanthropies (e.g. Bill and Melinda Gates Foundation). At the same time, WHO has found its budget squeezed and increasingly inflexible. Despite overall financial resources for global health increasing significantly (from US$5.7bn in 1990 to $26.9bn in 2010), much of this money has largely bypassed the WHO[2]. A drive from donors to have more control over WHO funds has led the organisation to increasingly rely on *voluntary, extra-budgetary funds* (EBFs) – contributions which are often earmarked for specific WHO programmes or projects. EBFs have grown from 25% of the total budget in 1970 to 40% in 1980, to more than 50% in 1990 and 77.3% in the 2008-2009 budget[3]. This restricts WHO's flexibility and skews global health priorities toward donor demands – for example, 60% of EBFs in 2008-2009 were for infectious diseases compared with 3.9% for non-communicable diseases.

Margaret Chan has characterised WHO as "not [being] an inclusive organisation" and said WHO needs to open up and hear the voice of different sectors

It was these financial concerns, raised during the World Health Assembly (WHA) in 2009, which sparked the current reform process. It prompted the WHO Director-General, Margaret Chan, to hold an informal consultation in January 2010 to discuss how to better align WHO's objectives with the money available to them and to ensure greater predictability and stability of financing. However, it soon became clear during this meeting that improvements in financing first require greater clarity about the current role of WHO – i.e. defining WHO's distinct contribution to global health, what functions should constitute its core business, and how it can improve its operations[4].

The January 2010 consultation concluded that WHO should have a tighter and more focused agenda and improve how it communicates its results as part of a

1 WHO (2006) *Constitution of the WHO*.
2 Butler D. (2011) Revamp for WHO. *Nature*. **473**(7348): 430-1.
3 WHO (2010) Draft Proposed Programme Budget 2010-2011.
4 Chan M. (2011) Closing Plenary at the WHO Global Forum: Addressing the Challenge of Noncommunicable Diseases.
5 WHO (2011) The Future of Financing for WHO. Report by the Director-General on Reforms for a Healthy Future: Development Plan.

revised resource mobilisation approach. In addition to the WHO being more selective about its priorities and functions, the January 2011 WHO Executive Board (EB) called for reforms to also capitalise more on WHO's leadership position in global health and improve its flexibility. Subsequently a report and development plan was prepared for the WHA in May 2011 which outlined three key elements of the reform programme:

1. Plan for strengthening WHO's central role in global health governance (GHG);
2. Clear articulation of WHO's unique role and functions;
3. Detailed plan for managerial reform.

Talking Shop

Firstly, on WHO's role in global health governance, Margaret Chan has characterised WHO as "not [being] an inclusive organisation"[4] and said WHO needs to open up and hear the voice of different sectors. She has also been quite adamant that WHO should contribute to rectifying what she has termed *silomania* whereby institutions work to protect their turf and focus on their specific area which she argues has created fragmentation and a lack of coherence in global health today. Her proposal is for WHO to convene a multi-stakeholder forum for global health, a *World Health Forum* (WHF). This would bring together Member States, civil society, the private sector, academia, and international organisations to discuss how to effectively work together to address key problems in global health and amplify important issues on which others, and not just WHO, may act.

It has been proposed that the first WHF would be in November 2012, over three days and convened every two years for two further cycles and then independently reviewed. For a clearer idea of what such a forum might look like, we can refer to the recent WHO Global Forum on meeting the challenge of non-communicable diseases (NCDs) in April 2011 in Moscow. This meeting brought together governments, civil and patient associations, private sector, and professional groups and was described by Chan as a "groundbreaking meeting for WHO", marking "the beginnings of a different WHO".

However, the idea of a WHF did not receive a particularly warm welcome at the WHA this year, and has to date been the most controversial aspect of the WHO reform programme. During the WHA many Member States and NGOs criticised the lack of detail provided and expressed concerns about how a WHF might interfere with WHO governance processes (i.e. how will the WHF affect the role of the WHA as the main governance body deciding on global health priorities and policy). Particular concerns were also raised regarding the potential increase in influence the WHF could give to the private sector and donors in setting WHO's agenda and the global health agenda generally. Some NGOs such as the International Baby Food Action Network (IBFAN), MSF Access Campaign and People's Health Movement (PHM) issued press releases calling for the WHF to be stopped arguing that the WHO's claims that the forum will not usurp the decision-making power of WHO's own (member-state based) governance are not credible, especially since the forum proposal fails to define who would participate and

The authority of WHO has been challenged in recent years by the emergence of diverse global health initiatives

how it will address conflicts of interest. For some Member States such as Brazil, concerns regarding the World Health Forum were part of larger issues with WHO's proposed relationship with *external stakeholders*, notably proposals for the Gates Foundation to partially fund the reform programme and for the WHO to seek to attract new donors including 'pool funds from private entities'[5].

There are some serious concerns about whether the proposed reforms are the right ones, in particular there is much scepticism surrounding the WHF and the potential opening up of WHO to both new sources of money and greater potential private sector influences

Consult, Consult, and Consult

Margaret Chan did, however, manage to pass a resolution supporting the proposed reforms, steering it through the stormy waters of the WHA by promising *inclusiveness*, that Member States would have the biggest voice in the reforms, and that she would "consult, consult, and consult" until Member States were happy. Yet at the WHO EB session immediately following the WHA, Member States and NGOs pushed to make the resolution clearer in mandating WHO to be more transparent, inclusive and consult with Member States. This included a request for the WHO to produce a more detailed concept paper on the World Health Forum by the end of June 2011 and consult with Member States to feed into a special WHO EB session in November 2011. The NGO Third World Network has described this step as "significant in that Member States pushed to regain control of WHO's critical reforms which has hitherto been driven by the Secretariat".

The concept paper (WHF) was produced on 22nd June 2011 and discussed at a WHO Mission Briefing in Geneva on 1st July 2011. However, while the concept paper does give a bit more clarity, it is still very vague and according to records from the meeting it appears that the paper did little to quell Member States concerns and questions. Member States still seem to be concerned as to what function the WHF provides and how it may interfere with WHO governance and priority-setting, together with logistical questions regarding how it would be funded, who would participate, and why the proposal is to not evaluate until after six years. Equally, some NGOs (IBFAN, PHM, Health Action International, Medicus Mundi etc) have remained critical, sending an analysis to Member States in advance of the WHO Mission Briefing[6]. This analysis criticises the "very weak" rationale behind the creation of a WHF stating that it is unlikely to achieve *coherence* and calls for proper accountability rather than *generic coherence*. It

WHO Director-General, Margaret Chan, faces an uphill battle to bring Member States and NGOs on board with her reform plans

also criticises WHO's poor delineation between private interest organisations and public interest ones which are both being put under the *civil society* umbrella. Instead of a WHF, these NGOs call for WHO to "undertake and properly resource public hearings, i.e. mechanisms of open consultations on specific subject matters" which would be more oriented towards gathering information and voices from different sectors but more flexible in their format than a WHF and without creating more structures and bureaucracy or interfering in WHO governance.

Indeed, with such a mixed response, it remains to be seen how, and indeed if, the WHF will emerge to facilitate further engagement between WHO, Member States and diffuse external actors.

Recent events at the WHA also demonstrate that Chan's leadership and ability to deliver a 'Member-State driven' process with effective consultation will be key to seeing the reforms through to final approval at the WHA in 2012

Core Competencies

With a need to provide greater clarity about the current role and direction of WHO in terms of attracting both financial and cross-sectoral support, five areas of core business are outlined:

1. Convening for better health: Bringing together experts to prepare technical guidelines for decision-makers and convening negotiations for health regulations and treaties;
2. Generating evidence on health trends and determinants: Collecting, analysing and disseminating health data and strengthening health information systems that yield and use this data;
3. Providing advice for health and development: Providing advice to health and development partners on health issues linked to the UN Millennium Development Goals (MDGs) and issues with high cost implications for low- and middle-income countries;
4. Coordinating health security: Increasing the preparedness of other institutions' for health security risks, coordinating those directly implementing response programmes, and implementing the recommendations of the International Health Regulations (IHR) Review Committee;
5. Strengthening health systems and institutions: Providing strategic advice to guide decision-making on how to strengthen health systems, focusing on making evidence available in ways that help decision-makers weigh up the merits of different options in light of national circumstances.

Here, there were concerns that WHO was positioning itself in an overly normative and technocratic role. NGOs such as MedicusMundi International Network and People's Health Movement, in official interventions during WHA discussions, stressed that WHO should not be consigned to becoming a technical agency with no political or legal role.

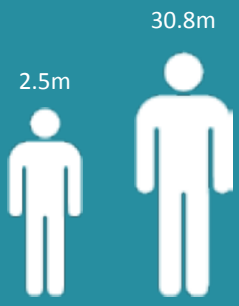
More Meat

Financial pressures have forced the WHO to go back to the drawing board and fundamentally re-examine what its role in global health should be in today's populous global health governance landscape. This article has shown that there are some serious concerns about whether the proposed reforms are the right ones, in particular there is much scepticism surrounding the WHF and the potential opening up of WHO to both new sources of money and greater potential private sector influences. Furthermore, some commentators have characterised the current reform plans as too vague, insufficiently clarifying what WHO's priorities should be, and failing to adequately address WHO's financial problems (i.e. how to get more flexible funding or voluntary funds which better align with WHO's priorities). Recent events at the WHA also demonstrate that Chan's leadership and ability to deliver a *Member-State driven* process with effective consultation will be key to seeing the reforms through to final approval at the WHA in 2012. Over the coming months, WHO will have to put more meat on the bones of its proposals and provide a clearer vision for its role in global health with Member State, stakeholder and donor buy-in if it is going to really deliver the biggest changes in the agency's history and rectify its financial situation. If Chan can not achieve this, it may well put her own prospects for re-election in danger with her term of office ending in June 2012.

Rob Doble is a PhD student in the Department of Global Health and Development at the London School of Hygiene and Tropical Medicine. His research focuses on the role of NGOs in global health governance.

6 Democratising Global Health Coalition (2011) Letter to WHO regarding Concept Papers on the WHO Reform Papers.

Patently Unfair?



Living with HIV/AIDS (2009)

Joseph McArthur, University College London

It can't be denied that there are huge gaps in healthcare provision across the world. The reason for the gaps in coverage of essential medicines, such as antiretroviral drugs (ARVs), is largely money. In the UK around £2000 is spent per person per year on healthcare by the government; in low-income countries about £20 is spent[1]. At this level of expenditure many treatments are inevitably unaffordable.

This leaves the burden of paying for treatment squarely on the shoulders of patients in these countries, amounting to approximately £6000 on average per person annually. The result of this disparity is unimaginable human suffering and millions of unnecessary deaths.

This article will focus on how to increase access to medicines by decreasing the cost of drugs through various means, exploring the role of patent pools, tiered pricing, *global access licencing* along with voluntary and compulsory licensing as methods of lowering prices.

Of course, the price of drugs is only part of the story. Many other factors such as a difficulty distributing drugs can lead to people not receiving the treatments they need. Furthermore, global health is an extremely complex issue, with other basic needs such as clean water and proper nutrition greatly affecting health outcomes.

Firstly, it is important to explain why prices can be so high for drugs that often do not cost much to manufacture. Drugs discovered in universities follow a similar route to those with origins in pharmaceutical companies. The exact number of drugs originating from universities is debatable, but is around 50% of all drugs that make it to market in some sectors[2].

Companies allow an independent organisation to group their patents together with other companies' patents in a pool. Patents can then be licenced from the patent pool to any generic pharmaceutical company in a developing country and produced.

The normal procedure is that when a researcher discovers a promising compound in a university it is patented, with the help of the technology transfer office. Then, as drug development can be extremely expensive and is often risky, the patent is licensed to a single pharmaceutical company that takes the compound to market. Depending on how long it takes to perform clinical trials and whether more patents are applied, the pharmaceutical company has approximately 15 years within which they have a monopoly on the sale of the drug, often charging high prices and leaving vulnerable populations without access.

1 WHO (2010) Health Systems Managing: The Path to Universal Coverage.

2 Global Forum for Health Research (2009) Monitoring Financial Flows in Health Research: Behind the Global Numbers.

3 UNAIDS (2010) UNAIDS Report On the Global AIDS Epidemic.

4 PEPFAR (2008) Report to Congress by the United States Global AIDS Coordinator on the Use of Generic Drugs in the President's Emergency Plan for AIDS Relief.

Patent Pools

The most well-known mechanism for reducing the cost of drugs is through the use of patent pools. Here companies allow an independent organisation to group their patents together with other companies' patents in a *pool*. These patents can then be licenced from the patent pool to any generic pharmaceutical company in a developing country and produced. The patent pool is also accessible to researchers. This is essential as to treat HIV many drugs need to be taken, usually around three at once. This can mean you need to take a lot of pills at different times of the day, which can make it difficult to adhere to the course; resulting in resistance to the drugs and causing patients' health to deteriorate. Using patent pools makes it far easier to combine all these pills into one pill, making it much simpler for people to continue treatment. The patent pool is also crucial for developing drugs for children. Ninety per cent of the 2.5 million children[3] with HIV live in sub-Saharan Africa, rendering them an unappealing market for drug development. As a consequence they must use drugs designed for adults, which are often harmful. This leads to less than 50% of children with HIV seeing their second birthday, and the ones that do are underweight, have stunted growth and often suffer from other infections[4].

One of the sticking points in negotiations between the patent pool and companies is the price middle-income countries should pay for medicines

There currently exists a patent pool for HIV medicines, called the Medicines Patent Pool (MPP). It was recently successful in persuading Gilead Sciences to enter the patent pool, joining the US National Institute of Health, making it the first major pharmaceutical company to do so. Gilead Sciences placed Tenofovir, a crucial Anti-HIV drug, a hepatitis B treatment and three promising HIV treatments still in development in the pool. One of these is a combination pill, combining four drugs in one pill. This move enabled generic production in exchange for a royalty and development of a new paediatric drug without royalty. Gilead should no doubt be praised for this move; however the deal does not allow access to their drugs in many middle-income countries home to huge numbers of impoverished people who need treatment. The MPP is still in negotiation with many companies, while others simply refuse to start discussions.

The missing face of AIDS: Less than 50% of children with HIV see their second birthday

Patent pools make it far easier to combine several HIV medications into one, ensuring more people adhere to treatment regimes

Challenges Ahead

The MPP faces major challenges in facilitating a functional patent pool. Many ARV producers have ignored calls from the World Health Organisation, the G8, and many humanitarian groups to join, claiming they are already doing enough. They believe using tiered pricing and voluntary licencing allows sufficient access. Voluntary licencing is where, instead of giving licences to the patent pool, a company will give them to specific generic producers. This allows generic production, but only by a limited number of companies, in a small number of countries. This means that the price reduction is a fraction of what it could be if broad patent pool were used. Tiered pricing involves charging high prices to high-income countries, lower prices to middle-income countries and lower still prices to low-income countries. The main problem with this strategy is that even when *at cost* pricing is used,, many drugs remain inaccessible to those who need them. Having generic companies compete has been shown to be much more effective than tiered pricing at lowering prices.

One of the sticking points in negotiations between the patent pool and companies is the price middle-income countries should pay for medicines – a significant question as they are home to half the world's population including 75% of people who live in extreme poverty. Pharmaceutical companies say that they should pay higher prices as many citizens are wealthy enough to pay, and so they are often excluded from licencing deals and do not benefit from tiered pricing. A recent survey from MSF showed a "growing and deadly divide in prices for antiretrovirals offered to the poorest countries versus low and middle-income countries" through tiered pricing schemes[5].

Compulsory licencing, allowed by several international agreements, is an effective, but rarely used mechanism to slash drug prices. During national emergencies, or where supply fails to meet demand, governments can issue a compulsory licence. This allows patent laws to be completely ignored for the drug in question, allowing it to be made or imported very cheaply. This is rarely used as the trade and economic repercussions can be severe.

5 MSF (2011) Caught in the Middle: HIV Medicines Pricing Sky High in Middle-Income Countries.

6 Sobolski G. K., Barton, J. H. & Emanuel, E. J. (2005) Technology Licensing: Lessons from the US Experience. *JAMA*. **294**(24): 3137-40.

7 PhRMA (2011) Industry Profile 2011.

Access For All

Another promising method for increasing access to not just medicines, but vaccines, biologics, diagnosis techniques and other medical techniques is the use of *Global Access Licences* (GALs). The main use of these has been in universities, however the basic principles are applicable in many situations. As mentioned earlier, when a useful discovery is made in universities it can be patented by the technology transfer office, and usually licenced to a single company. GALs do not change this process, they just add a clause into the licence saying that access must be provided to developing countries via generic production, or another method when this is not possible (as is often the case for biologics due to their complexity). GALs have many advantages. For starters, generic provision for developing countries is guaranteed before the drug is made, removing the need for lengthy negotiation when the drug is brought to market. Global access licencing can also protect discoveries from *follow-on patenting*. Also, the MPP is focused on ARVs at the moment, whereas GALs can be applied to almost any new idea that can benefit the developing world. Global access licencing has so far been implemented in several universities in the UK, and many more in the US due to campaigning by Universities Allied for Essential Medicines. Imperial College is not yet amongst these.

GALs have many advantages. Generic provision for developing countries is guaranteed before the drug is made, removing the need for lengthy negotiation when the drug is brought to market.

Case studies into the effectiveness of GALs show that they can more effective than the traditional method of licencing, especially where developing countries are concerned. Some presumed that GALs would prevent the commercialization of discoveries, but it has been demonstrated not only that the opposite is often true: current procedures can in fact hinder commercialization. Furthermore, creative uses of these licences can attract funds and developers. What pioneering universities have shown is that they can play an important role in improving access to their drugs by using GALs. Indeed, GALs are becoming increasingly important as pharmaceutical companies choose to shut down *in house* research projects, choosing instead to source drug candidates from universities and biotechnology companies.

An obvious disadvantage of reducing the cost of drugs would be if this resulted in huge losses for pharmaceutical companies and universities; therefore substantially diminishing funds for future developments. Studies into the amount universities make from licences show that, at top universities, technology transfer offices actually cost more to run than they make, or make up a tiny proportion of income[6]. Furthermore, the proportion of income that comes from sales in developing countries is significantly less, so effects on university balance sheets due to GALs is small. The impact on pharmaceutical companies' balance sheets from GALs and the patent pool is similarly small. Combined, India, China and South Africa accounted for 1.4% of drug sales in 2010, for members of the Pharmaceutical Research and Manufacturers of America (PhRMA)[7]. In an industry known for large profits, this is a small price to pay for the commendable act of saving lives. To help reduce this already small impact, royalties are provided to the patent holder on all sales of generic drugs.

The Future's Bright

Whilst facing continuing challenges in getting medicines to the people who really need them, there is no doubt that progress has been made in the past ten years. Many people now have access to substantially more medications, especially first line HIV drugs, at a much reduced cost thanks partially to the use of methods described above. However, we cannot sit back on our achievements; we must build on them. Many HIV positive people now need expensive second line ARVs as resistance emerges to others. Without these new medicines many people with currently controlled HIV will join others suffering from a myriad of treatable conditions. It is likely that not one single approach, but a combination of all of these methods, will play a role in improving the current situation.

Student groups such as Universities Allied for Essential Medicines, Student Stop Aids Campaign, Friends of MSF and Medsin have an impact on access to medicines and global health, why not join us?

www.essentialmedicine.org

Joseph McArthur is a 2nd year Pharmacology student at University College London and the co-ordinator of Universities Allied for Essential Medicine at University College London.

The Financial Burden of Healthcare

Neave O'Clery & Kajaluxy Ananthan, Imperial College London
Walaiporn Patcharanarumol, Thai Ministry of Public Health

Healthcare is expensive. Annual health expenditure globally is $5.3 trillion yet this is uneven with OECD countries representing only 18% of the world's population yet 86% of the total spend in 2007[1]. However, it is not always true that poorer countries necessarily have poorer health coverage and outcomes.

Thailand has led the way in developing a model for universal healthcare at reasonable cost. With life expectancy of 70 years comparable to many high-income countries, Thailand has successfully expanded health provision and ensured accessibility for all – for a mere $173 annual per capita spend (2008)[2]. Can lessons from the Thai experience be useful elsewhere?

Traditional infectious diseases such as HIV/AIDS, malaria and TB, together with the emergence of non-communicable diseases such as heart disease and cancer, are the main causes of morbidity and mortality in developing countries. The development and purchase of new medicines and treatments, as well as preventative methods and screening, is very expensive. With an average annual per capita spend of $3,881, the cost of universal treatment afforded by some OECD states is well out of reach of the majority of the world's nations.

In recent years there has been a concerted attempt by the global health community to examine and quantify the effects of healthcare financing, and understand existing models with a view to establishing what really works, and under which conditions. Two recent major reports from the WHO (2010)[3] and the World Bank (2008)[4] respectively attempt to draw conclusions about how low and middle income countries might move towards this elusive universal coverage.

Broadly speaking, there are three models of payment for healthcare from a consumer perspective: direct payment, meaning payment at the point of use, some form of insurance and universal coverage, although in practice most countries combine several approaches. Here we ask how we assess a healthcare system in terms of financing and outcomes. We examine the need to avoid direct payment models in favour of pooled funds, and assess the role of the state and private providers in financing, taxation and insurance.

To aid this study, we will look at three upper middle-income countries: Chile, South Africa and Thailand. Thailand mainly runs a National Health Service-type model funded by general taxation while Chile relies primarily on a mixed public/private compulsory insurance model. South Africa, on the other hand, depends on crippling direct payment and expensive private insurance. With comparable per capita GDP, Thailand and Chile have impressive life expectancies in the 70's compared to South Africa at just 54 years, see Table 1. Yet South Africa spends twice the % GDP on health than Thailand at just 4.3%.

Health, Wealth and Happiness

So what defines the healthcare status of a country? There are many indicators including life expectancy, adult, infant and maternal mortality rates, available hospital beds and number of doctors.

1 WHO (2010) National Health Accounts Report.
2 Working group on Thai NHA (2009) Thai National Health Account 1994-2008. International Health Policy Program.
3 WHO (2010) Health Systems Financing.
4 World Bank (2008) Good Practices in Health Financing (Chapter 12, Thailand: Good Practice in Expanding Health Coverage – Lessons from the Thai Health Care Reforms).

The adult mortality rate is measured as the probability of dying between 15 and 60 years per 1000 population. Both the adult mortality rate and life expectancy at birth health status indicators are a good measure of how treatable and how prevalent diseases are in a country. In contrast, infant mortality (probably of dying by age 1 per 1000 live births) and maternal mortality rate indicate accessibility and use of basic services, for example anteneonatal care, delivery and immunisation which would reflect functioning primary care services. The number of hospital beds and doctors is indicative of infrastructural and human resources for health capacity in a country. Cumulatively, these variables attempt to measure the quality of healthcare of a country.

Table 2 shows that health outcomes across Chile, South Africa and Thailand vary considerably. Strikingly, both infant and maternal mortality in South Africa are astronomical compared to both Chile and Thailand indicating a crisis in access to pre- and post-natal care despite having a comparable number of both doctors and hospital beds. Indeed, just 56% receive four antenatal care visits in SA compared to more than 80% in Thailand[5]. Life expectancy and adult mortality are similarly low in SA indicating a lifelong restriction to adequate healthcare. HIV/AIDS rates (per 100,000) are huge at 627, causing 35% of deaths below age 5 in 2009[1].

Thailand is notable for its relatively low number of doctors, and performs reasonably well against Chile across all indicators despite spending just over half in terms of % GDP. What are the healthcare models that underlie the vast differences in healthcare outcomes?

Money Matters

Although a hugely complex issue, consumer healthcare payments normally fall into one of the following categories: direct payment, some form of insurance or universal coverage with or without co-payment.

Direct payment has serious consequences: it is estimated that 1.3 billion[6] people worldwide do not have access to healthcare services as they simply cannot afford it even in times of crisis. The number of people who suffer from *financial catastrophe*, meaning having to pay equal or more than 40% of the household's non-subsistence income for health care, amount to about 150 million globally, while 100 million are pushed below the poverty line[3]. Out of pocket (OOP) private spending, see Table 1, is an indicator for direct payments.

The alternative, either payroll contribution to a public or private insurance scheme or indirect general taxation, avoids direct payment via the creation of pooled funds thus sharing the burden and risk associated with illness or accident. Hence, there are a variety of health financing models that fall loosely into the following categories: National Health Services (NHS) via general taxation, Mandatory Health Insurance (MHI) Funds via compulsory payroll contribution, and private health insurance although in practice most countries combine approaches. All may, or may not, be combined with co-payment that, in effect,

Table 1: Comparative statistics (all data for 2009)

Country	Population (m) *	GDP per capita (PPP – Int$) *	%GDP spend on healthcare †	% private spend from total †	%OOP from private spend †	Health spending per capita (PPP – Int$) †
Chile	17.0	14,285	8.2	53.2	64.6	1,172
South Africa	49.3	10,237	8.5	59.9	29.6	862
Thailand	67.8	7,957	4.3	24.2	68.1	345

* World Bank Atlas Method, World Bank 2009

† National Health Accounts, WHO 2009

Table 2: Health indicators

Country	Life expectancy ('09) *	Adult mortality ('09) *	Infant mort./ 1000 ('09) *	Maternal mort./ 100,000 ('08) *	Hospital beds/1000	Doctors/1000 **
Chile	79	87	7	26	2.1 ('09) †	1.09 ('03)
South Africa	54	496	43	410	2.8 ('10) ††	0.77 ('04)
Thailand	70	205	12	48	2.2 ('02) †††	0.37 ('04)

† Pan American Health Organization Basic Indicators, PAHO 2010

†† Regional Office for Africa, WHO 2010

††† Regional Office for South-East Asia, WHO 2007

* World Health Statistics, WHO 2011

** WHO Global Atlas of the Health Workforce, WHO 2010

A family shows off their new addition, a newborn, and the delivery record from Mae Tao Clinic in Mae Sot, Thailand

results in potentially crippling direct payment as above.

Up to one hundred countries worldwide finance their healthcare system predominantly via general taxation such as Thailand, whilst around 60 have payroll tax-based MHI systems such as Chile. South Africa is among very few countries that rely on direct payment for the poor and/or private health insurance for the wealthy.

South Africa

Health care in South Africa is in dire straits. Many children die every year in South Africa mostly from treatable communicable diseases such as diarrhoea, HIV/ AIDS, malaria, respiratory tract infections and pneumonia. Despite a GDP comparable to both Chile and Thailand, and a population size similar to Thailand, South Africa has a life expectancy of just 54 years.

Relying on patient payments at the point of treatment, research has shown that direct payments have forced 290,000 households below the poverty line in South Africa[6]. South Africa uses a Uniform Patient Fee Schedule that categorises the payment a patient makes based on their financial situation. Nonetheless, private expenditure makes up a significant 60% (2008) of total expenditure[1]. Of this, private insurance makes up over two-thirds whereas out of pocket expenditure makes up the remaining 29.6%. Aware of the situation, the current government aims to create a National Health Insurance system to limit inequalities in access to healthcare among the different socio-economic groups.

Chile

Chileans however, and the Thai below, have largely eradicated communicable diseases and today primarily suffer from the non-communicable diseases of the developed world – cancer, diabetes and hypertension.

Following a long history of insurance-based health provision biased towards the wealthy, Chile opted in 2000 for a mixed public/private approach to health insurance covering a set of explicitly defined conditions under Plan AUGE[7]. An extended period of economic growth, a high degree of formality in employment and an efficient tax collection system made this expansion possible. Today, public and private health insurance coexists to provide universal coverage.

Chile's mandatory health insurance (MHI) system consists of a single nonprofit public insurer (Fondo Nacional de Salud, FONASA) and multiple for-profit or non-profit private insurers (Instituciones de Salud Previsional, ISAPREs), each operating in competition. All formal sector workers, retired workers with a pension or self-employed workers with a retirement fund must enroll with the MHI by making a monthly contribution equal to 7% of their income or pension (up to a monthly ceiling of $2,000).

The public component currently covers two out of three Chileans, including 3 million people considered to be very poor, and is primarily funded by compulsory payroll contributions for workers, small copayments and general taxation. In 2003 Chile introduced a 1% increase in VAT to fund health. With 52.3% private health expenditure of total expenditure in 2009[1], ISAPRES cover 17.6% of the population[7], with providers

5 Patcharanarumol W. et al. (2011) *Good Health at Low Cost* (Chapter 7: Why and How Did Thailand Achieve Good Health at Low Cost?).

6 International Labour Office (2008) Social Health Protection: An ILO Strategy Towards Universal Access to Health Care.

7 WHO (2010) Towards Universal Health Coverage: The Chilean Experience.

funding treatments via their own health services, independent private providers and public hospitals. In 2008, ISAPREs offered no less than 8,000 different plans.

Although coverage of the population is near universal, inequalities exist with many private insurers denying enrolment to those who are at higher risk. Co-payment also presents problems to the very poor in a similar manner to direct payment above.

Thailand: *Universal Health Coverage Scheme*

Strong grassroots support and sustained economic growth saw the Thai Rak Thai party introduce universal coverage for the Thai population in 2001[4]. This universal health coverage scheme replaced previous fragmented schemes including means-tested health care for low-income families; a social welfare scheme for vulnerable groups including children up to 12 years and the elderly; and a voluntary health insurance card, and covered the remaining 30% uninsured. This was funded by national pool formed from general budget revenues and a small copayment of 30 baht (£0.63) per visit. The motto at that time of *30 Baht treats all diseases* was so popular that it was embedded in the mind of every Thai.

In 2006 the 30 baht co-payment was abolished and the Universal Coverage Scheme (UCS) became free and solely funded by tax revenue. Today this covers some 74.4% of the population or nearly 50 million people. The scheme is seen as a huge success for healthcare for the whole Thai population, in particular the poor: there has been a 25% increase in outpatient care and a 9% increase in hospitalisations[4]. The proportion of people facing catastrophic health expenditure was also been reduced significantly from 5.4% in 2000 to 2.0% in 2006[4]. Public and private employees that make up the remaining 25% of the population are covered via the Civil Servant Medical Benefit Scheme and the Social Security Scheme.

Under UCS and other schemes, Thailand offers prescription medicines, ambulatory care, hospitalization, disease prevention and health promotion free of charge to patients, along with more expensive medical services such as radiotherapy and chemotherapy for cancer treatment, surgical operations and critical care for accidents and emergencies. Renal replacement therapy for end-stage renal disease was included in the benefit package in 2007.

Health care financing in Thailand is based on general taxation yet there are no earmarked funds for the UCS, and every year it is vulnerable to budgetary competition. Concerns also persist that it has encouraged an unsustainable increase in demand, resulting in a rapid increase in the workload of health personnel. The source of future funding needed to care for its growing aging population remains a challenging issue.

Conclusions

Spending more on health services does not necessarily mean better outcomes. We have seen that, despite the fact that South Africa spends more than twice the amount on healthcare per capita compared to Thailand, it's life expectancy is 20 years lower. On the other hand Chile has a similar life expectancy to Thailand but spends over three times more on health provision, see Table 1.

The use of direct payment in the case of South Africa has led to a crippling burden on the poor population, essentially preventing access to healthcare for a large segment. In contrast, Thailand and Chile have moved away from direct payment towards pooled funding of healthcare via general taxation and compulsory insurance.

High levels of formal employment and efficient tax collect have enabled Chile to implement compulsory payroll contributions effectively. Although achieving high levels of health care and health outcomes, Chile spends significantly more than Thailand per capita and also suffers from direct payment forcing out the poorest segment of society.

In contrast, Thailand has high levels of informal workers, yet a popular mandate for universal healthcare backed by strong political commitment, experience and capacity to implement such a large project on a national scale and civil society support. Following a long history of healthcare experience and reform, Thailand successfully expanded healthcare to rural areas with functioning primary care provisions and ensured access to all, achieving what is a utopian vision for many: universal healthcare.

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Emerging Infectious Diseases: Global Risks, Global Strategy

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SARS. Ebola. Pandemic influenza. New diseases like these are emerging all the time. We don't know when they are coming – but they *are* coming. Most of them first arise in low-income countries that are not well equipped to find and eliminate them. If the UK, the US and other high income countries want to avoid deaths and the cost of tackling novel diseases in the developed world, they could do worse than looking at ways to stop the spread of new diseases in countries in which they occur. An ounce of prevention is worth £££ of cure.

Humans and microbes are locked in an ever-escalating arms race. We develop complex immune system protection, but germs always seem to be able to find ways to avoid and even exploit our defences. Over human history of evolution, humans have largely been limited to relatively small geographical distances; 200 years ago most people never went more than 20 miles from their birthplace. This meant that diseases tended to move slowly and generally within a specific climate zone. Now, with globalisation and mass travel, disease migration patterns have altered radically. Combined with climate change, pathogens have spread far from the areas they started, and new ones are being discovered at the rate of about one per year. Emerging diseases pose significant threats to low, middle, and high-income countries. Most of the pathogens originate in developing countries, although many of these are not identified until they migrate to developed countries with more sophisticated labs. Developing ways of rapid identification, isolation, and treatment of emerging infectious diseases would benefit both developed and developing countries.

With globalisation and mass travel, disease migration patterns have altered radically. Combined with climate change, pathogens have spread far from the areas they started

There have been several attempts to develop large-scale epidemiological networks, but these have largely been confined to high- and middle-income countries. This is partly a matter of pragmatism as these countries have more developed intra-national surveillance systems, which makes the collection and dissemination of information between countries much easier. The EU has recently developed its own international public health agency, the European Centre for Disease Control and Prevention (ECDC). As has been shown with the development of E. coli O104:H4, this type of international collaboration is crucial even between countries with large health budgets and many resources. When new epidemics are identified early, before the disease becomes entrenched in the population, there may even be the possibility of elimination, if not eradication.

Disease Surveillance: Not Just for Rich Countries

The best way to provide health care in resource-poor environments has been discussed at great length. The general consensus is that improving public health infrastructure is an important element in improving health in countries where money is limited. There have been arguments surrounding the strategy of disease elimination and eradication in low- and middle-income countries. One issue raised is whether this type of top-down health intervention, constructed and funded by the international community and high-income country donors, removes resources from more fundamental primary health care

in low-income countries. There is an analogous situation with emerging infectious diseases; comprehensive surveillance is difficult to achieve, resource-intensive, and requires the development of communication systems. It seems to be a false dichotomy, however, as improving communication and surveillance is an important element of improving primary health care. Rather than being antagonistic, these functions are somewhat symbiotic, and provide benefits not only to the target country, but to other countries as well. These positive externalities are a crucial factor in garnering and maintaining political support within high-income donor countries.

Elimination vs. Eradication

Elimination is the reduction to zero of a disease and/or an infection in a specified geographical region. Ongoing measures are needed to maintain this state. At the moment, polio elimination is high on the international health policy agenda.

Eradication is the global permanent elimination to zero of a pathogen. This has only been achieved once, with smallpox. It has not been made extinct, as there are laboratory samples left in the US and in Russia.

The Spread of Chikungunya Virus

One important potential benefit for high-income countries supporting the infectious disease surveillance networks of low and middle income countries is early reporting. When emerging infectious diseases are allowed to spread in the region of origin, importation to other zones is likely, if not inevitable. As climate change has expanded the areas in which tropical insects and other disease vectors can thrive – this importation can lead to endogenous transmission within higher income countries. One example of this was the Chikungunya virus fever outbreak in Italy in 2007. Chikungunya virus fever is a vector-spread disease, mostly found in the Indian Ocean region. It is usually spread by Aedes aegypti and Aedes albopictus mosquitoes, most commonly found in the tropical zone. There have been cases identified in other climate zones, but until recently, these were in people who had contracted the disease in an endemic zone, and then travelled to a colder region. In 2007, there was a large-scale outbreak in the Indian Ocean region, with 5003 confirmed cases (and likely many, many more). Shortly after this outbreak, several cases of Chikungunya fever were reported in Castiglione di Cervia, Italy[1]. It is unclear precisely where the outbreak originated, but it soon became known that the disease was spreading through the town via mosquitos: this was the first occurrence in Europe. The outbreak led to 334 suspected cases, with 204

Early detection is key: UNICEF works to to contain a cholera outbreak in Haiti

confirmed in a laboratory. The reaction also showed the importance of international cooperation, as the newly formed ECDC coordinated the response to the outbreak. In reasonably short order, the reservoir of mosquitoes in the area had been eliminated, and the outbreak stopped.

Outbreak Responses and Inequity

Responses to emerging infections have not always been as orderly. The handling of the 2003 SARS outbreak provided a classic case study of multiple fundamental mistakes, and ways in which international collaboration can fail. The Chinese government was secretive and withheld crucial information that prolonged the period before effective international collaboration was possible[2]. The Canadian government used its influence to have the WHO rescind a travel restriction, and then permitted a second wave of infection to occur in order to minimise economic consequences[3]. In other ways, the international health machine worked extremely efficiently. The WHO reacted swiftly when the problem was brought to them, and effective quarantine measures were developed and implemented to a significant degree, if not perfectly.

After the SARS epidemic, emerging infectious diseases rose dramatically on the policy agenda, and interest in preventing global spread has prompted policymakers in high-income countries to look at surveillance in high-risk source countries. The risks perceived by high-income countries in the advent of an overwhelming pandemic like the 1918-19 influenza pandemic reached beyond health protection to national security. The divisions between high- and low-income countries were highlighted in the preparations for an H5N1 pandemic, and then the real H1N1-2009 variant pandemic. The inequitable distribution of resources between countries where new strains are likely to originate, and the countries which will develop and manufacture effective countermeasures such as vaccines has also been a cause for concern for many low- income countries.

Indonesia is the clearest example of where this inequity has had serious consequences. In 2007, Indonesia began restricting access to influenza samples, and the situation has been unstable ever since[4]. This has been extremely unpopular with the international health community. Indonesia has justified its position by stating that the current way that vaccine development is carried out and the price applied by manufacturers, would mean that Indonesia and its citizens would not be able to afford it. This stance has arisen in response to the treatment of low-income countries by the private sector. Indonesia wishes to avoid being in the position where access to the vaccine is at the whim of an international organisation that has limited responsibility to any state government. In order to do so, Indonesia has been prepared to use its restricted leverage. If high income countries wish to encourage Indonesia to cooperate with virus sample sharing, it will be necessary either to compel compliance (perhaps via sanctions), or to improve incentives (such as international aid). A complicating factor is the production of generic drugs within Indonesia, a practice deplored by the governments of high-income countries with large pharmaceutical companies who have patents to protect. These same companies control the production and pricing of any vaccine in the event of a pandemic, with reference to the WHO and national governments.

The SARS epidemic focused attention on emerging infectious diseases. During the SARS outbreak in China, there was under-reporting, misreporting, and very little data sharing until the global outbreak was well underway. There was a fear of a loss of face and of disrupted international trade and tourism, and so these protectionist strategies were employed to mitigate the worst of the economic effects. In order to avoid these evasion strategies in Indonesia and other low-income countries that may be host to future emerging infectious diseases, and to address the concerns of low- and middle-income countries about surveillance capacity and unequal resource allocation in the event of a pandemic, more direct assistance may be required. The creation of stable public health infrastructure, the sine qua non of the Right to Health movement, would simultaneously improve health and provide consistent epidemiological reporting that would benefit both low and high income countries. Global risks need global strategies.

1 Angelini R. et al. (2007) Chikungunya in North-Eastern Italy: A Summing Up of the Outbreak. *Eurosurveillance*. **12**(11).

2 Chan L. et al. (2010) China's Engagement with Global Health Diplomacy: Was SARS a Watershed? *PLoS Medicine*. **7**(4).

3 Leslie M. (2006) Fear and Coughing in Toronto: SARS and the Uses of Risk. *Canadian Journal of Communication*. **31**(2).

4 Nuzzo J., Kwik G. (2011) Global Health Security: Closing the Gaps in Responding to Infectious Disease Emergencies. *Global Health Governance*.

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The Right to Health in Practice

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In the current era of globalisation, the world is diversifying as never before. Inequalities in economic, social, spiritual, political and civil matters characterise daily life. Estimates suggest that 80% of global disease burden lies in developing or low-income countries, based on crude calculations by disability-adjusted life years (DALYs)[1]. And measures do not seem to be in place to redress these inequalities. For instance, the Commission on Health Research Development estimated, albeit several years ago, that 90% of all global research and development expenditure is dedicated to 10% of the world's disease burden, primarily concentrated in wealthier countries.

Today, there may be a new climate of awareness maturing. Governments representing developed or high-income countries often discuss the urgent need to help the world's poorest or rescue the bottom billion from devastating illness. However this optimistic rhetoric is not always matched by foreign policy and international trade agreements, for example consider TRIPS, the World Trade Organisation's Trade-Related Aspects of International Property Rights Agreement consolidating strict patent rules worldwide with significant impact on access to essential medicines.

The following provides a comprehensive overview of the right to health and proposes a human rights-based approach to health as a sustainable framework that transcends borders for justice in healthcare.

Rights are moral and legal entitlements. Human rights have foundations in the theory of natural law and by definition human rights 'belong justifiably' to all persons[2]. Several core notions play essential roles in the realisation of human rights, namely the concept of a right, a duty, an entitlement and an obligation. For descriptive purposes, rights are classified as negative rights and positive rights. Negative rights imply freedoms, for instance the right to be free from forced medical experimentation or the right to be free from torture and ill treatment. Positive rights imply entitlements, for instance the right to access essential medicines and vaccines.

Every State in the world has ratified at least one international human rights treaty upholding the right to health

The philosophical basis for human rights is not restricted to the 20th Century and the United Nations Universal Declaration of Human Rights. Core principles shape several religious and ancient legal texts, such as the Babylonian Code of Hammurabi, the Hindu Laws of Manu, and the Analects of Confucius. The origins of the modern human rights movement arguably stems from the end of the 18th Century at a time where the relationship between government and the governed was evolving rapidly and redefining itself, highlighted by treatises in political philosophy on the Social Contract. However it is the genocidal atrocities and medical experimentation of an unparalleled evil committed by the Nazis, directed primarily at millions of Jews throughout Europe, from which the Universal Declaration of Human Rights (UDHR) was born. The inhumanity of the Nazi regime and gross disregard for human rights of all human beings left people and their leaders questioning the morality of the human race.

1 Benatar S. R. (2007) *Justice and Priority Setting in International Health Care Research*. (In Ashcroft R. E., Dawson A., Draper H., et al. (eds.) Principles of Healthcare Ethics. 2nd Edition. Chichester: John Wiley and Sons.

2 Simpson J. & Weiner E. (1989) *The Oxford English Dictionary*. New York: Oxford University Press.

In the present day, the International Covenant on Economic, Social and Cultural Rights (ICESCR) and the International Covenant on Civil and Political Rights (ICCPR) are legally binding instruments in international human rights law upholding, enshrining and protecting universal human rights. They are part of what is referred to as the Bill of Human Rights, which is composed of the ICESCR, ICCPR and UDHR. These instruments are vital in ensuring that governments are held accountable for their action, or inaction, for the sustained improvement of health among their society.

Health systems and services operating with a human rights-based approach must be appropriately available, accessible, acceptable and of good quality

Health as a Human Right

Human rights are undeniably interdependent, indivisible and interrelated[3]. This concept is significant when referring to health. The World Health Organisation (WHO) definition of health is considerably cited and defines health as 'a state of complete physical, mental and social well-being and not merely the absence of disease'[4]. Both the underlying determinants of health and a functioning health system accessible to all without discrimination are fundamental to the realisation of the right to the highest attainable standard of physical and mental health. The right to health however is not about a right to be healthy as many aspects, including genetic predisposition for instance, are outside the direct control of States.

Beyond the WHO Constitution and article 25 of the Universal Declaration of Human Rights, the right to health is articulated in the 1978 Declaration of Alma-Ata, regional treaties, article 12 of the ICESCR and further clarified in 'General Comment No.14: The Right to the Highest Attainable Standard of Health'. Every State in the world has ratified at least one international human rights treaty upholding the right to health and over 115 national constitutions recognise the right to health, therefore governments and affiliated institutions have committed themselves to respecting, protecting and realising this right in national law and domestic policy.

In practice, health systems and services operating with a human rights-based approach must be appropriately available, accessible, acceptable and of good quality. The principles of participation, non-discrimination, transparency and accountability on all levels and equality are paramount. The United Nations Human Rights Council monitors States and their legal obligations to ensure the case-appropriate measures are in place to realise the right to health.

Morals, Ethics and Values

Healthcare workers have unique access to individuals at times of greatest need and are in a prime position to report injustices and violations as they happen. The fundamental principles of human rights provide a practical framework to guide healthcare practitioners and public health professionals to realise of the inextricable right to the highest attainable standard of physical and mental health for all.

There is a moral imperative and obligation for the State to address injustices with concerted action and healthcare professionals have a responsibility to act when appropriate. Just actions based on respective duties and obligations must ensure that progressive realisation of the right to health and fair distribution of limited resources occurs without delay. Ethical principles have the compelling power to influence action. The following principles are central to realising the right to health and guiding day-to-day practice by healthcare professionals:

Respect

Due regard, civility and non-discrimination for all women, men, boys and girls regardless of background or ethnicity.

Equality

A sense of egalitarianism, sympathy and empathy. An appreciation of the injustices in situations others may be confronted with.

Dignity

Honouring the values and individuality of all persons.

Autonomy

Respecting the freedom of competent human beings. Empowering the individuals who carry the resultant outcomes.

[3] United Nations (1993) *The Vienna Declaration and Programme of Action*. The World Conference on Human Rights. New York: UN.

[4] World Health Organization (1946) *Preamble to the Constitution of the World Health Organization*. New York: WHO.

[5] Backman G. et al. (2008) Health Systems and the Right to Health: An Assessment of 194 Countries. *The Lancet*. **372**: 2047-85.

[6] Rawls J. (1971) *A Theory of Justice*. Cambridge: Harvard University Press.

Participation

The opportunity, by men and women, to be involved in the process and discuss subjective issues on both sides in an effort to understand, not presume, the optimal way forward.

Fairness

Facilitating accountability for unfair processes and unfair outcomes.

These principles are not novel. In fact these principles complement the traditional principles of medical ethics and the Hippocratic Oath. *First do no harm* is a fundamental moral concept that relies on an underlying respect between healthcare professionals and their autonomous patients, equality in treatment based on need, and fairness. However the principles presented above are inconsistently applied at present to resource allocation for health, which favour instead utilitarian and consequentialist models. The universality of human rights act as a reminder that individuals are born into unequal circumstances with a tremendous influence on the rest of their lives and may remain trapped, vulnerable and destined to fight hard for social justice.

Values, although complex to define, difficult to quantify and judged culturally relative, must be taken into consideration concurrently in all healthcare-related decisions

Redistributing societal benefits and burdens for the benefit of the marginalised is not uncommon in many states worldwide, as observed with social security policies. Translation of this principle beyond national borders is rare. A right to health approach moves beyond the mere cost-effectiveness analysis. Naturally, in the words of Paul Hunt, past-UN Special Rapporteur on the Right to Health, human rights cannot answer all the difficult practical problems a health system faces on a daily basis, any more than ethics or health economics can. However they provide a morally assertive and legally binding approach, ensuring an environment of universal respect, egalitarianism and accountability for unfair violations and participatory discussion to improve justice for all.

Furthermore, a landmark study[5] was recently published in The Lancet assessing health systems and the right to health in 194 countries, identifying key features of the right to health and proposing 72 indicators to monitor and analyse health systems worldwide. These indicators are essential to manage the progressive realisation of the right to health, which is not merely efficient management or good in a humanitarian sense, but an obligation under international law. Facts and figures are important, however not exclusively. Values, although complex to define, difficult to quantify and judged culturally relative, must be taken into consideration concurrently in all healthcare-related decisions.

People Driving Health

Methods to strengthen and improve the reporting system at the United Nations are urgently required to uphold universal human rights. The WHO alone cannot efficiently redress the inequalities in health and resources across the globe. A variety of players in a globalised world have direct and indirect impacts on health and resource availability for fair distribution. Institutions require clear communication and a bridge to connect with individuals they serve. Conflicting policies and priorities, such as the TRIPS agreement and access to essential medicines, restrict improvement in conditions for millions worldwide. To realise human rights and the right to health, the moral principles underlying these legal obligations must be applied as a framework for practical issues in daily life. Healthcare professionals must lead the way. Without this translation from theory to practice, conflict between what we say and what we do will remain.

> *"Each person possesses an inviolability founded on justice that even the welfare of society as a whole cannot override. For this reason justice denies that the loss of freedom for some is made right by a greater good shared by others."*
>
> John Rawls[6]

In the spirit of John Rawls, this principle must be applied to health to ensure the loss of health by some does not justify or make right the greater health of others. Health is global. For social justice on a global level, consistency in applying the human rights framework is urgently required for the realisation of the right to health and redressing injustices worldwide.

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Delivering Trauma Care to Developing Countries

Sir Terence English KBE

Trauma in all its manifestations and great variety of causes is responsible for approximately 5 million deaths a year globally and many of these occur in developing countries. The Primary Trauma Care Foundation provides courses to doctors in primary trauma care (PTC) at minimal cost and empowers developing countries to train their own staff. Pakistan and Gaza are but two examples of the potential for PTC to save lives.

Various courses have been developed to teach doctors how to deal with the immediate effects of trauma. All depend on acquiring a systematic approach, evaluating and dealing with the most life-threatening injuries first. Hence the emphasis on first ensuring that the airway is patent, then assessing breathing and circulation before proceeding to evaluate neurological, abdominal and bony injuries.

My interest in this subject started in 2003 when my orthopaedic friend, John Beavis, announced that he wanted to bring better trauma care to the tribal areas of the North West Frontier Province of Pakistan. I knew the Professor of Surgery in Peshawar, Mohammed Kabir, and offered to come with him during his assessment visit. We met with enthusiasm for the project from the local doctors, and after returning home signed up for the Advanced Trauma Life Support (ATLS) course at UCH. Thankfully we both passed, but in the process we realised that ATLS was not appropriate for a developing country like Pakistan. Fortuitously, I was then introduced to Douglas Wilkinson, Consultant in Intensive Care at the John Radcliffe Hospital in Oxford, who founded the Primary Trauma Care (PTC) Foundation in 1997 and it became obvious from talking to him and reviewing the training manual that PTC was a far better option for Pakistan than ATLS.

Pakistan

So in 2004 we took a group of six instructors to Peshawar for the first PTC course. Professor Kabir had carefully selected the candidates from the staff of the four local medical schools. After the initial two-day training course, an instructors course was held and then further training courses were held in each of the medical schools, so that by the time of our departure over 100 doctors had been trained in PTC in Peshawar.

The subsequent success of PTC in Pakistan was fascinating to observe. With support from UK instructors, courses were soon requested and held in Rawalpindi, Karachi and Lahore and subsequently taken to surrounding district hospitals. Then in 2005, as an example of the international role played by PTC, the Sindh group took a course to Delhi, this being an unusual example of medical collaboration between India and Pakistan.

As a result of my involvement with this, Douglas Wilkinson asked me to become the Patron of the Primary Trauma Care Foundation, a position I have been proud to hold since 2006. Courses in PTC have now been held in over 40 countries and the training manual translated into 14 languages. Doctors in these countries,

whether practising in cities or rural areas, are now better equipped to provide immediate care to seriously injured patients. The policy we have followed can be summarised as follows:

1. Teach a straightforward system of saving lives based on the same principles as ATLS but flexible enough to be adapted to local circumstances.
2. Provide training courses at minimal cost – all our instructors are volunteers – and allow countries to use our training manual and material and adapt these to their own needs.
3. Empower countries to train their own staff in trauma management and motivate them to develop strategies of trauma prevention.

Gaza

One of the more recent and very worthwhile projects came again from John Beavis, who suggested in 2008 that we should explore the possibility of taking the PTC courses to Gaza. However, it was not until August 2009 that we were able to gain entry to Gaza under the auspices of Medical Aid for Palestinians (MAP). On arrival we were dismayed to see the extensive damage that had been inflicted on public buildings, schools, hospitals, Mosques, private homes and apartments as a result of the Israeli invasion of 6 months previously. More than 1400 Gazans had been killed, many of them women and children, and there had been thousands of serious injuries that had swamped the medical facilities.

With willing help from the local MAP office in Gaza City, he and I were able to visit over a dozen hospitals throughout the Strip and confirm during our interviews with local doctors that they would welcome participating in trauma courses such as we described. MAP generously agreed to fund these and so in November 2009 we returned with a team of volunteers and held the first two training courses followed by an instructor's course at Al Shifa Hospital in Gaza City. There we were provided with good facilities and excellent support from Dr. Nasser abu Shabaan and his team.

Before our return to the UK Dr. Nasser generously agreed to set up and chair a committee that would be responsible for overseeing the propagation of PTC course throughout Gaza. Three months later two of our team returned to participate in the first training courses run by the locally trained instructors.

Subsequent courses have been a great success and by now many hundreds of doctors and nurses have been trained in Primary Trauma Care in Gaza. During my last visit in November 2010 I was delighted to observe 5th year medical students from the Islamic University enjoying the challenge of taking the course at Al Shifa Hospital. All of us associated with the project have come to admire the courage and fortitude with which the Gazans are facing the aftermath of the invasion and dealing with the continuing blockade by Israel which affects all aspects of their lives. Many good friendships have been made and these in turn have led to other medical projects being started in Gaza that we hope will be of equal benefit. These are but two examples of what the Primary Trauma Care Foundation is bringing to poorer and developing countries.

Injured victim of the 2005 Kashmir earthquake

Sir Terence English KBE is a retired cardiac surgeon, having performed Britain's first successful heart transplant in 1979. Sir Terence was elected President of the Royal College of Surgeons of England 1989-1992, and President of the British Medical Association in 1995-1996.

Are UK Universities Tackling Local or Global Health Issues?

Honor Bixby, Imperial College London

The institutional principles of universities – to create and disseminate knowledge for public benefit – are often forgotten in this age where universities strive to top league tables and attract lucrative grants. Universities are in a unique position to be a promising catalyst for change, but often campus decision-makers can be insulated from the realities of global health and funding priorities can consequently become skewed in favour of local challenges.

With the two N's – Neglected Tropical Diseases (NTDs) and Non-communicable Diseases (NCDs) – gaining prominence on the international agenda, how can universities re-orient their priorities to serve our global, rather than solely local, community?

Neglected Tropical Diseases (NTDs) are diseases of poverty, flourishing most in communities where substandard living conditions that optimise transmission of these parasitic and bacterial infections are commonplace. As Western nations have developed, and standards of hygiene and sanitation have improved, these diseases been forgotten. In terms of donor support, the big three – HIV/Aids, tuberculosis and malaria – overshadow them today. This seems counterintuitive, however, as their cumulative burden (measured in disability-adjusted life years, DALYs) exceeds that of either TB or malaria and is comparable to that of HIV/Aids. The immense burden of NTDs has become increasingly visible in recent years in no small part due to the valiant efforts of several UK-based academic institutions to alleviate the suffering, However, the overwhelming majority of research at UK universities still goes into largely domestic diseases or the headline-grabbing big three diseases of the developing world.

Furthermore, non-communicable diseases (NCDs) including cardiovascular diseases (CVDs), cancer, diabetes and respiratory disease, which constitute the primary burden of developed countries, are emerging as an immense concern for the developing world. Indeed, NCDs cause 63% of global deaths, with 80% occurring in the developing world[1]. In resource-poor settings, particularly in relation to NCDs, prevention is better than cure. Access to treatments is cost-prohibitive and lack of infrastructure and resources rarely allow for advanced procedures to be carried out. It is therefore imperative that universities consider cost and health equity in the development of new treatments and products.

The overwhelming majority of research at UK universities still goes into largely domestic diseases or the headline-grabbing big three diseases of the developing world

NTDs – Neglected no More?

The approximately 1.4 billion sufferers of NTDs are from the world's poorest populations: Africa, Asia and Latin America account for 90% of the disease burden. Their weak political voice and the profitless market they provide for pharmaceuticals mean their suffering has been *neglected*, earning these diseases their title.

1 UnitedHealth, National Heart, Lung, and Blood Institute Centers of Excellence (2011) Global Response to Non-Communicable Disease. *BMJ*. **342**(3823).

2 WHO (2010) Working to Overcome the Global Impact of Neglected Tropical Diseases: First WHO Report on Neglected Tropical Diseases.

NTDs not only result from poverty but also significantly contribute to it. Many infections are chronic so that, although they may not cause high levels of mortality, they are associated with high morbidity, restricting sufferers' ability to work and resulting in decreased economic productivity on a regional scale. In addition to this is the drainage of severely limited healthcare resources and the limitations they can place on childhood development both through direct suffering resulting in physical/mental disability and reduced school attendance and the responsibilities they face when family members are affected taking priority over their education. Countries are trapped in a cycle of stunted development.

It is imperative that universities consider cost and health equity in the development of new treatments and products

In recent years the full extent of this burden has been realised. Over half of the United Nation's Millennium Development Goals (MDGs) that aim to end poverty cannot be achieved without action to address NTDs. They have achieved a priority position on the international agenda and the outcome of the first meeting of the Global Partners on NTDs, organized by the World Health Organization (WHO) in 2007, was the Global Plan to Combat Neglected Tropical Diseases 2008-2015[2].

One consolation is that NTDs can often be simply and cheaply treated/prevented with existing medicines, making the problem more readily solvable although investment for research and development (R&D) of products aimed at an impoverished market is rare. This poor return-investment ratio removes any incentive in the eyes of profit-driven pharmaceutical companies. Conversely, the restricted distribution of NTDs also acts in their favour as it means there is no alternative wealthier market that these companies can make money from and therefore no risk of lost revenue if companies donate the required medicines.

The first WHO report on NTDs released by Dr. Margaret Chan, WHO Director-General, stated that aiming at the complete control and even elimination of NTDs is fully justified. Pharmaceutical companies' drug donation programs have made a significant contribution by lessening the financial barriers faced by control initiatives. Merck, by the end of 2010, had donated over 55 million tablets to prevent more than 10.2 million school children from developing schistosomiasis. GlaxoSmithKline (GSK) has made an recent five year commitment to expand its donation of albendazole, used to treat infections with soil-transmitted helminthes that cause lymphatic filariasis, ascariasis and other NTDs, by 400 million tablets each year in addition to the 600 million already provided[3].

Donated drugs have enabled locally administered NTD programmes to make a real difference

However, this ambitious goal relies on a collaborative effort. Universities here in the UK have played an important role in successful control initiatives to date. Notably the Schistosomiasis Control Initiative (SCI) of Imperial College and the Centre for Neglected Tropical Diseases (CNTD) based at the Liverpool School of Tropical Medicine (LSTM) are both collaborators of the Global Network for Neglected Tropical Diseases.

The SCI's main focus is setting up or expanding NTD control programmes in countries most affected including Burkina Faso, Burundi, Mali, Niger, Rwanda, Tanzania and Uganda. It relies heavily on private donations. Due to the success of the programme, it has been granted £25 million by the UK Department for International Development (DfID), enabling provision of 75 million treatments. The SCI goes beyond life-saving drug administration, working with the WHO and African governments towards sustainable control of all NTDs through providing proper training to domestic health workers in recipient countries.

Aside from those NTDs that are easily treatable, there are those that do not have suitable therapeutics, such as Chagas' disease, Human African trypanosomiasis (African Sleeping Sickness) and Leishmaniasis. Chagas' disease kills more people in the Americas than any other parasitic disease. Two treatments are currently available, but cure rates are only 60-70% and less than 50% if the chronic phase of the disease has been reached. These drugs are by no means ideal, resulting in severe side effects and are either not well tolerated or are ineffective once the chronic phase has commenced. Therapeutics and diagnostics that are effective and suitable for use in the field are clearly in severe need for these diseases.

In 2007, North America, Europe and Japan carried out 76% of the world's R&D. This demonstrates the dependence of developing nations on industrialised countries for such activities. The UK remains second to only the US in its research quality and productivity. Such leadership comes with a responsibility to focus more research attention on the neglected diseases that affect only the world's poorest.

NCDs – An Emerging Threat

It is non-communicable diseases (NCDs) that afflict Western populations, and attract the focus of the major research universities. This tendency can be attributed largely to funding allocation. Most academic research is funded by public money, through government research councils including the MRC (Medical Research Council), industry investment (such as pharmaceutical companies) and donations from charitable organizations (including the British Heart Foundation and Wellcome Trust). The latter, in 2009, comprised around 22% of research income to UK HEIs but donations frequently fail to cover the full cost of research (e.g. salaries) and sourcing is often globally competitive. Pharmaceutical investments rely on financial incentives resulting in money going towards the prevention and cure of diseases of affluence. The Department for Business, Innovation and Skills's Economic Impact Reporting Framework set the objective of public funded science and technology research as to 'generate many beneficial outputs and impacts which underpin the UK's long-term economic growth, economic well being and quality of life' – economic/societal gain for the UK is at its heart. It is, therefore, unsurprising that funding directs research towards NCDs[4].

Pharmaceutical investments rely on financial incentives resulting in money going towards the prevention and cure of diseases of affluence

However, these diseases are also an immense concern for the developing world. NCDs cause 63% of global deaths, with 80% occurring in the developing world. Around 21 million years of future productive life are lost each year to CVD. Margaret Chan of the WHO has said that if rates continue to increase as they are currently, not even the wealthiest nations will cope with the economic strain of these diseases. Despite this *early alarm*, they received no mention in the MDGs. From this

3 GlaxoSmithKline (2010) Support for WHO Strategy to Improve Children's Health with New 5-year Commitment to Expand Donations of Albendazole Medicine. [online] Available at: <http://www.gsk.com/media/pressreleases/2010/2010_pressrelease_10110.htm> [Accessed 30 July 2011]

4 The Russell Group Universities (2009) Submission of Evidence for the House of Lords Science and Technology Select Committee Inquiry: Setting Science and Technology Research Funding Priorities. [online] Available at: <http://www.parliament.uk/documents/lords-committees/science-technology/strfrgu.pdf> [Accessed 14 August 2011]

5 University of Oxford (2009). Oxford Cardiovascular Science: Research Themes. [online] Available at: <http://www.cardioscience.ox.ac.uk/bhf-centre-of-research-excellence/research-theme-descriptions> [Accessed 15 August 2011]

6 Hoen E. et al. (2011). Driving a Decade of Change: HIV/AIDS, Patents and Access to Medicines for All. *Journal of the International AIDS Society*. **14**(15).

Eating enough fruit? NCDs linked to obesity are increasingly becoming a huge problem around the world

perspective academic research carried out in the UK can be seen to be addressing a major global health issue that has thus far been missed off the global agenda, but how may this research translate for developing world issues?

With the example of CVD, much of the UK research is inclined towards gaining a deeper understanding of the disease pathophysiology. This applies to much of the research at the British Heart Foundation Centre of Research Excellence at Oxford University[5] and is fundamental to fighting CVD. Often knowledge gained, such as identifying the main disease determinants, can be applied globally and provides the groundwork for new treatments to be built on. However, more targeted research such as the Artificial Heart Muscle Project at Leeds University that looks into pioneering treatment for CVD has a more restricted target demographic. Only in countries with adequate healthcare systems in place including both facilities and expertise can the successes of this project be advantageous. Resource-limited countries don't fall into this category.

NCDs cause 63% of global deaths, with 80% occurring in the developing world

In resource-poor settings it is particularly true that prevention is better than cure. Access to treatments is cost-prohibitive and early intervention is key. Imperial College has been involved in successful clinical trials of a polypill for CVD prevention. A polypill simplifies treatment and therefore enhances adherence – the benefits have been seen with antiretroviral combinations against HIV[6]. Although this is promising, access to NCD therapies, as with NTDs for which effective treatment exists, is frequently limited due to lack of affordability. Universities should take responsibility to ensure that the products of their research reaches developing countries to encourage health equity. Through the process of technology transfer universities pass the intellectual property rights of their research to commercial companies. In licensing promising new drug candidates to pharmaceutical companies, access by low- and middle-income countries at the lowest possible price should be stipulated in the agreement to ensure global accessibility.

With current funding priorities and measures of success there remains little incentive for universities to address the needs of a global population. As awareness of NTDs and NCDs in developing countries increasingly breaks onto the international agenda, new models of partnership between academia, government and industry need to bring progress in prevention and treatment for diseases of those for who most need it, but can least afford it.

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Randomised Trials for Development:
The New Aid Revolution?

Rory Fenton, Imperial College London

There is probably no other question in economics that evokes such strong emotions and creates such a clear divide between *left* and *right*. To the *left*, the world's poor are caught in a poverty trap; without the minimum resources to help them help themselves, they will never break out of this cycle. Aid, then, is clearly needed as a *big push* to kick things off. To the *right*, aid encourages dependency, distorts markets and props up nasty regimes – keeping the poor in their place. There is no sign of either side winning this battle. But subjecting individual aid projects to robust statistical analysis through randomised controlled trials (RCTs), modelled on medical trials, could provide a way out of the ideological mire.

What is aid? Aid can come in many forms – such as military aid to help a country fight terrorists, or budgetary aid sent with no strings attached to bolster a government's finances, or the cancelling of historic debts. Here we focus on a more altruistic form of aid – that sent to help the world's poorest with little expectation of benefit to the donor, for example direct financing of mosquito nets or primary schools.

The moral cause for wishing to alleviate world poverty is a clear one. That one billion people live on this planet on less than a dollar a day while so many of us live in luxury is surely a moral outrage. The philosopher Peter Singer has compared such inaction to standing by a lake as a child drowns. Surely, he reasons, no person would give a seconds thought to diving in? Practically speaking, of course, giving aid is complex and costly yet the principle, he argues, is the same.

This metaphor encapsulates the argument for aid – that only immediate, decisive and potentially painful action, essentially diving in, can help the poor. The clear implication of Singer's reasoning is that the solution is to get actively involved – but what if modern aid offers our metaphorical child little more than a faulty life ring? Or worse, what if aid actually helps to drag her down? This is the real question in the aid debate. This goes beyond rock concerts and emotive advertisements; is the obvious solution the right one?

Investment in boats turned out to be not only a surprisingly ineffective way of catching fish – as opposed to just tying nets to rocks and leaving them – but was also heavily biased in favour of the relatively rich fishermen

Diving In

Many would say yes. These aren't solely rock stars and actors – distinguished professors of economics such as Columbia's Jeffery Sachs see aid as an essential way of unlocking the economic potential of the poor. In his book The End of Poverty, Sachs points to farming as an example of this – if farmers are donated fertiliser, they can massively increase their harvest, which in turn gives them money to be able to buy their own fertiliser next year, thus creating a virtuous cycle. For Sachs, the farmers are caught in a poverty trap (unable to buy the fertiliser they need to progress) and without an aid-based kick-start (free fertiliser) they will never escape from poverty. Sachs sees this poverty trap model applying to many other areas of development – sick, poor people cannot afford medicine, but whilst they are ill they are unable work, meaning that they get even poorer. But aid also has a larger role to play. It can help small, cash strapped democracies stay on

their feet and provide for their people's basic needs. It can also kick-start basic infrastructure such as roads and schools.

Sufficiently compelled by this call to action, I headed off with some other Imperial College students last year to witness just this type of aid – designed to kick-start economic progress – in rural Kenya. Herdsmen, caught by a severe drought, were encouraged to take up fishing. A British charity subsidised nets and boats for the fledgling fishermen, with the idea that the subsidies could be gradually reduced as the economy took off. Each boat would take ten fishermen and each fisherman supported around ten dependents, meaning 100 people were helped by just one boat. It seemed to be the perfect project.

RCTs in Uganda have found that providing food won't increase enrolment, but it does boost attendance

Unforeseen Consequences

There are, however, powerful arguments against this kind of help. On a nationwide scale, the large and sudden influx of foreign money makes the local currency rise in value, suffocating exports. This was best documented in Holland when the manufacturing sector contracted, following the discovery of natural gas in 1959, earning the phenomenon the name *Dutch disease*. Furthermore, money given to poor country governments needn't necessarily end up going to infrastructure or healthcare. According to Paul Collier of Oxford University, 40% of African military spending is funded by aid, unbeknownst to the donors. It is certainly no secret that the poorest countries often have the nastiest regimes.

Aid can also undermine democracy, making poor countries accountable to donors, not to their citizens. The old American maxim of 'no taxation without representation' too often works in reverse – no representation without taxation. When poor countries rely on foreign funds and not taxes from local people and businesses, the need to be accountable to citizens is reduced and corruption and inefficiencies can more easily set in. Somaliland provides an excellent counter-example – not recognised as a country by the international community, it cannot receive aid and in fact has seen significant improvements in accountability and reduced corruption as citizens demand more for their taxes. And lastly, we cannot forget the ethical implications of aid recipients relying on public services provided by politicians in wealthy countries for whom they cannot vote.

The Truth Lies in the Data

Where does this leave the Kenyan fishermen? They lack a mature manufacturing sector so that shouldn't be an issue. But how could the other factors affect them? It

Data collection showed that investment in Kenyan boats turned out to be an surprisingly ineffective way of catching fish (Kenya)

is here that we get to one of the biggest problems with aid - the lack of good data on its effectiveness. In truth neither the *left* nor *right* perspectives can offer a good evaluation of such a program without first gathering data. This was exactly what we did in Kenya.

Through interviewing 200 of the fishermen, we were able to gain a clearer picture of how the subsidies were impacting the local economy. The results were surprising; the perfect picture offered by aid evangelists was found to be murky at best. Investment in boats turned out to be not only a surprisingly ineffective way of catching fish – as opposed to just tying nets to rocks and leaving them – but was also heavily biased in favour of the relatively rich fishermen who could afford to pay the unsubsidised half of the price. However, we also found that investment in nets, especially targeted at the poorest, was a very cost effective way of helping out, with nets paying for themselves after two months. This was not only interesting, it was also very useful. The data enabled the charity to refocus its efforts, saving valuable donations and improving the quality of life for the fishermen.

Beyond simple moralising and abstract philosophising, scientific trials offer perhaps the most effective approach yet to understanding and tackling poverty

Our research is part of a bigger shift in the aid debate – its scientific revolution. In seeking out quality data, we were able to get to the heart of the issue. The apex of this is the use of randomised controlled trials (RCTs), in the style of medical trials, on aid projects. The idea is simple. Half of a population is given a form of aid (nets, extra teachers etc.) while the other isn't. Those who do and don't receive the aid are chosen at random and in such a way that they cannot affect each other so that the impact of the aid can be clearly demonstrated. Essentially like any lab experiment. The idea is simple and common sense to any science student but it is having a significant impact on a hitherto opaque world.

The world before evidence-based medicine is hard to imagine – quack doctors of varying credibility combined folklore and pseudoscience to propose cures for just about any illness. Today, trials form the basis of medicine. Think of the 1991 discovery that folic acid reduces incidence of spina bifida[1], as a result of which 10% of the world's flour is now fortified with the acid and thousands of such birth defects have been prevented. This same process is gradually taking place in aid. RCTs in Uganda have found that providing food in schools won't increase enrolment, but it does boost attendance[2]. RCTs across Africa have found that charging even a nominal fee for a malaria bed greatly reduces their use, contrary to the intuitive view that people only value what they pay for[3]. Aid is experiencing its own scientific revolution.

The pioneers of this field are undoubtedly Professors Abhijit Banerjee and Esther Duflo of MIT's Poverty Action Lab who have been working in this area since the Lab's founding in 2003. In their 2011 book Poor Economics, they outline the results of their RCT work. Their findings agree with neither *left* nor *right*, they simply find out what works. A new student union project at Imperial College called The African Development Project is dedicated to doing just this; involving science and engineering students in the evaluation of aid projects.

The potential of RCTs is very exciting indeed. They can provide no magic bullet – far too many such cures have been proposed in the past – but they do provide a way to go beyond the ideological warfare and change the aid debate for the better. Beyond simple moralising and abstract philosophising, scientific trials offer perhaps the most effective approach yet to understanding and tackling poverty. Its message is simple: find out what works, and then fund what works.

Students and staff interested in finding out more about The African Development Project can contact Rory at africandevelopment@ic.ac.uk

1 MRC Vitamin Study Research Group (1991) Prevention of Neural Tube Defects: Results of the Medical Research Council Vitamin Study. *Lanclet*. **338**(8760): 131-137.

2 World Bank (2008) The Impact of Alternative Food for Education Programs on School Participation and Education Attainment in Northern Uganda.

3 Cohen J. (2007) Free Distribution Or Cost-Sharing? Evidence from a Randomized Malaria Prevention Experiment. *Brookings Institution*.

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Could For-Profits Have a Greater Role to Play in Global Health?

Thomas Cowling, Imperial College London

The global health stage is entertained by the well-meaning strides of numerous non-profit organisations; governmental, non-governmental and inter-governmental. Yet, more potent and thrilling actors are hesitantly waiting in the wings with the potential to take centre stage: the for-profit organisations. A emerging concept termed shared value insists that firms are not required to make trade-offs between their social impact and financial success, instead emphasising the opportunities and benefits that improving social impact can confer on profits.

Consumers are increasingly expectant of firms with regard to their societal obligations and impact. These obligations may be seen to encompass health improvement of populations worldwide. Some firms have acknowledged and reacted to these expectations in the hope of meeting them. However, the true players in this game are not only meeting these expectations, they are surpassing them. To do so, they act in self-interest by delivering a wide range of benefits to society that simultaneously enhance their competitive advantage. The resulting positive feedback loop centred on the exchange and sharing of value between firms and society is intriguing, and greatly promising for global health. Is a new day about to dawn, bringing together two seemingly disparate worlds?

Traditional business and economic thinking views the purpose of the firm as resting with the creation of value for its owners or shareholders. Social issues fall outside its scope. If the rarity arises such that its impact on society is considered, any worries are quickly alleviated upon realisation that the firm employs, invests and pays taxes. This line of thought is gradually being superseded, although its advocates remain[1]. The annual reports of the majority of the largest companies assert commitment to social purposes alongside the maximisation of profits.

In recent years, firms have become increasingly viewed as potential sources of major social, environmental and economic problems. The financial crisis of 2008 and the BP oil spill provide two salient reminders of the damaging effects firms can have on their external environment. This realisation has contributed to the advent and increasing prominence of the notion Corporate Social Responsibility (CSR), broadly defined as a company's 'status and activities with respect to its perceived societal obligations'[2].

A Question of Motivation

Why do we concern ourselves with global health, in the first instance, and expect firms to contribute to improvements in it thereafter? One may assume that the answer to the former lies with the natural tendency to be altruistic but issues of equity and equality may be equally pertinent. The answer to the latter is more difficult, but perhaps of lesser importance. It is the existence and extent of expectation, and not its origin, which is of superior significance. Either way, consumers' awareness of firms' activities is unprecedented thanks to the intensifying sharing and access of information on the Internet. It is also important to acknowledge the power of the media in transmitting ideas and messages to a large, receptive audience.

1 Karnani A. (2011) Doing Well by Doing Good: The Grand Illusion. *California Management Review*. **53**(2): 69-86.

2 Bhattacharya C. B. & Sen S. (2004) Doing Better at Doing Good: When, Why, and How Consumers Respond to Corporate Social Initiatives. *California Management Review*. **47**(1): 9-24.

Paving the way: Bangladeshi economist and 2006 Nobel Peace Prize winner, Muhammad Yunus, founded in 1995 the non-profit company Grameen Telecom to bring mobile phones to rural villages in his native country

The picture painted is that firms have been forced to pursue CSR initiatives. Indeed, some firms seem to reluctantly acknowledge CSR and treat it as an unavoidable mandate. Others ignore it completely, perhaps to their disadvantage, as it seems that firms are able to benefit from their investment in CSR through improved brand image and subsequent relationship formation with consumers[3,4]. An example of a high profile CSR campaign is that of Coca-Cola's *Exercise is Medicine* program which is designed to encourage the medical community of the United States to advise patients on the importance of physical activity. It also sponsors more than 150 physical activity programs in more than 100 countries and aims to have at least one physical activity program in every country where it operates by 2015.

Pause for thought. A moment's reflection will allow you to question the real effect of these initiatives and/or the underlying motives. On the surface intentions are good – promoting physical activity and resultant health improvements – but could a multinational organisation with one of the world's leading brands do more? Consider the distribution channels that Coca-Cola exploit to transport their products to some of the world's poorest countries, such as Mozambique and Uganda, as well as the marketing know-how to sell them. Could the same channels, operations and logic be leveraged to distribute and ensure uptake of medicines in communities that could otherwise not access or be educated about them? A UK-led initiative, Colalife, aims to do just this and is planning a pilot project in conjunction with Coca-Cola to distribute simple medicines in AidPods in Zambia which is due to start by the end of 2011.

The question of concern surrounds the use of CSR as a superficial veil disguising otherwise unethical organisations. Is it a peripheral activity of most organisations, rather than a core one? Do these initiatives only achieve marginal and incremental improvements in areas such as global health? The key issue is then, if the notion of CSR fails, what can replace it?

Profit-Driven Development?

The concept of creating shared value is currently hailed as the most sophisticated thinking in the domain. It has been defined as 'policies and operating practices that

3 Du S., Bhattacharya C. B. & Sen S. (2007) Reaping Relational Rewards from Corporate Social Responsibility: The Role of Competitive Positioning. *International Journal of Research in Marketing*. **24**(3): 224-241.

4 Eisingerich A. B., Rubera G. (2010) Drivers of Brand Commitment: A Cross-National Investigation. *Journal of International Marketing*. **18**(2): 64-79.

5 Porter M. E., Kramer M.R. (2011) Creating Shared Value. *Harvard Business Review*. **89**(1): 62-77.

6 Acumen Fund (2011) WaterHealth International. [Online] Available at: <http://www.acumenfund.org/investment/waterhealth-international.html>

enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities in which it operates'[5]. It pays close attention to the intricate relationship between a firm and its environment, and their interdependency in the generation of prosperity. It insists that firms are not required to make trade-offs between their social impact and financial success; it instead emphasises the benefits that improving social impact can confer on profits.

Shared value is not a new guise for social responsibility or philanthropy, but is a new way to achieve economic success. It is a core strategic focus of firms, rather than a peripheral afterthought. And this is the key. The notion of CSR emerged out of a sea of stakeholders' expectations and some firms reacted. Shared value, on the other hand, is a proactive stance taken by firms as they seek to maximise their competitiveness in increasingly global markets. It is company-driven – all it requires is for firms to behave as firms – and herein lies the concept's greatest strength.

The benefits of a shared value approach can be enjoyed by economies of all development statuses around the globe. Unilever is aiming to get 1 billion people to add at least one more hand-washing occasion to individuals' current daily tally by 2015. In order to achieve this, they are rolling out the Lifebuoy brand of soap in tandem with hygiene promotion programmes across Africa, Asia, Latin America, Middle East and Turkey. This has helped them to enter new markets such as Nigeria and Latin America, whilst experiencing double-digit growth in the last four years. Meanwhile, hand washing at key moments throughout the day, according to a clinical trial conducted by Unilever in Mumbai, can reduce diarrhoeal disease by 25% and eye infections by 46%. Both society and Unilever benefit. Meanwhile, in more advanced economies, food and drink companies such as KFC and PepsiCo are refocusing their products to be more nutritious and less damaging to consumers' health, whilst capitalising on an emerging market of health-conscious consumers.

A new type of hybrid organisation has emerged, blurring the traditional distinction between for-profit and non-profit organisations, that best exemplifies shared value. WaterHealth International (WHI) is a for-profit firm that uses innovative water purification techniques to distribute clean water to millions of people in countries that include Ghana and India. By using a sustainable, low-cost model, water is distributed at a low price to some of the most needy communities. In India, it is estimated that 170 million people lack access to safe drinking water and the water-borne diseases that result cost an annual $600 million USD in medical treatment and lost economic output[6]. WHI sells clean water to its 250,000 customers for 4 Indian rupees per 20 litres that equates to less than $0.01 USD per litre[6]. This venture is effectively an example of social entrepreneurship. Although various definitions and nuances in the use of this term exist, it generally refers to the identification and pursuit of opportunities that can provide societal and environmental benefit.

No False Dichotomy

The importance of business leaders in embracing and promoting the shared value concept within their organisations cannot be understated. A tendency to focus on short-term performance in response to stakeholder pressure negates the likelihood that the potential long-term benefits of a shared value approach will be truly appreciated by executive teams. It is important not to create a false dichotomy between core profit-driven economic activity and shared value. It is not the distinction that should be emphasised, but the subtle connections, mutualisms and healthy co-existence. While this approach may not be applicable in every conceivable instance, the scope for implementation of this concept is immensely wide-ranging.

Government intervention is frequently employed in markets to allow them to function equitably. In order to promote socially responsible behaviour and/or a shared value approach, meaningful regulatory changes that incentivise firms to act accordingly may be an option. Appropriate regulation may focus setting clear and measurable social goals that stimulate innovation in a competitive environment[5].

The tentative evolution of the manner in which firms approach and think about their relationship with society provides a degree of promise for global health. In order for this promise to be realised, a facilitative environment must be created by regulators and governments. Yet the most important ingredient may be one that is inherent, and becoming increasingly pertinent, in markets tending towards globalism: competition. If so, this powerful force will compel, and even oblige, many firms to help develop society in ways that benefit all parties; improving global health to an undeterminable extent in the process.

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Climate Change & Water Resources

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Assessing the impact of climate change on water resources is fraught with difficulties. Although the general tendencies are relatively straightforward, the magnitude and direction of change are expected to vary strongly across spatial and temporal scales. A major issue is the discrepancy between the global scope of climate models, and the local nature of water supply systems. This difference in spatial scale often results in a low predictive capacity of impact models. However, climate change is only one of many pressures on water resources. Being able to predict future impacts of climate change surely is a bonus. But even if projections offer limited information, many pathways to improved sustainability exist.

If one buys asparagus in London, it is likely it was produced in Peru. The country has become the largest exporter of asparagus in the world, also exporting many other agricultural products, ranging from cotton to bananas. What is remarkable though, is that these products originate from a narrow strip of land along the coast, squeezed between the Pacific Ocean and the Andes. It is one of the driest places on earth with precipitation typically below 20mm per year, about 30 times less than London. The success of Peru's agricultural boom is rooted in water flowing from the nearby mountains. The orographic effect captures air moisture from the Pacific, while spill-over rains from the Amazon basin provide an additional source of water. Precipitation is stored in lakes, wetlands, and to a lesser extent in glaciers, from where it is released slowly and steadily into rivers and irrigation canals.

These water resources, however, may prove to be less reliable than they seem. Precipitation patterns over the Andes are governed by several large-scale circulation patterns, including the notoriously complex El Niño phenomenon. Little is known about the drivers of El Niño, but it is not unlikely that small perturbations will have strong local impacts on precipitation. Furthermore, increasing temperatures may alter the carbon content of wetland soils, affecting their water storage and regulation capacity. The fate of tropical glaciers is less uncertain, and does not forebode well for the local water resources[1].

Water, as much as energy, lubricates global economic activity and sustains our lifestyles. And thirsty we are.

Water, as much as energy, lubricates global economic activity and sustains our lifestyles. And thirsty we are. Although the minimal amount of water to survive is around three to four litres per person per day, a modern society uses magnitudes more. The daily water consumption in the UK is around 150 litres per person per day. Including the so-called virtual water, which is used to produce all goods and services we consume, the total amount of water required for a western lifestyle quickly

1 Bradley R. S. et al. (2006) Threats to Water Supply in the Tropical Andes. *Science*. **312**: 1755-6.

2 Bates B. C. et al. (2008) Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change. IPCC Secretariat.

3 Pall P. et al. (2011) Anthropogenic Greenhouse Gas Contribution to Flood Risk in England and Wales in Autumn 2000. *Nature*. **470**: 382-5.

4 Buytaert W., Cuesta-Camacho F. & Tobon C. (2011) Potential Impacts of Climate Change on the Environmental Services of Humid Tropical Alpine Regions. *Global Ecology and Biogeography*. **20**: 19-33.

rises to about 3m^3 per person per day. Managing water resources is about balancing this demand with a supply that is as affordable and sustainable as possible. Climate change may pose significant challenges to this.

An Uncertain Future

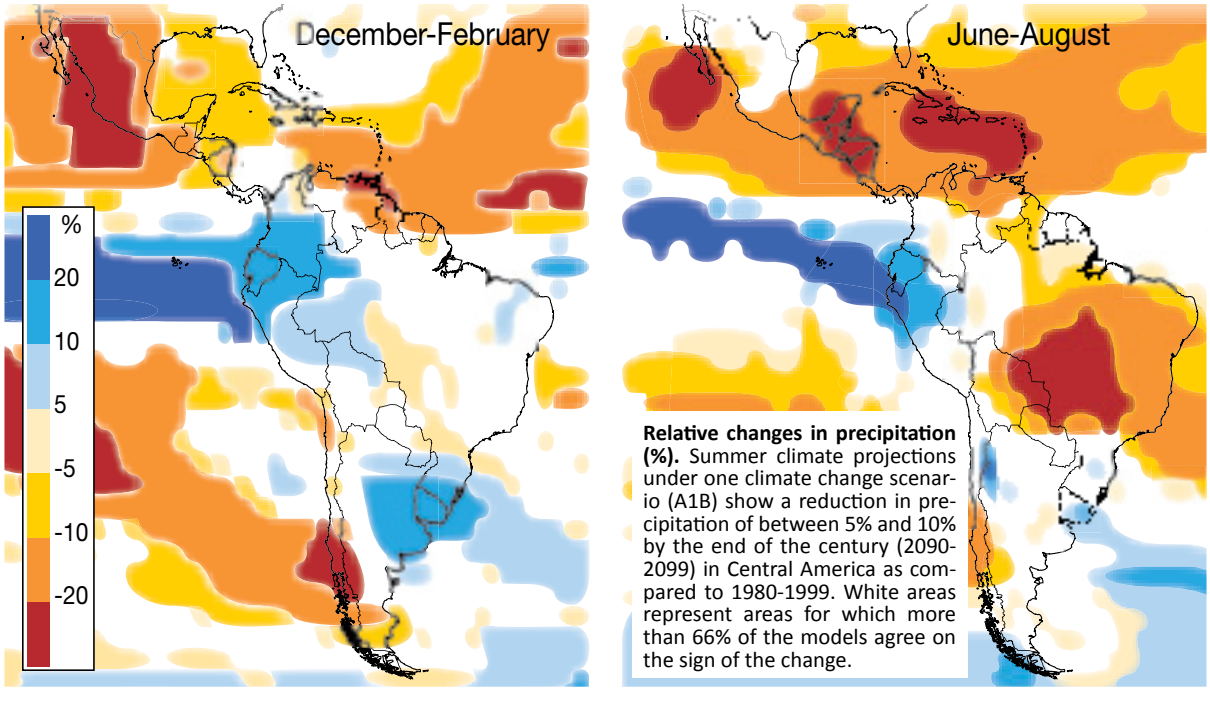
Any perturbation to the global climate will have profound impacts on the water cycle, and by extension on water resources

Indeed, the water cycle is a fundamental part of our climate. Incoming radiation evaporates water from the oceans and the land surface, forming clouds and determining energy fluxes. The exceptionally large latent heat of evaporation makes water vapour one of the main carriers of energy around the globe. It comes as no surprise, then, that any perturbation to the global climate will have profound impacts on the water cycle, and by extension on water resources[2].

Global climate change is expected to affect water resources in two fundamental ways: a change in the precipitation that replenishes freshwater resources, and a change in temperature that will cause more water to be evaporated from open surfaces and transpired by the vegetation. Combined, these are typically referred to as evapotranspiration. It is not just a result of the available energy; warmer air is also capable of storing more water vapour. From a water resources perspective, evapotranspiration is considered a loss. The part of precipitation that does not evapotranspire, either runs off the surface to rivers or infiltrates to recharge groundwater systems. Both rivers and groundwater aquifers can be exploited for water supply. The water vapour will also eventually condense and generate precipitation, but this may happen at a large distance from its source. So we can expect precipitation will rise globally, and this is indeed projected by global climate models. But behind these global trends lay strong spatial and temporal patterns, which may change in unpredictable ways.

Water resources are very vulnerable to local changes in precipitation patterns. Water is heavy, and therefore difficult to transport over large distances. As a result, water is sourced as close as possible to where it is to be consumed, which is typically within or close to the watershed. Especially in geographically complex areas such

Projections for changes in precipitation patterns are extremely complex, involving a high degree of uncertainty and large heterogeneity. In particular, for much of Mexico, southern Chile and the northeastern portion of the Bolivarian Republic of Venezuela, the decrease is projected to be between 10% and 20%. These changes in precipitation are important primarily because of their impact on water availability, re-supply of aquifers, maintenance of plant cover and agricultural yields in the region. (Source: IPCC Synthesis Report 2007)



Relative changes in precipitation (%). Summer climate projections under one climate change scenario (A1B) show a reduction in precipitation of between 5% and 10% by the end of the century (2090-2099) in Central America as compared to 1980-1999. White areas represent areas for which more than 66% of the models agree on the sign of the change.

Droughts, like this one in the Sahel region of West Africa, remain very hard to predict with current climate models

as mountains, the transport of water from one river basin to another is costly, as it requires digging tunnels and canals or even pumping water upslope. Hence, any changes in the spatial patterns of precipitation will affect water resources.

Temporal patterns of precipitation are expected to change as well. The higher energy content of the atmosphere will lead to a larger variability and stronger extremes. For precipitation this means longer and more severe droughts, as well as more intense precipitation events[3]. Both are bad news for water resources. Longer droughts will require more storage capacity, while intense precipitation events are more likely to damage and pollute water reservoirs and infrastructure than to help in replenishing them. At the same time, natural water stores such as vegetation, soils, wetlands and glaciers, are prone to degradation either by the changing climate itself or by other human activities[4].

In the importance of the local precipitation patterns lays a fundamental issue with predicting the impact of climate change on water resources. Global climate models do not represent them well. This has partially to do with the coarse resolution of current model implementations. The spatial discretization of these models is typically of the order of several 100km, which does not capture local precipitation processes. But the stochastic nature of precipitation also makes it harder to predict than large-scale circulation patterns.

Projections of climate change impacts on water resources tend to be riddled with uncertainties

There are several ways to deal with the coarse resolution of global climate models. Regional climate models can be implemented at higher resolution, but they require a lot of data and computing resources. Alternatively, statistical methods can be used to translate large-scale impacts to the local scale, but they rely strongly on the assumption that the relation between large scale and small-scale processes remains stationary. Taking these uncertainties into account, the range of climate projections tends to be very wide, up to the point that there is no agreement between different models on the direction of the change in precipitation. The situation is aggravated by the need for impact models that translate the climate projections into variables of direct relevance for water resources, such as streamflow and groundwater recharge. These models typically add significant uncertainty to the final model projections.

As a result, projections of climate change impacts on water resources tend to be riddled with uncertainties. The question then remains if and how such projections can inform adaptation strategies and policy decisions.

***No Regret* Policies**

Water managers usually turn to scientists for updates on the latest certainties. In the case of climate change, it might be wiser to turn to scientists for updates on the range of uncertainties for impact questions. Indeed, although climate and impact models are continuously improved, it is unlikely that the uncertainties in model predictions will decrease significantly in the near future. For every known model deficiency that is addressed, several *unknown unknowns* are discovered that complicate matters further. Still, adaptation decisions need to be taken now. The question is then whether prediction efforts riddled with uncertainties are helpful to optimise future water management. Developments in climate adaptation and water management research present a number of different approaches to uncertainties and decision-making.

Adaptive water management starts from the acceptance of irreducible uncertainties about future (climatic) changes

Adaptive water management starts from the acceptance of irreducible uncertainties about future (climatic) changes[5]. It moves away from a *predict-and-control* paradigm towards a more adaptive approach, with continuous learning and flexibility as key aims. In this sense, infrastructure investments with high sunk costs, irreversible decisions, or fixed management strategies prevent continuous learning and adjustment. A more effective way of dealing with unpredictability is to avoid control by creating the capacity to respond effectively to changing and unknown conditions, through developing strategies that are robust under the full range of possible future scenarios, through diversification of strategies or through strategies that can be flexibly applied when needed.

Robust strategies can be complemented with a focus on the key vulnerabilities of the water system and the services it provides, rather than on the optimal strategy. A related approach is the development of *no regret* interventions, defined as strategies that yield benefits regardless of future trends in climate scenarios. Given that climate is only one of the many uncertain processes, *no regret* strategies will favour measures that are beneficial for these other domains as well.

This approach is particularly useful in a water resources management context, where the uncertainties of other processes affecting water supply and demand tend to be much lower. For instance, the Andes have a long history of intensive land-use, with cultivation and grazing on steep slopes and large-scale deforestation leading to soil degradation. These processes are well known to affect water resources negatively. Soil compaction favours surface runoff, decreasing the recharge of groundwater aquifers and accelerating the hydrological response. The result is a river regime with higher peaks and lower base flows, increasing the risk for both flooding and water scarcity. At the same time, the population in the arid coast of Peru is growing fast. Lima, the second biggest desert city in the world, grew with a rate of over 2% per year over the last decade. With a degrading water supply and a steadily increasing demand, water resources are likely to run into trouble in the near future. Climate change may affect the velocity and magnitude, but will not change the fundamental trend. Hence, *no regret* strategies such as protecting ecosystems that provide clear benefits to water supply, such as high altitudinal wetlands, and reducing distribution losses and water consumption are obvious pathways to an increased sustainability.

These challenges are of course not limited to Peru. Tropical mountain areas are especially vulnerable because of their complex topography and climate, but water resources in many other regions are threatened by overexploitation and contamination. Managing these resources in a dynamic society with various quickly changing external pressures is challenging, and climate change will certainly increase this complexity. Being able to predict the potential impact of climate change, even with uncertainty, may help to reduce the options and inform decision-making. But even when uncertainties are high, there is a lot of scope in understanding how mankind currently interacts with the water cycle and exploring options to optimise this interaction.

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5 Pahl-Wostl C. (2007) Transitions Towards Adaptive Management of Water Facing Climate and Global Change. *Water Resources Management*. **21**: 49-62.

Beyond Big Ideas:
Searching for the Middle Ground in Agricultural Development

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Success in the agricultural sector can have wide reaching benefits for hunger and poverty alleviation, climate change mitigation and environmental resource management. However, the potential for agriculture to be part of the solution is often unmet due to polarisation and a focus on extremes that stifles genuine debate.

In advocating for the middle ground, we are seeking to provide developing country farmers with fair choices, informed by clear and strong evidence, to ensure their participation and success in agricultural development. The middle ground in this debate, however, is often difficult to reach and even harder to maintain. By moving beyond the dialectic of big ideas and utilising the successes of the middle ground, we believe agriculture can play a crucial role in tackling the *perfect storm* of difficulties that the world faces[1].

Back-and-forth disagreement between organic and conventional farming complicates development decisions

The world faces a myriad of challenges, including climate change, declining environmental resources, fluctuating food prices, a growing population and the ever-existent problem of huge numbers of poor and hungry people. Organic farming has been suggested as a way of increasing the resilience and sustainability of farming systems without damage to the environment. Despite this opportunity, the back-and-forth disagreement between organic and conventional farming complicates development decisions, and suppresses the potential that exists midway between the two ideas.

The debate is also subject to misconceptions and confusion, a common theme when extremes are vehemently supported. One oft-cited claim that does not stand up to scrutiny highlights the prohibition of pesticides in organic farming. In fact, organic farming does use pesticides, albeit not synthetic pesticides despite many synthetic chemicals being highly beneficial (e.g. antibacterial drugs). In contrast, a range of natural chemicals including arsenic and nicotine are recognised as significantly damaging[2]. The acceptance of such ill-founded arguments can further complicate genuine discussion and analysis.

Both in the developing and developed worlds, the discussion surrounding Genetically Modified (GM) food is also representative of the reactionary and regressive actions that prevent genuine and beneficial innovation in the agricultural sector. The GM debate has become uneven, devoid of scientific content and intrinsically negative, stoked by the ill-founded hysteria of the media and general public. A clear balance is necessary, with GM food recognised as being neither apocalyptic nor a technological panacea.

1 Sample I. (2009) World Faces Perfect Storm of Problems by 2030. (Quoting Beddington J. at Sustainable Development UK Conference 2009).

2 Taverne D. (2010) The myths of organic farming. *World Agriculture*. **1**: 43-5.

3 Trewavas A. (2001) Commentary: Urban myths of organic farming. *Nature*. **410**: 409-10.

4 Spindler A. (2007) Organic vs. Conventional: What Do Experts Say? [online] Available at <www.cnn.com> [Accessed 13 April 2007].

5 Elliot S. L. & Mumford J. D. (2002) Organic, Integrated and Conventional Apple Production: Why Not Consider the Middle Ground? *Crop Protection*. **21**: 427-9. (Quoting Mayr E. (1997) This Is Biology: The Science of the Living World).

In fact there are some aspects of farming that the general populace accepts as fact that can actually be counterbalanced by science. For example, conventional large monocultures are thought of as unsustainable, unstable and bad for the environment, and in many cases this is true. However, there exist certain plant species that rely on monocultures to survive, such as phragmites, wild wheat and mangroves. Not only are there very few certainties in science but our understanding of ecological systems is constantly changing, making extremes difficult to justify[3].

The GM debate has become uneven, devoid of scientific content and intrinsically negative, stoked by the ill-founded hysteria of the media and general public

Ideologies Can Be Blended

The way forward, after decades of discourse, appears to be the blending of the two disparate ideologies. Although organic farming is commonly thought of as being holistic (and conventional farming as reductionist) this is false, given that organic farming routinely dismisses certain farming aspects. As an alternative and perhaps the elusive middle ground, integrated farming, combining traditional farming with selective use of modern technology, has emerged. Detailed analyses of site-specific conditions, requirements and environmental (as well as output) oriented goals are emphasised in integrated farm management, as too are pragmatism and flexibility. Indeed, conventional mixed farming in smaller plots and intercropping, can benefit wildlife to the same degree as organic farming, but at a lower cost to the consumer as conventional yields are maintained. Organic farming has been found to yield 75 to 90% the amount of output from conventional farms[4].

The middle ground in this case takes part of its ideology from organic farming, and its four principles of ecology, health, fairness and care, and part from the cost-effectiveness of conventional farming to the end that the majority benefit rather than the elite. As reaffirmed by Elliot and Mumford, 'the debate is polarised yet the history of science is replete with such polarities resolving themselves somewhere in the middle'[5].

Science Must Be There to Provide Balanced Evidence

It is not only organic farming that is often argued as an alternative to conventional farming. Conservation farming, or zero-tillage farming, is advocated as a way of addressing widespread soil erosion and depletion of

An elusive middle ground combining traditional farming with selective use of modern technology has emerged

organic matter that more conventional farming systems, reliant on the plough, can induce. Some of the benefits conservation farming is believed to bring include increased rainwater use efficiency, more stable yields, lower production costs, soil carbon sequestration and conservation, and higher labour productivity. Yet there is very little scientific evidence to support these claims and the widespread belief that this system can help a diverse range of smallholders is unclear.[6]

In reality, conservation farming has been shown to be negative for yield of clay-poor, structurally weak soils in (semi-) arid areas, notably areas that are widespread throughout Sub-Saharan Africa. Where conditions are humid, have high rainfall or poorly drained soils, the reduction in water loss brought about by conservation farming can lead to waterlogging and lower yields[7]. In this case science is important in helping to decide where conservation farming is and is not appropriate, as opposed to attempting to *prove* which argument is correct. Ultimately, science must be used to inform and educate, and not to polarise.

Science Is Not the Only Consideration

Scientific evidence can be used to clarify many conflicting arguments, reflecting the variety, unpredictability and irregularity of the natural world, and can therefore not be solely relied upon to resolve debates. Furthermore, it is not only the scientific evidence base that is relevant to debates surrounding the appropriateness and adoption of conservation farming: socio-economic issues and personal farmer preference must also be considered. For example, crop residues or mulch are preserved on the field under conservation farming but mulch is typically not conserved on smallholder farms: it may be burned to reduce the incidence of pest outbreaks, used or sold as livestock fodder, or even eaten by termites. The decision to conserve mulch for crop cover will include consideration of the benefits and costs of these potential uses.

Indeed the concept of conservation farming may be too idealistic in that smallholder farmers cannot always commit to the investments needed to make large changes to their systems, particularly given the risk of failure, nor can they readily access land, labour and other inputs. Low adoption can also be attributed to the vast and simultaneous changes to the farming system smallholders must carry out. Extremes, perhaps, are only the content of debates, rather than practiced, given their transformative requirements.

Sometimes Extremes Are False

In some cases the extreme views held in agricultural development debates are false

In some cases the extreme views held in agricultural development debates are false. The central role of agriculture in the development process intrinsically links the concept to the political and economic spheres and their associated debates. An important question therefore focuses on the role of the state versus the market in promoting and maintaining agricultural development. Markets are regarded as facilitating competition and innovation through incentives, and as key promoters of economic efficiency and individual participation. The state, by contrast, is concerned with redistribution, market regulation and providing an enabling environment for civil society and the private sector to flourish.

Although the above are *ideal type* concepts, the divergence between support for state governance versus a complete reliance on markets is false. Markets cannot function without the regulating and facilitating role of the state and the way forward may again be a blending of ideologies, as recognised by the increased utilisation of public-private partnerships. The former partner providing an enabling environment for investment and protection for the most vulnerable members of society, the latter bringing funding, business acumen and the goal of profitability, aiming to ensure the sustainability of new markets.

6 Giller K. E. et al. (2009) Conservation Agriculture and Smallholder Farming in Africa: The Heretic's View. *Field Crops Research*. **114**: 23-34.

7 Rockström J. et al. (2009) Conservation Farming Strategies in East and Southern Africa: Yields and Rain Water Productivity From On-Farm Action Research. *Soil and Tillage Research*. **103**: 23-32.

8 Poulton C. et al. (2004) Competition and Coordination in Liberalized African Cotton Marketing Systems. *World Development*. **32**: 519-36.

9 Wiggins S. (2009) Can the Smallholder Model Deliver Poverty Reduction and Food Security for a Rapidly Growing Population in Africa? (Background paper: How to feed the World in 2050. Rome).

10 Conway G. (2010) On Being a Smallholder. Conference on New Directions for Smallholder Agriculture, International Fund for Agricultural Development. Rome. (25/01/2011).

Conservation farming has been shown to underperform in structurally weak soils in semi-arid areas such as here in Ethiopia

All Options on the Table

Central to debates regarding agricultural development is the challenge of increasing incomes for smallholder farmers as a route out of poverty. Large-scale farming is often believed to be the most applicable for poverty reduction due to the economies of scale it benefits from. This leads to lower production and transaction costs per unit of food produced. Large-scale farming has been successful in developing such industries as fruits, vegetables and intensive pigs and poultry, principally industries that require large investment[8]. Smallholders, however, can be highly efficient, producing more per hectare than large farms and there are some instances where large farms have not been successful[9]. In this case evidence supports both extremes, but under different conditions. The key to agricultural development is choosing the most appropriate option in each circumstance[10].

Extremes, perhaps, are only the content of debates, rather than practiced, given their transformative requirements

The Middle Ground

Focusing on extremes can be harmful to advancement in agricultural development. This progress is crucial for the 400 to 500 million smallholder farmers in the world for whom increasing productivity, stability and equitability is crucial to their livelihoods. Impediments to agricultural development can be attributed in part to the relatively weak link between the academic sphere and the business sphere. The former thrives on debate while the latter is focused on action. Better communication channels through organisations that straddle the two spheres are needed.

If agricultural development is to rise to the challenge of feeding a population of around 9.2 billion by 2050 all actors need to work together alongside civil society. Academia will play a key role in educating the public and private actors, through a balanced display of evidence, while the private sector along with government and NGOs can effectively implement prescribed courses of action after evaluation of socio-economic factors. To do this successfully all parties will need to agree on the best course of action. The most effective method of attaining agreement is through finding the middle ground, a strategy we believe is often the most beneficial.

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Conflict Minerals in the DRC

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Global consumer demand for mobile phones, laptop computers and other electronic equipment is increasing rapidly. The manufacture of these devices relies on minerals such as tin, tantalum, tungsten, and gold. A significant deposit of these ores is found in the Great Lakes region of Africa, with the Democratic Republic of Congo (DRC) alone holding an estimated 64% of world coltan reserves[1], the mineral from which tantalum is refined.

Mining and quarrying are key industries to the DRC, representing 8.6% of GDP in 2006[2]. At the same time, the sector suffers from many problems; including corruption, the presence of child and forced labor and very low safety standards. Armed groups control mining operations in eastern DRC and funds raised from mining are fueling the ongoing civil war in the region.

With clear analogies to the blood diamonds of Sierra Leone and Angola, the US has taken steps to force importers to disclose whether any of these conflict minerals have been included in their products. Yet will this measure have the desired effect or instead result in plummeting prices and increased poverty for vulnerable Congolese miners?

The DRC is the site of the largest conflict in modern African history. In the decade 1998 – 2008, the war and its aftermath had claimed the lives of an estimated 5.8 million people, and violence still persists in the region today.

The eastern region of DRC, specifically the provinces of North and South Kivu, is home to a wealth of natural resources. Armed groups involved in the conflict control many of these mines, and revenues from mining activities represent a significant source of finance to these groups, fueling the ongoing conflict. In 2009, military forces – either the Democratic Forces for the Liberation of Rwanda (FDLR) or the Congolese army – controlled 12 of the 13 major tin, tantalite and tungsten mines in the eastern DRC[3].

Whilst being rich in mineral resources, this part of DRC has one of the poorest human rights records in the world and is plagued by violence. The NGO Human Rights Watch reported that the total number of sexual violence cases registered at health centers in North and South Kivu exceeded 7,500 by September 2009[4].

In response to the problem of conflict minerals, the US has passed the *Dodd-Frank Wall Street Reform and Consumer Protection Act*. Included in the act is a clause that requires US companies to disclose whether any conflict minerals, sourced from the DRC or its neighbouring countries, have been included in their products.

Whilst the act has good intentions, it may result in smelters and producers withdrawing from the DRC, which would jeopardize the ability of an estimated 750,000 to 2,000,00 artisanal miners to earn a living and support their dependents.

Miners, Négociants and Comptoirs

Mining in eastern DRC is small scale – in 2008, there were no industrial mines in the region[5]. Minerals are quarried by hand in open cast mines, and moved by artisanal

1 United States Government Accountability Office (2008)

2 OECD (2008) African Economic Outlook: DRC.

3 Blore S. & Smillie I. (2011) Taming the Resource Curse: Implementing the ICGLR Certification Mechanism for Conflict-prone Minerals.

4 US Department of State (2009) Human Rights Report on DRC.

miners from the mines to small villages. Local militia groups stop miners at checkpoints along the way, and demand payment in minerals or cash for safe passage. Due to the lack of infrastructure in this part of the Congo, miners travel on foot, carrying heavy loads for long distances.

Once at the village, local dealers or négociants purchase the minerals. Miners themselves are poorly paid, receiving around $10 per kilogram of mineral ore – a fraction of its market value[6]. In the regional capitals of Bakuvu (South Kivu) or Goma (North Kivu), négociants sell the minerals on to traders or comptoirs. These comptoirs collect ore from a large number of négociants, mixing it to perform some basic processing. The processing centers are located in DRC and in neighboring countries like Rwanda.

Comptoirs have links to international trading companies, who transport the ore to smelting sites in the Middle East, South and East Asia. Once the ore has reached smelting sites, it is mixed with ore from Australia, Canada and Brazil. The ore is refined to extract metals that are then are sold onto the world market.

By forcing companies to disclose their use of conflict minerals, it is expected that they will clean up their supply chains in an effort to avoid negative public attention and consumer boycott

The above supply chain lacks transparency, presenting many opportunities for diversion and corruption. In 2007, it was estimated that 14,000 tons of cassiterite arrived into Goma from the Walikale region. This ore had a market value of $88.7m, but only $800,000 was estimated to have remained in the area where it was mined. The lion's share of the wealth generated from the mining activities was accrued to military, business and political leaders[7].

Dodd-Frank

On 21 July 2010, President Obama signed the *Dodd-Frank Wall Street Reform and Consumer Protection Act* of 2010 (the Act) into law. Section 1502 of the Act specifically focuses on additional disclosure requirements for companies who source conflict minerals from the DRC and its neighboring countries.

The inclusion of section 1502 was due to an understanding within US Congress that the exploitation and trade of conflict minerals is fueling the war in DRC. By forcing companies to disclose their use of conflict minerals, it is expected that they will clean up their supply chains in an effort to avoid negative public attention and consumer boycott.

The ruling applies to companies that file reports with the Securities and Exchange Commission under the Exchange Act and use conflict minerals in the manufacture of their products. The definition of a qualifying company is broad, but at a high level it would include companies operating in the electronics, communications, aerospace, automotive, consumer goods, jewellery, toy, industrial machinery and apparel industries.

Whilst the Act has been signed into law, specific rules relating to section 1502 have not been released at present. These are expected towards the end of 2011. As a result, it is not possible to determine specific implications of the Act, but it is possible to consider some potential impacts.

Disclosing publically that your products contain minerals that have potentially funded militia groups in eastern DRC will be deeply unpopular with companies for fear of consumer boycott and reputational damage.

As demonstrated by the description of mining operations in eastern DRC, the supply chain for conflict-prone minerals lacks transparency. Companies may feel that the only way to ensure that the minerals they use are conflict free is to stop sourcing from the DRC and its neighboring countries entirely.

If a company does decide to continue sourcing from the DRC, it will have to issue a Conflict Minerals report. Issuing such a report not only exposes a company to the risk of reputational damage, but it also represents a significant expense. This will further push companies to withdraw from DRC and its neighboring countries.

Withdrawal from DRC would have a significant impact on the estimated 750,000 to 2,000,000 artisanal miners working in DRC. It would not lead to the cessation of mining

5 ITRI (2008) Factsheet on Cassiterite production and trade in DRC.

6 Blood Coltan (Documentary film) (2008).

7 The Extractive Industries Transparency Initiative (EITI) & Artisanal and Small-Scale Mining (ASM) (2007).

8 UNDP Human Development Index (2010).

activities, but it would result in the prices for minerals from the DRC to drop as demand plummets. Considering that DRC is ranked 168th out of 169 in the 2010 Human Development Index[8], any loss of income will hit the country hard.

Transparency

Withdrawing from the DRC will allow companies to clean their supply chains, but it does not address the root cause of the problem. As a result, a boycott does not provide a sustainable solution to the issues associated with conflict minerals.

All stakeholders in the DRC mineral trade need to work together to develop long-term solutions. Stakeholders include governments of countries that produce, process and transit conflict prone minerals, the UN, comptoirs and négociants in DRC, metal smelters, companies purchasing refined minerals, investors of those companies, civil society in DRC and its neighboring countries, and the international civil society.

The obvious first step would be to work towards lasting peace in eastern DRC, and de-militarize the region – yet, as with all African conflicts, to say this is complex is an understatement. One of the main drivers of the extortion is the large military presence in the region. Soldiers loyal to both FDLR and the DRC government often go months without pay, and therefore support themselves through the mines.

The second step would be to create more transparent supply chains for conflict-prone minerals. To ensure that the funds used to purchase minerals do not end up the in hands of armed groups, it is essential to create a system to track minerals from mines where they are extracted through to the smelters where the ores are refined, and on to the companies that use the metals in their products.

Such an approach was largely effective in stemming the flow of blood diamonds under the Kimberley Process Certification Scheme (KPCS). Under this scheme only rough diamonds that are transported in sealed packages with accompanying certification may cross international borders. 75 countries worldwide are signed up to this scheme.

An analogous system, currently being piloted by the International Conference on the Great Lakes Region (ICGLR), involves identifying mines that are not controlled by armed groups and certifying minerals that have been mined at these sites. The certified minerals are placed in tamper proof containers and tracked throughout the supply chain. The regional certificates serve as a guarantee that the minerals were mined under acceptable conditions, in areas free from conflict, and have exited their country of origin legally, with all dues and taxes paid.

It is the demand for consumer electronics that is driving the extraction of minerals from the DRC

The proposed system is highly complex, involving significant investment from many of the stakeholders in the mineral trade, but it does offer an opportunity to create a more transparent and just supply chain for conflict-prone minerals.

If companies decide to withdraw from the DRC in response to their obligations under the Dodd Frank Act, a system such as this would be harder to implement as a major stakeholder in the mineral trade has effectively chosen to bury the issue of conflict minerals.

Blackberry or iPhone?

It is the demand for consumer electronics that is driving the extraction of minerals from the DRC. Sales of mobile phones worldwide reached 1.6 billion units in 2010, up 32% from the previous year[9]. In the same year, 352 million computers were sold globally, a 14% increase on 2009[10].

The supply chain for conflict minerals is long and opaque, which means that consumers are often unaware of the issues associated with their purchases. Educating consumers about the issues described in this article will result in greater pressure on companies like Apple and Nokia to address the problems associated with conflict minerals.

Yet there are no quick fixes, all stakeholders in the DRC mineral trade need to work together to develop long-term solutions. It is a combination of action by government, enterprise and the consumer that will reject conflict-prone minerals and refuse to fund terrorism and torture.

Do you have blood on your hands?

Gordon Hewitt is a postgraduate student at the MSc Environmental Technology, Imperial College London. He also was a 2011 summer intern at the United Nations-backed Principles for Responsible Investment Initiative.

9 Gartner, Inc. (2011) Competitive Landscape: Mobile Devices.
10 International Telecommunication Union (2011).

Toward a Distributed-Power World

Renewables and Smart Grids Will Reshape the Energy Sector

Frank Klose, Michael Kofluk, Stephan Lehrke & Harald Rubner, The Boston Consulting Group

Europe's power utilities are entering a period of great uncertainty and change, with seismic shifts transforming the energy landscape. Energy security concerns and related worries about price and political volatility are driving governments across Europe to reexamine the source of energy supplies. Meanwhile, the climate imperative has moved up the agenda, with European policymakers expressing clear political support for the move to a low-carbon society.

This paper focuses on a potential development for European power generation: prospects for a distributed-energy system in which decentralised and renewable-power generation eventually displaces conventional power plants, reducing the balancing role of the transmission grid and shifting intelligence to the distribution grid through the creation of local and regional energy systems. This scenario is disruptive because it transforms many of the industry's common beliefs. It does create many more opportunities for business model innovation. However, it also presents severe challenges to the leading incumbents.

The regulatory landscape is evolving rapidly. European Union targets for 2020 aim at reducing greenhouse gas emissions by at least 20 percent from 1990 levels, applying energy-efficiency approaches to cut usage by 20 percent compared with projected levels, and having 20 percent of EU energy consumption come from renewable sources – collectively known as the 20-20-20 targets. With political will gathering behind these ambitious targets, renewable energy is entering the portfolios of power generators at a rapid pace. Promoted by a wide range of subsidies, renewable energy is claiming increasingly large proportions of the power supply. Solar power, as well as onshore and offshore wind power have emerged as prominent sources of energy, with many – such as solar – coming from distributed-generation plants.

At the same time, the old centralised systems that deliver a one-way supply of electricity to consumers will be increasingly displaced by localised generation, and the future power landscape will include a larger proportion of small-scale sources, such as cogeneration through combined heat and power (CHP) plants. Moreover, some energy will be produced by consumers themselves, through a distributed network of power that incorporates everything from rooftop wind turbines and solar panels to CHP microplants (micro-CHPs) in consumers' cellars.

Prospects for a distributed-energy system in which decentralized and renewable-power generation eventually displaces conventional power plants

In the process, conventional power generation will assume a less prominent position in the hierarchy of energy technologies, with centralised power plants facing lower use as the demand for and availability of cleaner sources increase. Meanwhile, power utilities will be required to strengthen their role in balancing increasingly complex ranges of fluctuating energy sources, especially renewables and microgenerated power.

Utilities will also need to develop new business models to maintain the profitability of traditional power generation. These will include increasing the flexibility of

their generation fleet, or power plants, to enable them to profit from price fluctuations and, potentially, from fees for providing backup capacity rather than from hours of power sold in the day-ahead market. Utilities must act to bolster revenues as their traditional-generation business model fades with the reduction in annual running hours of power plants. They will also need to invest in smaller decentralised technologies, *smart* flexible power plants, and sophisticated energy-management systems so that they can capitalise on the increasingly diverse range of power sources coming into play.

Furthermore, the IT sector is invading the energy sector's territory, particularly through a further transformation in how power is managed – the implementation of smart grids. Smart grids (which use digital technology to allow greater visibility of energy use and power flows), supported by smart meters, allow bidirectional communication between utilities and customers, facilitating a two-way flow of electricity. Smart grids therefore create the possibility for more flexible pricing mechanisms and the opportunity for both private and corporate consumers to contribute to the power supply as *prosumers*, who switch between net production and net consumption of power.

What Will Disruptive Power Changes Look Like?

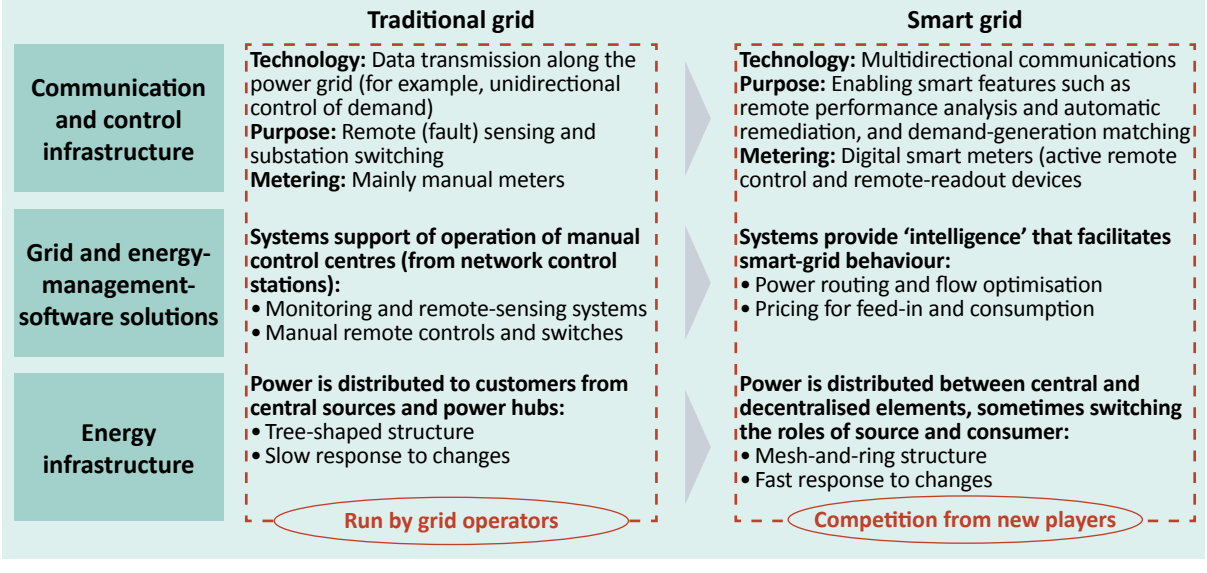
Today, the electricity value chain is structured as a sequential, centrally organised process – from generation to retail. Large power plants are scattered across Europe's major centers of consumption, feeding power through the grid. Business models of utilities have been based on the premise that utilities provide a simple commodity, with operational strategies focused on reliability of supply, one-way flow of power from provider to consumer, and energy sales that use simple *all-you-can-eat* pricing structures for private customers.

An increasing share of renewable and other forms of decentralized energy is entering the power supply

This model is no longer sustainable. The political drive toward cleaner energy is creating barriers to the construction of new power plants. These barriers are driven both by resistance to new large-scale plants and the challenges to profitability resulting from fewer expected running hours. Furthermore, power companies are experiencing a loss in demand as factories cut their output in the face of recession. Demand is being further constrained by the continued focus of both governments and businesses on increasing gains through energy efficiency.

At the same time, an increasing share of renewable and other forms of decentralised energy is entering the power supply. We project major growth in wind power, solar-photovoltaic (PV) power, and CHP (especially small-scale plants) in the European Union's 27 member states (the EU-27) by 2020, and that decentralised generation will account for as much as 40 percent of the installed base by that date.

The smart grid challenges the role of incumbents in every layer of technology and infrastructure



BCG has developed a *distributed-world scenario* to demonstrate the impact on traditional power generation. This scenario illustrates one possible power landscape, as well as the technical advances, business model innovation, and political support required for its realization. The scenario is based on the following four assumptions:

- By 2020, the EU-27 will be increasingly functioning as a single market for power. Northwestern Europe will be acting as a de facto *copper plate* (which assumes an unrestricted power network across Europe), with countries physically linked by high-voltage transmission lines, or interconnectors. The rest of Europe will become more connected, too.
- Renewables and other forms of decentralised generation will be backed by strong regulatory support in the form of feed-in tariffs for CHP and renewables, which, in the current regulatory environment, are systems often categorised as *must-runs* on the left of what is called the merit order curve – which ranks power generation technologies according to their production efficiencies. The associated costs have to be covered by consumers' power bills.
- Flat power demand will be driven by further deindustrialisation in Europe and concentrated efforts to increase energy efficiency.
- There will be a moderate rise in commodity prices. As a result, conventional power generation will move to the right of the merit order curve. By 2020, renewable technologies and CHP units could jointly provide more than 50 percent of all electricity consumed within the EU-27. Nuclear plants would provide most of the remainder, with conventional fossil-fuel plants being replaced in the most valuable part of the supply curve by renewable sources and distributed-generation plants, which benefit from subsidies. This would put utilities' conventional-generation business model under pressure.

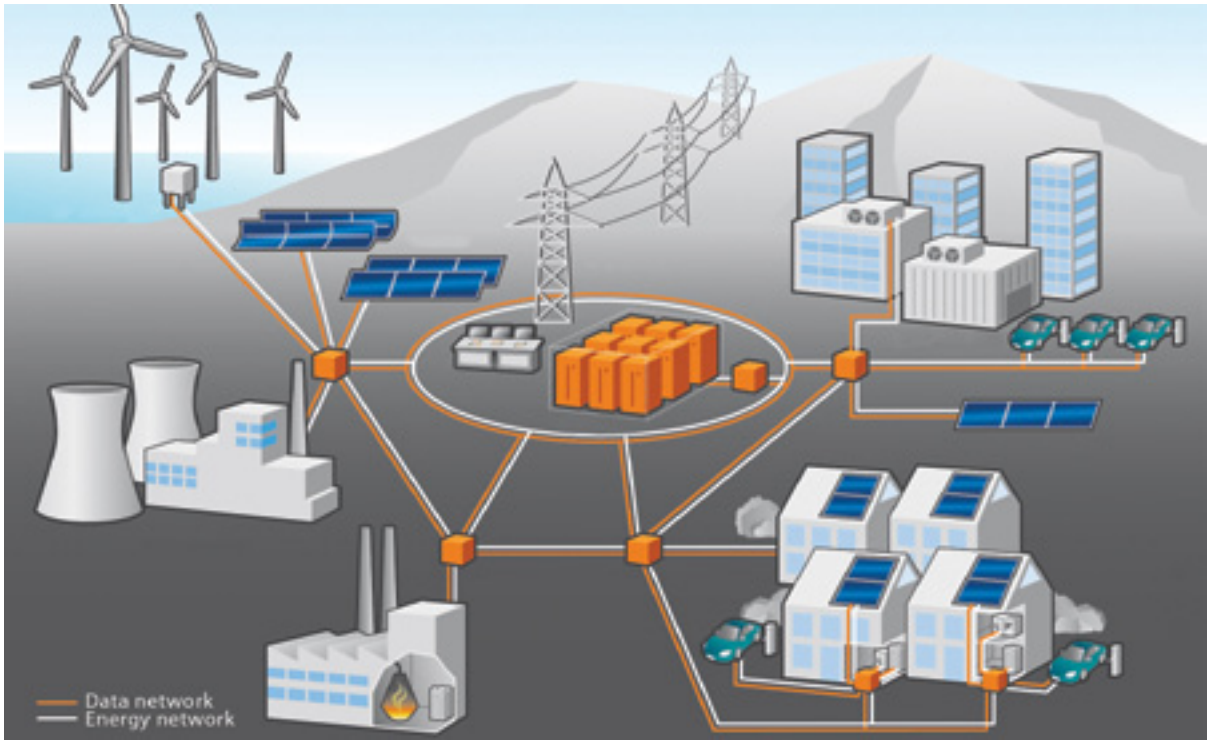
What is clear is that business as usual is no longer an option. To sustain the status quo, vibrant growth would need to reemerge swiftly in Europe (something few economists are predicting), and governments would have to renege on their pledges to provide preferential feed-in tariffs to renewable technologies and distributed-generation developers. In most scenarios – even if this is delayed by a few years – the landscape is set to change dramatically, leaving only a very small role for utilities' business models in their present form.

Some of these renewable-energy sources present operational challenges, however. The forces of nature (wind power and solar PV) are intermittent, providing a variable energy supply with both predictable (day-night and seasonal) fluctuations and unpredictable fluctuations driven by medium-term weather conditions and forecast errors. Such intermittency will require complex power-balancing mechanisms that use alternative capacity – including conventional generation and energy storage – to fill supply gaps when production from renewables is low. Because the need for conventional power generation is inconsistent and often unpredictable, a highly flexible generation fleet will be needed until other balancing mechanisms are fully implemented. This will favour gas-fired power plants, which usually have much higher ramp-up and ramp-down speeds compared with, for example, standard coal-fired power plants.

A critical tool will be the smart grid – a distribution grid that can also actively manage fluctuating supply and demand using grid and IT-infrastructure and optimisation software

A critical tool will be the smart grid – a distribution grid that can also actively manage fluctuating supply and demand using grid and IT-infrastructure and optimisation software – supported by smart meters, which allow for real-time bidirectional communication between the customer and the power supplier. Distributed generation will rely on upgrading the grid and applying digital technology to it, including monitoring devices to control and regulate voltage, smart switches that regulate production and consumption to avoid major breakdowns, communications and information devices that orchestrate virtual renewable- and nonrenewable-power sources, and, finally, smart meters to better align varying consumption with production volumes.

Applying IT to the system will be essential for managing the two-way flow of power and facilitating demand-side management, which encourages users to modify their own electricity use. Smart grids will also allow for local and regional supply-and-demand optimisation and the dispatch of local generation capacity to fill the supply gaps at times when production from renewable



Smart grids allow bidirectional communication between utilities and customers, facilitating a two-way flow of electricity

sources of energy is low. When it comes to managing new distributed sources of energy, most experts agree that the smart grid will be among the main enablers in a distributed world. However, the value of a smart grid will depend on business model innovations that accompany developments in this area.

The Hardware Needed

At one time, discussions about the infrastructure supporting the delivery of energy to its users were confined to large physical assets, such as transmission lines. Today, however, new and different forms of technology, such as energy storage devices, are part of the picture. At the same time, IT is making its entrance into the energy sector – a trend that is likely to radically alter the way power management is conducted.

In a world of wireless technology and cloud computing, transmission lines might look like old-world infrastructure. Yet they remain essential to energy delivery. On the one hand, the need for transmission grid capacity will be reduced as more and more energy is generated locally. On the other, huge generation assets such as those in the North Sea make sense only if the respective transmission capacity is available to transport the energy to the centers of consumption. This will require surrounding countries to make large investments in high-voltage transmission grids.

IT, which is one of the most significant forms of infrastructure supporting a low-carbon world, has not traditionally been associated with the power generation sector. Smart grids carrying data and communications serve three main functions:

- Smart distribution grids are able to manage the increasing share of reverse-flow power resulting from a high proportion of electricity generated on a decentralised basis.
- Armed with wireless digital technology, the humble electricity meter becomes a powerful tool in energy management, facilitating real-time monitoring of consumption and allowing utilities to use pricing signals to influence that consumption.
- By dispatching and optimising distributed generation and consumption, smart grids can compensate for imbalances in the distribution grid.

Without the abilities of the smart grid, it will be impossible to expand distributed-generation capacity to include these microsources. As with renewables, distributed generation is accompanied by unpredictable short-term variations in the supply-demand balance of the

distribution grid. Experience indicates that if the share of fluctuating power generation rises higher than approximately 20 to 25 percent of produced power, there could be problems for the stability of the grid. To operate a large-scale demand-side management business, therefore, requires that information about consumption be closely integrated with data about the grid status.

Despite its central role in facilitating demand-side management, the smart grid has its limitations when it comes to balancing fluctuating power sources. Pricing incentives can persuade consumers to shift some of their demand to off-peak periods, but most loads cannot be deferred for long periods of time. The success of demand-side management relies on human behavior and changes in consumption patterns, which depend on whether pricing incentives are sufficient to encourage consumers to use power at less convenient times of the day or night.

For this reason, another technology – electricity storage – will be needed to assist in balancing intermittent power sources. At present, few credible forms of the technology have emerged, largely because the financial incentives for aggressive investments are absent. However, the role of energy storage as a mechanism that can compensate for power source fluctuations is becoming clear.

New Business Models

As the traditional-generation business model fades and power plants' run time decreases, utilities need to identify and design new business models that can deliver additional revenue. It is not yet clear what kind of business opportunities such developments as the smart grid present for utilities. Nevertheless, these companies must consider how they can participate in the new systems, because in the meantime, a new set of players is ready to enter the energy sector, capture value, and eat into market share.

New entrants to the power sector include players in the IT sector, with smart-grid and other energy start-ups joining established companies in the rush to capitalise on changes in the power landscape. These companies are focused on systems that provide the *intelligence* needed to facilitate smart-grid behavior, including power routing, flow optimization, and pricing for feed-in and consumption. Some of the new players are also managing power distribution between centralised and decentralised producers, enabling quick responses to load changes. The smart-grid playing field is different from that of a traditional grid, making the entry of new players very likely.

The question is whether utilities can build on their strengths and take a slice of this market. The abilities required to do so are not yet among the core competencies of utilities, so it remains to be seen how great a share of the value-added part of the power sector the utilities can capture. Meanwhile, particularly as value creation flows downstream, the next few years are likely to see nontraditional energy companies making further inroads into the power sector, putting pressure on incumbents that lack the flexibility needed to introduce new business models.

If utilities do not want to be crowded out of the power generation market and marginalised as mere downstream commodity suppliers, they need to act now

The emergence of a distributed-energy landscape will have important implications for all parties, from utilities, gas companies, and technology providers to transmission system operators and distribution system operators. They face risks in not taking action, but there are opportunities for those that move forward. If utilities do not want to be crowded out of the power generation market and marginalised as mere downstream commodity suppliers, they need to act now. The evolution of a decentralised power landscape will not only change the relationship of the different energy-sector players to the electricity value chain, it will also change the very structure of that value chain.

Excerpt from "Toward a Distributed-Power World. Renewables and Smart Grids Will Reshape the Energy Sector", orginially published on www.bcgperspectives.com.

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Risk & Uncertainty in Climate Change & Business Innovation

Anna Plodowski, Imperial College Business School

It has become commonplace in political and economic discourse to talk about climate change in terms of risk. Policy and business responses often express clear targets, for example in reducing emissions. This assumes that reaching such an emissions target will mitigate certain environmental effects and avert runaway climate change. It also implies that the business response can only be enacted if it is focused around quantifiable risks.

However, this article argues for a new paradigm – that climate change needs to be understood in terms of uncertainty as well as risk, and that doing so will draw in new players and enhance business opportunities and innovation.

Some aspects of climate change are widely agreed upon by scientists, others are subject to continuing discussion and yet more are 'not well understood'

Risk is an estimation of how likely a future event is to occur that is based on understanding past events and applying that understanding to the future. Uncertainty is different. It relates to a more fundamental state of not being able to know some things in advance, even if they are important. When policy makers and business leaders talk about climate change in terms of risk this reflects assumptions that we already keep track of all the important causal factors of climate change and the ways these factors interact. Hence, this assumes we are capable of predicting future climate change and its effects. However, our scientific understanding is not so clear cut.

Climate Change, Science and Uncertainty

The Royal Society (2010) report *Climate Change: A Summary of the Science*[1] showed that while some aspects of climate change are widely agreed upon by scientists, others are subject to continuing discussion and yet more are 'not well understood' or fundamentally uncertain. Based on the scientific evidence to date, it would appear that we need to be able to respond to climate change both in terms of risks that we know or can estimate, and uncertainty that we don't know and can't estimate.

It can be argued that scientific research functions to reduce our uncertainty, by discovering laws about phenomena or at least estimations of quantifiable risks. However, scientific research cannot always function to reduce uncertainty. For example, the lack of data in some past phenomena can be a major shortcoming of any scientific model. The fact that crucial data from the distant past may be missing means that we will never be able to modify our understanding to incorporate these potentially important phenomena. Even if we have complete knowledge of the past, we cannot readily model evolution of complex systems in

1 Royal Society (2010) Climate Change: A Summary of the Science

2 Wasdell D. (2011) 3rd conference on Global Warming Lisbon 2011: Climate Sensitivity: Amplification of the Anthropogenic Disturbance of the Climate System.

3 Tietsche S., Notz D., Jungclaus J. H. & Marotzke J. (2011) Recovery Mechanisms of Arctic Summer Sea Ice. *Geophysical Research Letters*. **38**: 4.

4 Maslowski W. (2011) European Geosciences Union. General Assembly.

5 Baker T. & Nelson R. E. (2005) Creating Something From Nothing: Resource Construction through Entrepreneurial Bricolage. *Administrative Science Quarterly*. **50**: 329-66.

which feedback effects and significant interactions between components do not have clear mechanistic or easily predictable relationships.

In climate science there are huge challenges, both conceptual and computational, in developing sufficiently complex predictive models that include interactions between all the factors we know to be relevant. A recent presentation at the 3rd Conference on Global Warming in Lisbon earlier this summer by David Wasdell[2] illustrated this challenge – some commonly used climate models do not include carbon cycle feedbacks or albedo effects. It is worth noting that David Wasdell's presentation strongly suggests that the severity of the likely impacts increases as more feedbacks and interactive processes are added to the models, whilst the onset of these effects becomes earlier.

Successful international new ventures oscillate between planned activities in identifying new markets and improvised activities once operating in those markets

A more practical source of uncertainty lies in the fact that the rate at which our understanding advances may be slower than the rate of change of the climate. For instance, uncertainty continues to surround the rate of decay of summer Arctic sea ice[3]. Some predictions indicate that Arctic summer ice will be gone by 2016 suggesting that action is needed now[4]. This highlights the need for an acknowledgment that a lack of certainty should not preclude action.

The above indicates that we need to understand the climate system and our responses to it in terms of risk and uncertainty. A similar situation exists with regard to business innovation.

Business Innovation

Research into business innovation indicates that success requires the ability to exploit both risk and uncertainty. Focusing on one at the expense of the other may result in failure.

For instance, researchers[5] observed the activities of small firms operating under severe resource constraints, exploring the impact of *bricolage*, the ability to re-combine existing resources in novel ways to meet new needs. One can interpret bricolage as the ability to exploit uncertainty, since many of the firms were keeping a stock of resources on the basis that they 'might come in handy some time'. In other words, there was no specific plan for which the resources were being kept. Rather, they were used when a new opportunity arose in which they were recognised as beneficial.

Uncertainty continues to surround the decay of summer Arctic sea ice, which may be gone by 2016 if no action is taken now

If bricolage is a means of responding to new and unexpected opportunities, one might expect that higher levels of bricolage will lead to higher chances of success. However, the relationship between exploitation of uncertainty and firm growth is more subtle. Those firms that engaged in parallel bricolage, with multiple on-going projects relying on bricolage, did not grow. By enacting bricolage in all domains of their activity, they failed to develop standardised organisational routines or structures and were unable to exploit opportunities that were likely to be repeated. In other words, they limited themselves to acting only in uncertain environments, rather than also being able to exploit risky environments.

In contrast, the firms that grew engaged in selective bricolage, where the novel combination of resources in response to new demands was focused only on a particular project or part thereof, with the remainder of the activities being non-improvisatory (i.e. responding to known risks or certainties). This indicates that the exploitation of both uncertainty and risk is needed for firm growth.

In a similar vein, others found that new ventures that entered new foreign markets successfully were able to improvise in their activities in that new market, and were more able to walk away from failure. In other words, they were able to recognise the uncertainty in their new context which inevitably had many features about which they could not know beforehand. However, they were able to do this only if they had also formulated criteria for deciding which new market to enter (i.e. an estimation of risks). Firms that did not do this but entered new foreign markets opportunistically (responding to uncertainty) were less able to improvise their activities subsequently, and interpreted the failure of their activities in the new market as the result of external factors. This suggests that establishing some of the possible risks in one's environment helps one to improvise effective responses to uncertainty under both success and failure. Indeed, it was argued[6] that this research indicates that successful international new ventures oscillate between planned activities in identifying new markets and improvised activities once operating in those markets.

The examples indicate how business innovation requires the exploitation of both risk and uncertainty.

Why Add Uncertainty?

However, from a policy and business perspective, the climate challenge already appears to be framed in terms of risk. Indeed, a common complaint from the clean-tech sector is that the clear and unambiguous policy measures needed are currently lacking, consistent with the view that minimising risk will enable effective action. How then might emphasising uncertainty in our understanding of climate change assist business innovation?

Since business innovation already necessarily involves successful responding to uncertainty, including climate uncertainty may make climate change a more familiar challenge for business

Including climate uncertainty may make climate change a more familiar challenge for business that already has routinely to deal with the uncertainties posed by competitors, customers or new technology. As such, emphasising the unpredictability of climate change is likely to add momentum to the development of more responsive structures, processes and routines, which may also benefit non-climate-specific domains of activity.

Secondly, framing climate change in terms of uncertainty in which there will inevitably be some highly surprising winners is likely to activate a more diverse range of actors from whom more innovative responses can develop.

Understanding climate change and the business response both in terms of risk and uncertainty should be the new paradigm. So here's to action in our exciting, risky and uncertain present!

Anna Plodowski is a former cognitive neuroscientist with an interest in extremes of human behaviour and evolutionary psychological perspectives. She is currently doing a second PhD in the Innovation & Entrepreneurship Group at Imperial College Business School, on the topic of consumer energy behaviour and smart meter design.

6 Bingham C. B. (2009) Oscillating Improvisation: How Entrepreneurial Firms Create Success in Foreign Market Entries Over Time. *Strategic Entrepreneurship Journal*. **3**: 321-45.

A Disequilibrium View of Market Fluctuations

Joachim Klindworth, Imperial College Business School

In an ideal world, financial markets can be considered as an inherently stable system that fluctuates about an optimal point. The financial tsunami of 2008, however, compelled us to reconsider the existing notion of stable equilibrium. This article will introduce the paradigm of an inherently unstable market[1], employing concepts in risk management, and illustrate how wild fluctuations and avalanches caused by correlation between assets can force the market to stray far away from equilibrium. This potential for persistent disequilibrium requires new and innovative legislation to protect the critical and vulnerable in society.

Movements from equilibrium are often subject to feedback cycles pushing prices further from equilibrium thus enabling non-equilibrium behaviour to persist

Economist Eugene Fama pioneered the theory that markets are in the state of equilibrium, or the efficient market hypothesis. In his seminal paper[2], Fama defined the efficient market as '*a market where there are large numbers of rational, profit-maximisers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants*.' Modelling financial markets as random walks, he concluded that the market price (of, for example, a stock) is an unbiased estimate of the true value of an investment. Fluctuations about the equilibrium are random and uncorrelated, and that there is an equal chance that a particular stock is under or over valued at any point in time.

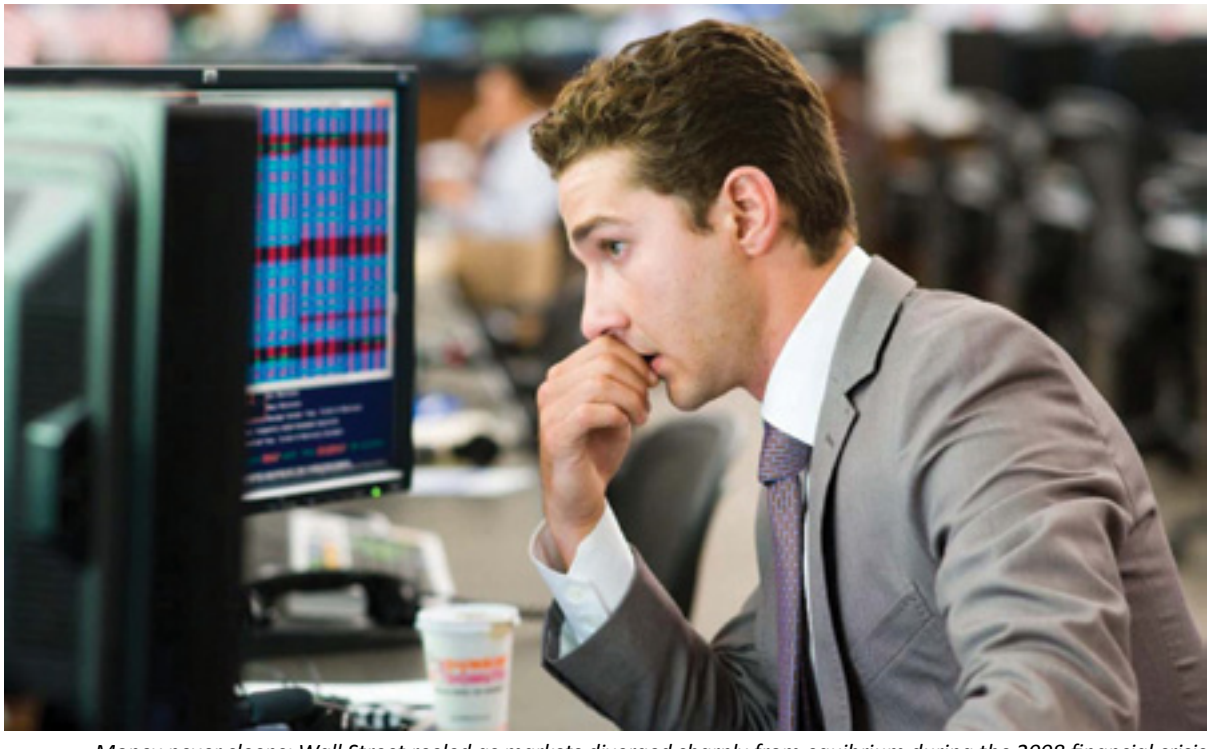
The financial tsunami, however, highlighted the shortcomings of the *efficient market hypothesis*. The market behaved in a highly correlated manner, with overwhelming negative feedback cycles. The sudden downturn in mainly high-risk US sub-prime mortgages led banks to stop lending. As credit dried up, many businesses faltered, and much debt was rendered un-payable. However, the negative feedback cycle ran deeper. Through financial derivatives such as Collateralized Debt Obligations (CDOs), the risk associated with sub-prime mortgages was heavily traded internationally as a commodity. Huge losses were incurred as the extent of the exposure of banks to this risk became clear, and many global institutions failed. Such a description of the events of late 2008 is admittedly hugely simplified; however, the role of correlation and feedback cycles in driving markets away from equilibrium is clearly evident.

Risky Business

In the aftermath of the credit crunch, risk management, which attempts to hedge financial positions against unlikely negative events, or so-called 'Black Swan' events, has been brought into the spotlight. Prior to the events of 2008, risk management was seen as a rigorous and scientifically sound method to minimize losses, preserving a company's credibility even in adverse market conditions. Yet during the early months of the crisis, markets behaved in a manner

1 Soros G. (2008) *The New Paradigm for Financial Markets*. New York: PublicAffairs.

2 Fama E. F. (1965) Random Walks In Stock Market Prices. *Financial Analysts Journal*. **21**(5): 55-59.



Money never sleeps: Wall Street reeled as markets diverged sharply from equibrium during the 2008 financial crisis

unseen before, characterised by high volatility and an unusually high correlation through all assets.

Much of the difficulty stems from the fact that risk is far more complex than its counterpart return. An investment today will result with certainty in a specific return tomorrow: either a profit or a loss. On the other hand, risk is a highly diversified concept. There is systematic risk – market risk – and idiosyncratic risk – company specific risk. A standard definition of market risk is the volatility in the returns of a certain stock market index. Because market risk is an aggregate measure over the entire market, it cannot be avoided by diversification, and so is of greater interest to regulatory bodies.

A critical social structure that perhaps deserves regulatory intervention is the food market

Another issue is that in computing risk, a normal distribution of returns is commonly assumed. This implies that negative and positive movements in the market occur with similar frequencies on the left and right hand side of a distribution. However, real market data clearly demonstrates that there are far more extreme negative movements, which can result in a strong discrepancy in calculating risk measurements. In the worst case the actual risk is underestimated and investors suffer losses.

These market movements can be connected back to feedback cycles, which occur not only during global economic downturns, but also in more everyday situations. Consider a company with raising share prices. From an elementary perspective, a higher share price gives the company the ability to raise more capital than competitors, which in turn gives them a competitive advantage. The company can then use its new capital to buy out competitors or to expand existing operations. It is then likely that share prices will rise even higher, far from equilibrium.

Similarly, a company with a strong credit rating is normally able to borrow at attractive rates. However, a downgrade from a credit rating agency is likely to increase the amount of collateral the company must pledge to back its obligations, thus reducing liquidity,

[3] Schwarcz S. L. (2008) Systemic Risk. *Georgetown Law Journal*. **97**(1): 193-249.

[4] Watts J. (2009) Food Supplies at Risk from Price Speculation. *The Guardian*, 19 August.

hampering business operations and possibly precipitating a further downgrade. The role of correlation is demonstrated again: movements from equilibrium are often subject to feedback cycles pushing prices further from equilibrium thus enabling non-equilibrium behaviour to persist. As mentioned above, these feedback cycles can cause market movements that do not follow the generally assumed distributions, one factor in incorrect assessment of risk.

A path towards stabilising legislation is introducing more transparency in the financial system

Stabilising Factors

Against this background of volatility, it can be said that the perception of risk, specifically liquidity risk, has changed. Stability may not be taken for granted. Before the credit crunch, mitigating market risk was the responsibility of investors, whereas controlling systemic risk was the role of the State. However, if markets are inherently prone to strong feedback cycles, market risk can easily lead to systemic risk. Furthermore, making a direct analogy to the infamous Tragedy of the Commons, no individual actor can smoothen out feedback cycle yet all actors can and will take advantage of those cycles and worsen its negative effects[3]. Therefore, legislation must recognize the inherent instability of markets.

A path towards stabilising legislation is introducing more transparency in the financial system. Before the credit crunch investors had no knowledge about the individual risk exposures to industry sectors or sovereign debt of financial institutions. The new European bank stress test analyses various aspects of risk-bearing capability, including how a bank can withstand market fluctuations caused by possible credit defaults of individual countries. While imperfect, it is hoped that with increased transparency and wider availability of information, these tests will lead to a smoothening of market fluctuations, as negative news will be disseminated more gradually and systematically.

Another strategy to reduce the risk of future shocks is decoupling highly correlated markets from fundamental and critical social structures. Drawing a line between markets that are allowed to fluctuate at will and those that should be 'pinned' to equilibrium is not an exact science. However, one can make the argument that markets in which one has no choice but to participate deserve particular regulation. For example, coupling an ordinary man's saving to a volatile market with which he likely has little contact is unwise. Legislation such as the Glass–Steagall Act of 1933, which separated commercial and investment banking in the USA, is a good example of legislative attempts to decouple such markets. The Gramm–Leach–Bliley Act of 1999, however, repealed it, allowing commercial banks, investment banks, securities firms, and insurance companies to consolidate.

A critical social structure that perhaps deserves regulatory intervention is the food market, which is unparalleled in its direct influence on the literal survival of so many, remains virtually unregulated and prone to speculation from commodity investors. Joachim von Braun, the head of the International Food Policy Research Institute (IFPRI)[4], warns that the "food market remains seriously exposed to short-term flows of indexed funds into commodity exchanges." Correlation between the food markets and the volatile global economy is not only dangerous but also potentially fatal to many, and requires international efforts to curb speculation.

The food market, which is unparalleled in its direct influence on the literal survival of so many, remains virtually unregulated and prone to speculation from commodity investors

The disequilibrium view of markets as illustrated above offers a new paradigm for regulatory intervention. If market equilibrium is an illusion, the State should isolate critical social infrastructure from volatile and unpredictable markets and seek to increase market transparency.

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Risk after an Arab Spring: Investing in the Middle East

Tariq Bin Hendi, Imperial College Business School

Risk is a key factor in determining investment and business strategy. Too much risk deters investors whilst too little risk likely means little to no yield on invested funds. Yet in the Arab World, where investment risk and potential returns have always been high compared to the West, political instability continues to deter backers. This presents a substantial obstacle to countries and firms in the region; particularly those who desperately need new funds to drive the economic growth and development expected by those supporting regime change.

While most developing countries, such as Russia, India, and China, have benefited from internal and external sources of funding, the Arab World has had to rely predominantly on growth funded from within. This is mostly thanks to constant political upheaval and instability in the region.

The Arab World can be split into two groups: nations with abundant natural resources (oil and gas), and those with very little. The gulf between the two could not be vaster. Most investment in the Arab World has traditionally come from within the Arab World. After the discovery of oil, poorer Arab countries became reliant on newly wealthy neighbouring Arab governments to fund their development and growth. However, as wealthier Arab nations such as the UAE and Qatar began investing in their domestic large-scale infrastructure projects, they became increasingly reluctant to invest in poorer countries in the region.

Foreign Funds

With less support from neighbouring governments, some Arab governments tried to attract non-Arab foreign direct investment (FDI) yet very few non-Arab countries or firms were willing to gamble on resource-poor, volatile countries, unless strong government and financial guarantees were in place for the investing firm. Without much sovereign wealth, guarantees were difficult to provide: financial institutions were hesitant to lend to Arab countries with no oil. Any substantial business in the region was normally conducted through joint ventures with local businesses, where the local partner took a disproportionate amount of the risk. The level of corruption in many of the Arab countries also played a large part in effectively alienating non-regional foreign investment. With a large and growing youth population and few jobs, this lack of investment and misuse of funds presented a major problem.

Regional governments with large sovereign wealth funds continue to pour money into the West to diversify, but in reality for no other reason than to preserve wealth by avoiding the perceived increased risk of investing at home

That was the scenario before 2011. This past year the Arab World has seen a sweeping wave of change, termed by many as the *Arab Spring*. People in the Arab region have been marching to demand reforms to what they view as corrupt regimes that offered little hope of work or economic prosperity. In Egypt and Tunisia, protestors and reformers have succeeded in removing the previous governments. In contrast,

protests in Syria, Libya, and Yemen have led to varying degrees of violent conflict. Many regimes, especially in the oil-rich Gulf, have suppressed uprisings through the announcement of generous welfare systems for their citizens or by using force.

Safe Haven?

All of this has had very real and inevitable consequences on local investment and FDI in the region. In particular, regional governments with large sovereign wealth funds continue to pour money into the West to *diversify*, but in reality for no other reason than to preserve wealth by avoiding the perceived increased risk of investing at home. However, investing abroad often brings its own, often unapparent, exposure and risk.

The effects of the Arab Spring can be understood by considering its affects on risk levels. There are two broad categories of risk: systematic and unsystematic. Systematic risk is a risk that affects most asset classes, such as political risk, while unsystematic risk is asset or firm specific risk. Systematic risk is almost impossible to protect against while diversification can help offset unsystematic risk. However, diversification in the form of investment of large portions of funds outside the Arab World leads to a wide array of associated risks, from commodity and currency risk to equity and interest rate risk.

Currency and commodity risk is incurred as most sovereign wealth funds and government investment firms in the Arab World have exposure to international currencies, predominantly US Dollar, the Euro and the British Pound. Some countries have tried to address this issue by pegging their respective currencies to these Western currencies. Inevitably, this means that they import US and European inflation or deflation through both negative growth and currency devaluation. In particular oil is traded in dollars, which automatically puts most Gulf countries in the precarious position where they have to help absorb any perturbation in the US economy and market.

Hence, when the uprisings started to impact local economies and drive up the price of oil, many Arab countries moved their excess cash into perceived safe-havens such as US Treasury Bonds, yet negative fundamentals and interest rate risks that currently exist in the US meant they inherited substantial risk. Although it may soon be more practical to move the funds back into local projects and businesses that will yield much higher returns compared to US bonds, there is no sign of this yet. In addition, Western firms that were only recently starting to look at the Arab World as a potential area of investment have pulled out substantially, or opted in favour of other developing nations in Asia.

Planning for Prosperity

The real question is timing. In the short-term, funding will be difficult to attain due to both the perceived and real risk in the region. This will affect businesses and poorer countries the most, as funding becomes much more expensive to obtain, if at all. The long-term view is less clear as the potential positive outcomes of the unrest seem so uncertain.

Removing a corrupt government does not ensure that another will not replace it. These countries will have to move forward quickly and present plans to convince investors to help reinvigorate the region and spur development

When the dust finally settles, social, economic, and political rebuilding will be necessary. Removing a corrupt government does not ensure that another will not replace it. These countries will have to move forward quickly and present plans to convince investors of the opportunities to help reinvigorate the region and spur development. Without this support, these movements for change will have had little positive outcome for the region and will only drive up the costs of business in an already expensive region.

Tariq Bin Hendi is a PhD student at the Imperial College Business School. His thesis focuses on the impact of labour nationalisation on wages and unemployment in the United Arab Emirates.

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