#30 VISIONS OF SUSTAINABILITY

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#30VISIONS OF SUSTAINABILITY

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VISIONS OF TAINABILITY

The concept of sustainability has come to be established throughout our lifetimes. With a simple internet search yielding over 100 million references, the word is used constantly by politicians, business people, experts and even the population itself.

Despite the protestations of the term's harshest critics, sustainability doesn't have to constitute a backward step in our progress as a species. On the contrary, it instead represents a great challenge for the future, whereby economic and social development must be brought into harmony with the preservation of ecosystems and the resources they provide us with.

Sustainability is linked to noble aspirations, such as the wish to leave future generations a better world, to improve quality of life for present generations, and to replace selfishness with cooperation. Sustainability requires the will to arrive at a consensus, such as that shown in the latest Climate Change Conference held in Paris, in which an unprecedented universal agreement was reached on tackling the phenomenon.

To really make strides in this direction, however, what are needed are not aspirations, but values. Ever since brothers Karl and Alfons Knauf opened their first mining town in Germany in 1932, the history of our company has been based on values. Many things have changed since then, however one constant thread has been Knauf's method of facing new challenges from a social perspective that takes the surrounding environment into consideration. Our challenge for the twenty-first century is how to ensure that a company with over 26,000 employees, 150 factories and thousands of offices and warehouses can develop in the framework of sustainability.

There is only one way we can begin to face such a complex challenge, and that is with one simple approach: the future will only be better if it is sustainable.

ALEXANDER KNAUF

“Le véritable voyage de découverte ne consiste pas à chercher de nouveaux paysages, mais à avoir de nouveaux yeux.”

The real voyage of discovery consists not in seeking new landscapes, but in having new eyes.

Marcel Proust

For centuries, revealed knowledge has provided humanity with an intelligible and perfect image of the world. The advent of modern society and the strength of critical thought has called into question ancient certitudes and transmitted a vision of reality which is highly complex, meaning that today we even refer to multiple realities whose sum and interconnections create the fabric of the world we live in.

Exploding into public debate over the last 30 years, sustainability has been referred to as difficult to define and lacking in precision. We believe this very 'defect' is in fact its greatest strength. The concept of sustainability is a tool that puts us in touch with reality's distinct dimensions – or multiple realities – that are interconnected and developed in a complex system.

Nowadays, it is no longer possible to imagine a world that is nothing short of a highly intricate web, and everyday life is the greatest proof of such connectedness. Even the most superficial of analyses would reveal our societies' shared economic, social, political and environmental problems, with a mere cursory glance at the global oil situation an instant reminder.

Over many months we have interviewed 30 experts in various fields of knowledge including science, economics, philosophy, technology, politics and management, with a focus on sustainability. Right from our earliest steps towards devising a work of this style, we believed that this would be the best way to reveal sustainability for what it is: an open and living concept profoundly interlinked with all of human activities. Because it is precisely human activities that are, by definition, limited in time and space, and if there is one word that most faithfully represents the essence of sustainability, it is the idea of limits.

Imagine a slice of cake layered with sponge, cream and fruit. Even though some people would undoubtedly prefer one layer to another, most people would pick up their fork and break a piece off so as to taste all the layers at once. This is the spirit with which we would like you to savour our book, full as it is of intellects, that, despite their differences, come together to transmit a unique reflection on how to build a better world.

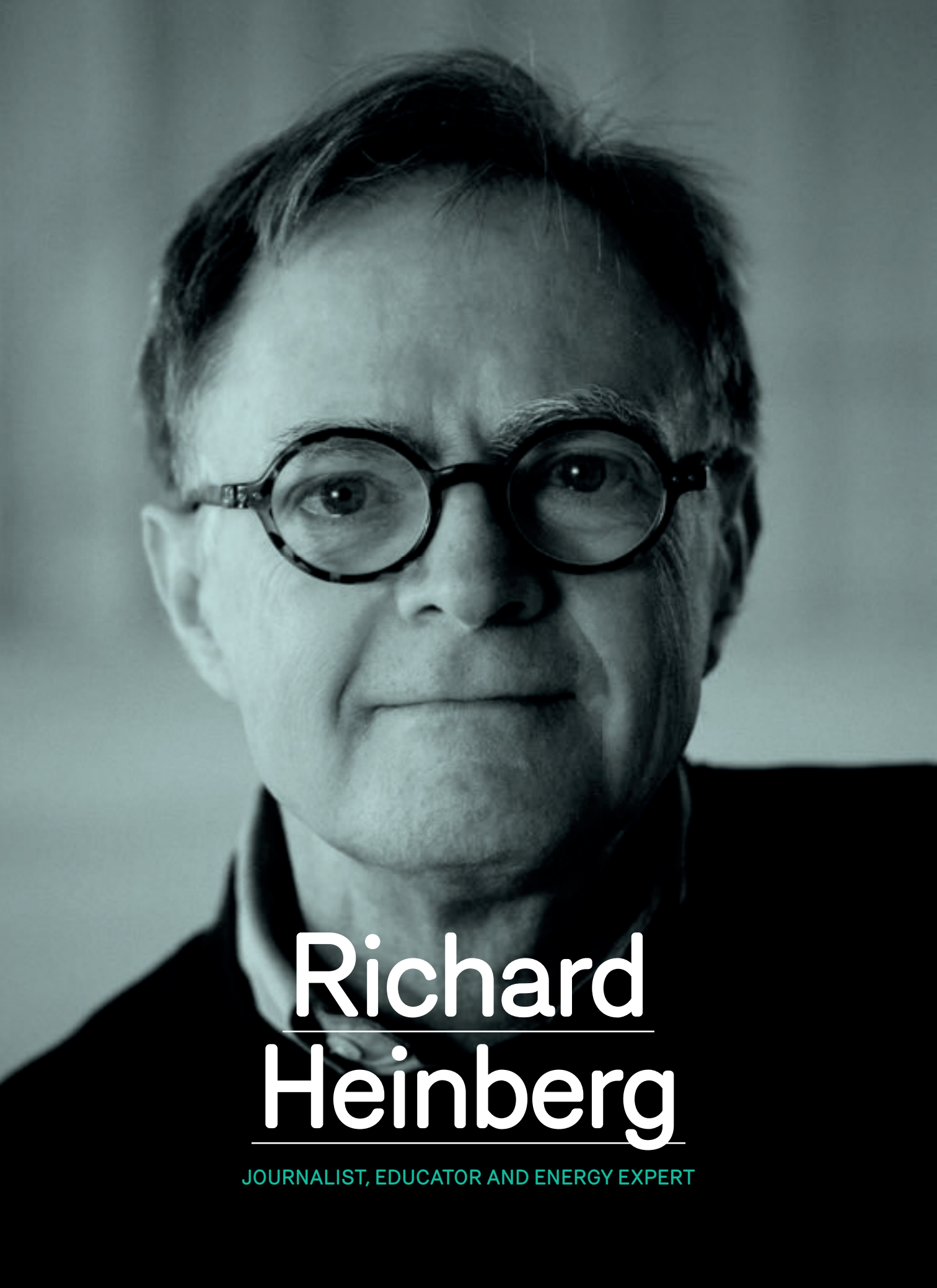
Bon Appétit!

ALBERTO DE LUCA
Managing Director
Knauf GmbH Sucursal en España

Sustainability is based on the idea that the environmental and social costs of development have certain limits. In order to enable future generations to live in the best possible conditions, human activities on the planet must take these limits into consideration. For this reason, sustainability may be considered to be the main challenge of our time.

The main challenge of our time

Richard Heinberg | James Greyson
Heiner Benking | Ramon Folch



Richard Heinberg

JOURNALIST, EDUCATOR AND ENERGY EXPERT

The awareness that civilization can cause irreparable damage to the planet is something new in history. This awareness brings a scheme of thought that questions many of the current principles and practices. Likewise, this new vision creates a sense of collective responsibility for the fate of humankind.

"We are reaching the limits to growth"

Many times in history people have felt that they were living through a process of critical change, and this is currently happening at the beginning of twenty-first century. But what would be the specific characteristics of this moment in time? Would it be the energy question? The unsustainability of the production model? The emergence of a planetary consciousness unable to overcome national interests? What do you believe to be our greatest challenge as a species at this moment?

RH. In many ways it is the same challenge humans have always faced: the ecological dilemma of population growth pressing against ecological limits. However, today that dilemma has been magnified to an unprecedented and profoundly dangerous degree. With the energy from cheap fossil fuels we were able to expand agriculture, manufacturing, transport, sanitation, and scientific research to support far more people than ever lived previously. But now those fuels are depleting and we have come to realize that burning them imperils all life on the planet due to carbon emissions and climate change. We are faced with the requirement to end our reliance on fossil fuels, even though there is no clear pathway for doing so quickly enough that does not also entail a reduction in the economic benefits from cheap, abundant energy that we have come to rely on. We are reaching the limits to growth, but we have become structurally reliant on growth to provide jobs, returns on investments, and tax revenues. Without more growth, the global economy as it is currently configured cannot work.

What kind of scenarios do you envisage for humanity with the decreasing availability of oil? Do you think a relatively smooth transition is possible? Or is conflict the only way to move towards a new era?

RH. Of course a smooth transition would be preferable, but that would require planning ahead to reduce the need for oil before actual scarcity. Many people (myself included) have been loudly advocating a planned reduction in petroleum consumption for many years now. But this did not fit with the priorities of policy makers, who prize continued short-term economic growth above everything else, even if it has calamitous long-term consequences. We have run out of time for a planned transition. That means that markets will drive the dynamics of the end of the oil age. We will likely see price swings that will by turns destabilize national economies and the oil industry itself. This process of destabilization is already under way. In addition, we can expect more armed conflict over access to petroleum reserves.

Does the complexity of our contemporary societies make strong foundations for resilience and adaptability to uncertain scenarios?

RH. No, just the opposite is the case. We have created complexity the way all civilizations do—by centralizing services and eliminating redundancy. An agricultural society is able to intensify food production and centralize distribution, thus freeing up some of its members – who would otherwise be gathering or growing food – to engage in other full-time occupations, such as manufacturing, statecraft, soldiery, or the arts. This makes for a more complex society. With fossil fuels, especially oil, ›

we were able to mechanize and thus intensify food production as never before, freeing up the vast majority of the population to work at an astonishing number of occupations. This was the birth of the middle class. We also adopted an economic ideology that said the way to greater wealth lay in promoting economic efficiency in every way possible, which means concentrating production in places where labor and materials are cheapest. This became increasingly possible due to the availability of cheap transport fuel and transport technologies like the container ship and the cargo plane. So now we live in a world where we all depend upon products (like the cell phone) that are made out of rare materials extracted in unique locations spread all over the planet, which are transported to manufacturing hubs where labor is cheap, with the final result often transported halfway around the world to the end user. All of this depends upon the continued availability of a resource (petroleum) that is non-renewable, depleting, and highly polluting. Obviously, there are a lot of things that can go wrong with a system like this. It is not a resilient system; it is a highly brittle one.

In your opinion what key decisions should mankind make to be able to best manage the impact of a world without available oil?
RH. Without oil, transport will in most cases be slower and more expensive. Without cheap transport, trade will not increase. And without increasing trade, economies will not grow. But over the past century economies have been engineered to require growth to create jobs, pay off debt, produce returns on investments, and generate tax revenue. A world of declining petroleum is therefore likely to be a world in financial turmoil, and that will make investments in renewable energy much more difficult. So we need to get off the growth treadmill, decoupling GDP from quality of life. Ultimately, that will probably require changes in monetary systems and the forgiveness of a great deal of outstanding debt. We will also have to address the equity question: we can no longer count on the rising tide of economic growth to lift all boats. We'll also need policies to ration fuels, so that we can channel consumption of our remaining fuels into the building of the infrastructure we'll need in an all-renewable world (fossil fuels will be needed to build and install solar panels and wind turbines). If we start localizing economies, reducing long-distance trade through import substitution and reducing energy consumption across the board now, the transition will be far easier later on, when the challenges will be much greater.

Do you think that governments and businesses are preparing serious contingency plans to deal with this issue?
RH. Yes, but their contingency plans are not very intelligent ones. An example of an intelligent contingency plan would be quota rationing of energy. Indeed, the time has passed when such a plan should have been implemented. Nothing happened, and I see no clear indication that such a plan is secretly being drawn up. The contingency plan that does appear to be in preparation is for the use of military tactics to control an increasingly desperate and angry citizenry. We see this especially in the United States, but there are signs of it in many other nations as well.

Are some countries better prepared than others? What is the particular position of the United States?
RH. The common opinion is that the United States is much better prepared than other countries to face the end of the oil age, primarily due to its increased oil and gas production resulting from applying fracking technology to low-permeability reservoirs. This has generated a false sense of security, because these resources are expensive to produce and deplete rapidly. While US oil and gas production has soared during the past decade, its oil production has already started to head back downward and a decline in gas production will not be far behind. Meanwhile, the country has a very high per-capita dependency on fossil fuels. True, even with all this in mind, the US is probably in better shape than countries like Japan, which import nearly all of their energy resources. But the best preparation would be to have minimal dependency on fossil fuels to begin with, and a head start on alternative energy

"If we start now to localize economies, reduce long-distance trade through import substitution, and reduce energy consumption across the board, the transition will go far more easily later on"

production from renewable sources. I don't know of a country that serves as a shining example in this regard, though some do better in one respect or another (Denmark produces a lot of renewable energy, Cuba has reduced fossil fuel inputs to its food system).

What scope for action is left to civil society in order to manage the coming change? Are there any current initiatives that may serve as models for correct courses of action? Could you give some examples you know of?

RH. My colleagues at the Post Carbon Institute and I have given a lot of thought to those questions. We see the best strategy as building community resilience. Resilience doesn't simply mean the ability to bounce back from disturbances; it means co-evolving with a changing context or environment. The energy and environmental context of society will be shifting quickly and profoundly during the coming decades; obviously it will be important that we are able to maintain essential functions during this time. That means society will have to adapt. Resilience scientists have studied the process of adaptation, and the principles they've uncovered are directly relevant to human society in the twentieth century. In our view, the community is the ideal point of intervention in building resilience: there are too many obstacles on national and international levels, and communities offer face-to-face opportunities for communication and evaluation. One organization that is already working to build community resilience is the Transition Initiatives, often known as Transition Towns. The umbrella organization simply provides ideas and encouragement for hundreds of grass-roots efforts in many countries to reduce fossil fuel dependency and rebuild local economies: the essential adaptive work that we'll all be doing.

Energy alternatives exist today in many different areas such as road transport and electricity production, etc. The aviation industry, however, does not have any alternatives to its current fuel. How do you see the effects on this particular sector, given its importance to our economy's basis on people and goods traveling around the world?

RH. Yes, as you point out, there are no good energy alternatives for the aviation industry. The easiest replacement for kerosene-based aviation fuels would be biofuels, but there are two problems with these. The first is that they have chemical characteristics not well suited to the temperature and air pressure changes that aircraft normally encounter. This problem is being dealt with through research into complex blends of fuels (Virgin Airlines has done most of this work). But the second problem is not so easily solved: biofuels are costly to produce, from both a monetary and an energy standpoint. As a result, a biofuels-based airline industry would face crippling fuel costs. And producing biofuels at the scale needed would probably have a substantial environmental impact (as we have already seen in the corn ethanol and palm oil industries). Another proposed solution is cryogenic hydrogen, which could be made using electricity from solar or wind sources. However, this would require the complete redesign, not just of engines, but also of entire planes, due to the need for much larger fuel tanks. And again, this would be expensive fuel. Even the most advanced electric batteries would only propel very small aircraft, carrying one or two passengers. So in principle the problem with fueling aviation in the post-petroleum era is solvable, but not in a way that would ensure the financial viability of the industry. Therefore the most realistic prospects for that industry include continued company consolidation, fare increases, the need for increased government subsidies, and an eventual shrinkage in numbers of planes, passengers, and airports.

Do you think with all the coming changes it will be possible to preserve the concepts and realities of human rights and representative democracy? Might they be threatened by socioeconomic disruption? Or they could be replaced by new formulations that could deepen the original sense of democracy and connect it to individual and collective responsibility towards the environment and the fate of the planet? This would of course have to include an improved version of what we currently refer to as sustainable development. There seems to be room for innovation in this field...

RH. Democracy may be a better form of government for nation-states than any of the alternatives, but in an era of tightening environmental constraints it has one serious flaw. Our survival dilemma – looming ecological limits – requires us to voluntarily reduce population and consumption of energy and materials in order to minimize the scale of the consequences as those limits bite. Otherwise we will accelerate right until we hit the wall; it won't be a pretty sight. But reducing population and consumption effectively means shrinking the economy. Who will vote for that? ›

What politician is persuasive enough to get people to support such a program? Nearly everyone wants more growth, and every politician without exception promises it. I suppose if we had better sources of information, and if everyone understood what is at stake, then voters' attitudes might change. But democracy applies to the information marketplace as well: we get to choose which information sources to read, watch, or listen to. And most information outlets, like most politicians, have found that it serves their interests to tell people what they want to believe. Most people want to believe that there are no ecological limits, that people are limitlessly intelligent and inventive, and that therefore the economy can continue to grow forever. It's an absurd proposition if you examine it for even a few seconds, and yet more people adhere to it than to any religion. In fact, more people probably believe in infinite economic growth than believe in God. That's a pretty big hurdle for democracy to overcome. Do we therefore need some kind of benevolent dictatorship? Good luck finding a dictator who places the interests of future generations over his own! No, I think that we are in for a series of crises that will shake the foundations of national governments. In the ideal scenario, that would open up space for the flourishing of democracy at a smaller scale, where people are more in touch with the realities of limits. But that's likely to be an iterative process; we probably won't get it right the first time around.

You have confessed that reading *Limits to Growth* back in 1972 deeply shocked you and made you consider certain aspects of sustainability for the first time, although the concept had not been formulated as such then. More than four decades later, although the world has developed certain awareness on these issues, it has not responded with a precise and common approach to the challenges. You must have thought a lot about this. Why have no serious decisions been made even though we know what's going on?

RH. Obviously there are vested interests – such as those of the fossil fuel companies – that seek to cloud people's perceptions of our dilemma and what needs to be done about it. But human nature is also to blame: as I've just explained, we have a tendency to want leaders to tell us good news about ourselves (in this case, that there are no constraints on our prospects for further expansion of population and consumption). If there are problems, political leaders tend to blame them on some "other" who can be vilified. That's how a lot of wars get started. With climate change, who is the villain? Some say it's the fossil fuel companies, some say the scientists who are foisting a hoax on society, some say the Chinese who are burning their coal to make our flat-screen TVs. In reality it is all of us. Dealing with climate change doesn't require us to vanquish an enemy; it requires us to change how we live. And nobody wants to do that, absent a crisis. Therefore it seems clear that our adaptation to ecological limits will be driven by crises—not just one big one, but a series of them. Hopefully, we will begin to learn from them before too many have occurred. Those of us who do understand the problem and who wish to help could perhaps accomplish the most by adopting a crisis-led theory of change, in which ways of understanding and strategies for adaptation that may not be popular now are researched and developed so that they are ready to go when a larger portion of the population has come to see that business as usual is no longer an option.

In your book *Afterburn: Society Beyond Fossil Fuels*, you write about the need to reboot our society, and suggest the magnitude of this shift will be similar to that of the advent of agriculture and the birth of modern industry. 'Afterburn' is the result of what you describe as 'The Great Burning'. Are we moving from a civilization of excess to a civilization of moderation? Are you confident that humanity will find a way in this difficult voyage?

RH. Perhaps "confident" is too strong a term. We will find a way, out of necessity. The details are up to us. The voyage could be more or less harrowing, depending on our individual and collective choices. But one way or another we will arrive at a future in which we live within nature's budget of energy and materials. One thing is certain: whatever society exists a century from now will not be based on fossil fuels. The world will probably have fewer people in it, perhaps significantly fewer. Our ethics will have changed too: instead of prizing consumption and economic growth, we will have learned to value conservation, economic stability, and quality of life.

Richard Heinberg is widely regarded as one of the world's foremost educators on the need to transition society off fossil fuels. Since 2002 he has spoken to hundreds of public, government, and business audiences around the world, and has made countless appearances on radio and television. He is the award-winning author of twelve books and scores of essays and articles. Heinberg is Senior Fellow-in-Residence at the Post Carbon Institute, and a recipient of the Atlas Award for climate heroes (2012) and the M. King Hubbert Award for Excellence in Energy Education (2006).

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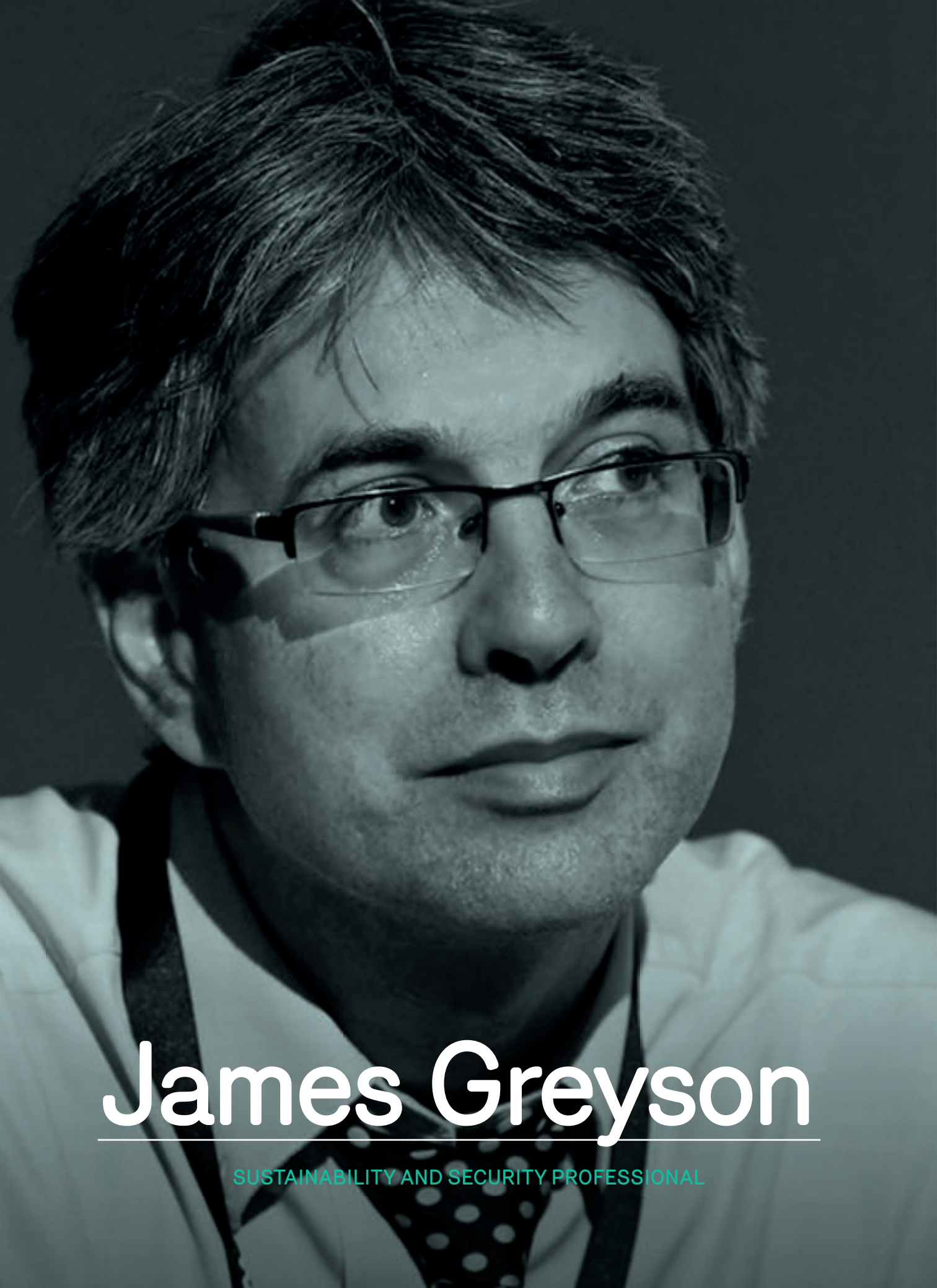

James Greyson

SUSTAINABILITY AND SECURITY PROFESSIONAL

Global challenges cannot be addressed with a reductionist thinking that tries to solve problems separately. Everything is connected so that the right way of dealing with the world is acting with a systemic vision. This shift will not be easy due to inertia and tradition but is absolutely necessary in the 21st century.

"Reductionism offers the attractive illusion of problem-solving"

Sustainability seems to be dominated by a great paradox: the more we talk about it, the more we can confirm that zero progress has been made on the main challenges (resources depletion, environmental damage, inequalities and poverty). Why is this so?

JG. The paradox is real. A vast global movement of millions of people and millions of initiatives has discussed and acted on global sustainability challenges for many decades. Yet incredibly the problems persist and worsen. If our collective survival is a race between these huge problems and our small responses to them, then we're not keeping up. We could even say we're still stuck at the starting position, with people running in all directions, many calling out that they don't see a problem and the majority of people unaware that they're in this race.

The international movement to address global challenges can be traced back to 1972, when the United Nations held the first international environmental conference in Stockholm[1] and when the Apollo 17 spacecraft provided the iconic fragile 'blue marble[2]' image of Earth. It would be understandable if two or three years later some global problems had still not improved. By 1975 the lack of progress should have sparked an intense worldwide debate on what went wrong, for example. "Why are our efforts overall not working? What opportunities for really effective solutions are we missing?".

As we know, this intensive debate never happened in 1975; or in any other year. The latest 2015 United Nations sustainability conference, about goals and targets, issued a much longer Declaration[3] than the event in 1972. However the basic approach, of listing goals to inform national planning, has not been revised since 1972. Instead of intensively rethinking our approach to global challenges, an alternative process has emerged. Everywhere in the world, for every issue being tackled, there are intensive initiatives to congratulate people and projects working on any piece of any solution. This is reassuring and hopeful for everyone involved, although telling ourselves how well we're doing with global problems does make it much harder to see why we're not making progress.

People's views about the difficulty of global challenges are shaped by decades of overall non-progress with the problems. Are global problems just too big and complex for us to expect rapid solutions? Are particular obstacles, such as wealthy elites, corrupt politicians or greedy businesses, just too powerful to advance any effective change? Or is the underlying obstacle that effective solutions have yet to be attempted and our problem-solving activities rely on the same type of thinking that causes the problems? Different thinking could find new solutions that embrace the complexity, tackle the obstacles and belatedly launch rapid progress. ›

[1] www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1503
[2] https://en.wikipedia.org/wiki/The_Blue_Marble
[3] www.un.org/ga/search/view_doc.asp?symbol=A/69/L.85&Lang=E

You are the head of Blindspot Think Tank. Can you explain what the purpose of this organization is and describe its main lines of work?

JG. I founded BlindSpot Think Tank after 15 years of working internationally as a sustainability professional, when I realised that millions of people like me were devoting their entire careers to the big global challenges without ever solving them. I wanted to ask "what are we missing?" and to seek possible solutions beyond where people usually look. After 10 years working with BlindSpot and having our breakthrough research published in the NATO Science for Peace and Security Programme, I'm confident that that an entirely new approach to global challenges is feasible and ready to be implemented.

This new approach is being advanced at BlindSpot's Planet Levers Lab. The aim is simple: to see global challenges as a whole system and to enable rapid whole system change. The world's complexity and interconnectedness can be switched from causing global problems to preventing them. Suitably ambitious policies can act as the switches or levers to implement this change. A whole system goal of global security can encompass the goal of stopping or reversing all major global problems. This would allow all people and ecosystems to thrive in future, if this huge systemic change is implemented soon enough.

BlindSpot's climate project is our Climate Rescue Centre. This shows how the planet levers remain essential even when we consider only a single global challenge. The goal of 'climate rescue' is to rapidly cut greenhouse gas concentrations, not just emissions. This highlights the blindspot between climate science and climate policy, where for decades the weak international goal of cutting emissions has failed even to cut emissions. The Climate Rescue Centre demonstrates viable policy and tangible practice to reverse climate instability before positive feedbacks plunge the planet into unstoppable climate chaos.

Planet lever #3 would stop resources from ending up as accumulated waste in land, water and air. This is an example of a system change on the table since at least 1966[4], but it has unfortunately only been pursued in ways that don't allow it to actually happen. BlindSpot's Circular Economy 4Real project designed and published the world's first method for circular economics, which provides both the necessary market incentives and the necessary financing. Circular economics would allow for a rapid transition to a 'circular society' where people's decisions and lifestyles lead to closed loop resource flows and expanding ecosystem services.

> "People's views about the difficulty of global challenges are shaped by decades of overall non-progress with the problems"

Unlearn Unsustainability is BlindSpot's project about thinking differently. The reductionist thinking that built modern civilisation is also responsible for causing the problems that undermine it, for designing all the 'solutions' that don't solve the problems and then for ignoring the opportunity for rethinking. A viewpoint of global whole system change offers a highly effective way to share systems thinking habits and for 'blindspotting' missed opportunities in any initiative or organisation. Our planet lever #2 can reinforce the innate systems thinking abilities of entire populations by replacing conventional prescriptive instructional teaching with learning led by curiosity.

The Blindspot motto is "system change is not hard to do, just hard to see". Why is it so hard to see?

JG. System change is hard to see because it's unexplored. If people were already familiar with the small number of systemic errors that cause the large number of symptomatic problems worldwide, then system change would be highly visible and obvious. It would appear in public, professional and policy debates. It almost certainly would have happened, so the systems that have been causing the big problems would already now be set up to solve them. System change has been kept hidden by the same psychology that attracts people into the viewpoints of denial or reductionism. When we deny that there is a problem, it no longer feels overwhelming. When we plan some change in some defined area, the problems feel less overwhelming and more manageable. This solves our immediate problem of feeling overwhelmed by the immensity and the complexity of global challenges, even though it cannot solve any actual global problems.

When people are unaware of the viewpoint of system change they cannot consider it as an option to avoid both feeling overwhelmed and being

[4] http://www.eoearth.org/view/article/156525/

overwhelmed by worsening global problems. In public, policy and academic debates it's not yet on the map of available viewpoints. Today's map of viewpoints for global challenges is much like ancient maps of the world, with the Cartesian reductionist viewpoint intensively mapped and the system change viewpoint unexplored.

As the world's biggest problems worsen, there should be huge interest in global systemic solutions. Ancient maps offer a clue as to why this hasn't happened. In past centuries, cartographers would mark unexplored areas with warnings such as 'here be dragons ' to illustrate a common fear of going too far beyond what's known and familiar. Modern day 'dragons[5]' are the reasons why people feel uncomfortable or threatened, for example, when considering more problems or more solutions that were not already considered. "Stay where you are!" the dragons warn.

Is shrinking thinking the result of the Western philosophical tradition? Or is it the result of our own human nature? How can shrinking thinking be reversed?

JG. Shrinking thinking is where the challenge of managing problematic global complexity is answered by withdrawing from it. People cope with complexity by disregarding most of it and attending to selected areas. The Western philosophical tradition of reductionism had long been a success before anyone started talking about global problems. Descartes's reductionism gave us glimpses into the complex workings of nature. It gave us complex technological societies where we can use cars and smartphones. Reductionism became so dominant as a habit of thinking that without any conscious decision it was immediately adopted as "the way" to tackle global problems by virtually everyone.

For more than four decades, human nature has steadily reinforced reductionism as the default way to consider and act on global problems. Reductionism offers the attractive illusion of problem-solving. Achievements such as protecting a forest or ceasing a war look like steps toward getting problems under control globally. As the problems instead become bigger and more overwhelming, our psychology perversely makes more reduction, into smaller fragments of change, seem like the only way forward.

Shrinking thinking is fortunately optional for each of us. It can be reversed by seeing the system change opportunities beyond conventional solutions. These opportunities remain hidden only so long as they are collectively ignored. When they are brought to light by being discussed, explored, defined, mapped and widely shared, they will be harder to ignore. When there are debates about how to implement rapid global whole system change, it will be harder for people to act as if the option doesn't even exist.

The reversal of shrinking thinking starts with the practice of blindspotting. What do we keep missing? Why haven't standard methods worked? What assumptions are made? Those who still believe that we're on a trajectory toward solving global challenges can try a thought experiment by assuming the opposite. What if problem-solving efforts that haven't worked are part of the problem? What would a new trajectory involve? If these questions seem unhelpful or irrelevant, this is a normal reaction – keep asking!

Concepts such as connectedness and leverage are very important to the method you propose, which also features 'planet levers'. Could you describe each of these planet levers? A key strand is that applying these planet levers at the same time would facilitate a systemic change.

JG. The connectedness of our world, including all our problems, is infinite; everything is connected to everything else. To try to cope with this unfathomable complexity there are three possible viewpoints. Firstly, we could shrink our area of concern to the point where the problems no longer exist or no longer seem to require our involvement. This is the 'ostrich' or denial view. Secondly, we could shrink our ambition and focus on selected subsystems of global problems until they seem manageable. This is the reductionist viewpoint taken by virtually all problem-solving efforts. Thirdly, we could perceive and work with global complexity as an undivided whole system.

The system change viewpoint opens up new possibilities to handle complexity. Rather than expecting everyone to try to manage everything to address every problem, we look for patterns of connections. Today's patterns of connections are locked into arrangements that cause diverse problems everywhere. The same connectedness could be set up instead to prevent or reverse these problems. Suitable changes of policy, called planet levers, provide the leverage to change the way ›

[5] https://en.wikipedia.org/wiki/Here_be_dragons

the world works. Planet levers are connected like the levers of a lock, and must all be moved at the same time so the system can be unlocked without the parts obstructing each other.

Planet lever #1; net-positive progress[6]. The purpose of lever #1 is to end the worldwide delusion of progress, based on plans to gradually reduce problems that in fact get worse. Official planning related to global challenges, development and economic growth would explicitly acknowledge that real progress requires systemic change to reverse interconnected ecological, social and economic problems. Plans would set out how human systems must in future be restorative, by both preventing continuing impacts and by clearing stockpiles of accumulated problems. This can be implemented with the remaining six levers.

Planet lever #2; curiosity-led learning[7]. The causes of global problems, and our persistent failure to solve them, can both be traced back to reductionist habits of thinking that are unintentionally trained into every generation of young people. Lever #2 would enable education to instead build on people's innate creativity and curiosity. The practice of education at all levels would switch from delivering the next sequential piece of a predetermined curriculum to engaging with the unending flow of curiosity available in any group of people. This would not greatly change the content of learning but it would radically change the experience. People would see a world comprised of endless connections and possibilities, rather than a world constrained by limited conventional 'right answers'.

Planet lever #3; circular economics[8]. A multitude of local and global difficulties, from marine pollution to unreliable products to climate change, can be traced back to material flows that are linear: from resource to product to waste. All these problems would be tackled with lever #3. Today's linear economics would be switched to patterns of resource use that are circular: from resource to product to new resource. Circular economics involves producers' responsibility for the risk of their products becoming waste in the land, water or air. Producers would be obliged to insure against this waste-risk, with premiums spent throughout society on action to shift from linear to circular resource flows.

Planet lever #4; political incentive for peace[9]. The likelihoods of peace or conflict depend on investments in preparing for either peace or conflict. High levels of global military spending (currently above $1.7 trillion) massively undermine security by restricting the available investment in preventing the causes of conflict. Lever #4 would institute the missing political incentive to spend as little as possible preparing for conflict. The icon of political success, economic growth, would be simply adjusted by not counting weapons-related additions. This updating of Gross Domestic Product to 'Gross Peaceful Product' would tie political stature and re-election prospects to security strategies that minimise dependence on violence as a response to conflict.

Planet lever #5; Natural capital guardianship[10]. Conventional conservation practice can be radically upgraded by lever #5 to provide global legal protection of nature's ecosystem services and biodiversity. Ownership of a piece of the Earth would be reinterpreted by international treaty to include a duty of care to future generations. All rights for access and use of natural resources would be interpreted as applying only to the renewable harvest. This would create a culture of guardianship that replaces people's assumed ownership of the Earth with a sense of belonging to the Earth, which has been the foundation of all long-lasting cultures. A modern culture of belonging and guardianship would be equally suited to private, state and common areas of the Earth.

Planet lever #6; matching stockpiles of wealth and problems[11]. Persistent long-term unsustainability has built up massive, dangerously precarious stockpiles of ecological, social and financial problems, such as atmospheric carbon accumulations, war-ravaged countries and unpayable debts. Lever #6 would engage with one of these stockpiles, the surplus wealth of the world's mega-rich, to pay for clearing all of the others. The cultural tradition of potlatch, granting status according to the sharing of wealth, would be updated to underpin a peer-led global philanthropic movement to identify and resolve problem stockpiles worldwide. Citizens and governments would act decisively to incentivise full participation, for example by taxing speculation and property hoarding.

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[6] See also http://blindspot.org.uk/first-policy-switch/
[7] See also http://blindspot.org.uk/second-policy-switch/
[8] See also http://blindspot.org.uk/third-policy-switch/
[9] See also http://blindspot.org.uk/fourth-policy-switch/
[10] See also http://blindspot.org.uk/fifth-policy-switch/
[11] See also http://blindspot.org.uk/sixth-policy-switch/

"The reductionist thinking that built modern civilisation is also responsible for causing the problems that undermine it"

Planet lever #7; public money creation[12]. The creation of almost all money by banks as interest-bearing debt means that as money supply grows so does the debt of the economy, austerity, exploitive behaviours and the prospect of international financial collapse. The final lever, #7, is the basis for public and private financial security. In future, money would be created centrally (by a public owned and accountable body) and locally (by community public-interest bodies). Banks would benefit from ending money creation, which would cure their self-destructive casino culture. Everyone would benefit from the end of austerity, as public-created money would be spent into circulation, replacing money borrowed by governments.

Much of the sustainability movement, and most attempts to explore system change, have faltered on the question of economic growth. Growth is a terrible measure of progress since it usually rises along with unsustainability. However, telling politicians that sustainability is incompatible with growth has dramatically backfired. Most politicians worldwide now accept that they must choose between growth and genuine sustainability. Politicians rely heavily on growth as a measure of their success, since it usually looks good even when things are bad, so meaningful sustainability has been largely abandoned worldwide. Yet each of the planet levers can be used as effective and robust growth strategies. Current settings of the levers destroy the potential for future economic growth. Moving the levers preserves and builds the potential for continuing growth.

You work with decision-makers. Considering the importance of knowing what level of understanding these people have on the need for systemic change, do you perceive progress in their views and actions? Or do they stick to the usual way of solving problems separately?

JG. I wish I could say there was progress with decision-makers' understanding of systemic change. Most of them stick to the usual way of solving problems separately. Even when decision-makers promote a systemic change they try to do it with exactly the same proposals that have always been attempted. An example is the call[13] by Members of the European Parliament for systemic change to a more circular economy. Circular economy certainly would be a systemic change but it cannot happen with conventional proposals based on incremental targets, indicators and top-down design rules for products. Prescriptive approaches only restrain innovation and build opposition. Fortunately with circular economics, prescriptiveness is unnecessary and obsolete.

Decision-makers tend to be very busy so they rely more than most people on shrinking thinking to cope with the complexity of the issues they handle. A focus on conventional policy options and on selected priority issues seems to save time. When discussing issues with large numbers of colleagues and stakeholders, shrinking thinking offers a familiar shared language and familiar concepts that seem to save time. Ironically if decision-makers could find time to consider systemic change, they would find that it saves massively on time by creating far more positive change with far less legislative and regulatory effort. Very few systemic changes can tackle many symptomatic problems and very little government time, money or interference is needed.

Systems thinking and systems science has been developed as a field of study for many decades, for longer than sustainability has been discussed. However systems approaches have yet to shift decision-making or to be adopted sufficiently to solve any big problems. It seems that systemic change does not catch on when used in the same way as reductionism, to manage some complexity within limited areas of selected subsystems. Decision-makers may be able to become effective systems thinkers only by looking beyond their areas of responsibility and exploring the viewpoint of change without reductionism – of global whole system change.

People in positions of influence have another reason to struggle with systemic change. The method and the policy are not complicated. There are no valid obstacles to doing it. So why have decision-makers ›

[12] See also http://blindspot.org.uk/seventh-policy-switch/
[13] http://www.europarl.europa.eu/news/en/news-room/content/20150702IPR73644/html/Circular-economy-MEPs-call-for-%E2%80%9Csystemic-change%E2%80%9D-to-address-resource-scarcity

not called for it and made it happen already? How will the public respond when they discover that effective global problem-solving could have started decades ago; that much violent conflict, hardship, destruction and loss could have been avoided? Decision-makers don't just need to know what's possible; they also need to know how to explain the persistent failure of policy and politics. The simplest answer is that it's a systemic failure. Collective neglect of systemic errors is itself a systemic error that anyone can acknowledge and try to fix.

How important would a new kind of global security be (perhaps involving new institutions for global governance overriding the current UN) in moving towards sustainability?

JG. New language can bridge the gap between shrinking thinking and concepts that match the scale of the problems. The concept of sustainability includes social, economic and ecological protection although in practice, work on sustainable development typically neglects issues such as financial stability and conflict prevention. Sustainable development also suffers from a long tradition of being sought in ways that stop it from happening, such as by anti-capitalist activism or target-led bureaucratic planning, that are both routinely ignored by decision-makers. The goal of 'global security' seems far more suitable as a whole system goal.

Global security means all facets of security everywhere. It encompasses financial security, national security, climate security, ecological security, resource security, water security, food security and human security, for example. Global security means implementing rapid effective solutions to all major global problems to enable a decent life for everyone. It means unshrinking compassion and ambition as well as our thinking. The interconnectedness of the issues, which is inconvenient for reductionist efforts, becomes central to the problem-solving method. Rather than persistently trying and failing to solve a list of distinct problems, we can now tackle as a whole the overall problem of a civilisation that's set up to undermine its prospects for the future.

Seeing global challenges as a whole system makes it possible to discuss how the system operates. Currently we're locked into outcomes of diminishing global security, where some security is provided for some people within financial or geographical bubbles. At an unpredictable point in time these bubbles will burst, and security will become a fond memory. Collapse may be triggered by any of the symptoms of any facet of security that humanity fails to ensure. Everyone's preferred outcome, where collapse is avoided and the world is set up to generate global security, could still be achievable.

Global governance has experimented for the past 50 years with every imaginable variation of the reductionist method. Surely it's now time to try the non-reductionist method? For this we can consider the role of institutions in implementing global system change. Changing the 'hardware' of institutional arrangements tends to be slow because existing institutions already occupy areas that any new institutions hope to work on. The other possibility is the 'software' of global governance; the ideas, methods and assumptions that could be changed by a new viewpoint or a new insight in the time it takes to change our minds. Collaborative global system change work could advance insights between institutions, including among UN departments.

You often emphasise that the path we follow is optional, and that there are of course alternatives. But changing course is not the same for a small boat and a large ocean liner. And the truth is that our system is a very large ship. Which would be the first strategic step towards changing our path?

JG. Seeing civilisation as a very large ship can help us see how to change the path away from collisions with climate, social, financial and ecological icebergs. We can see that it's not good enough only to fortify our own cabin or to avoid just some icebergs or to proceed more slowly in the same direction. Our task is to change direction by 180 degrees, to enact a turnaround strategy. The advantage of diametrical change is that diametrical thinking is brought to light rather than suppressed. The habits of thinking and problem-solving methods used in the past are more likely to be questioned than routinely reused.

The first step to changing the path of our shared ship, away from collapse and toward global security, is making that choice about diametrical change and diametrical thinking. This frees us from remaining

stuck pushing on the same old rusty levers that just don't work. Conventional solutions have leverage only to the extent that all the problems can be conveniently separated and gradually improved. This extent has proven to be minimal, due to the world's extreme interconnectedness. Should we keep expecting all the problems to adapt to our habits of thinking about them, or should we simply adapt our thinking?

By adapting our thinking we can open up dramatically more effective opportunities to turn around our very large ship. The past limited responsiveness of our ship might be due to people pushing on every obvious small lever and ignoring the less obvious big ones. Moving the right levers may even allow our very large ship to change path as fast as a small boat. The speed of system change would be limited by how quickly all the planet levers are moved from their current default positions. The new system could then allow genuine solutions to self-organise in the same way as all the difficulties self-organise today.

BlindSpot's Planet Levers Lab works on the levers to turn the ship around. This is a fast-expanding initiative to make sure that the planet levers are ready to use and the international problem-solving community are ready to use them. Close collaborations with decision-makers and journalists could quickly transform system change from blindspot to real-world breakthrough. We are helping people make the connection between their specific issues of concern and the system change approach. We are building the network of individuals and organisations ready to explore system change and to help make it happen. If you are interested, please get in touch! x

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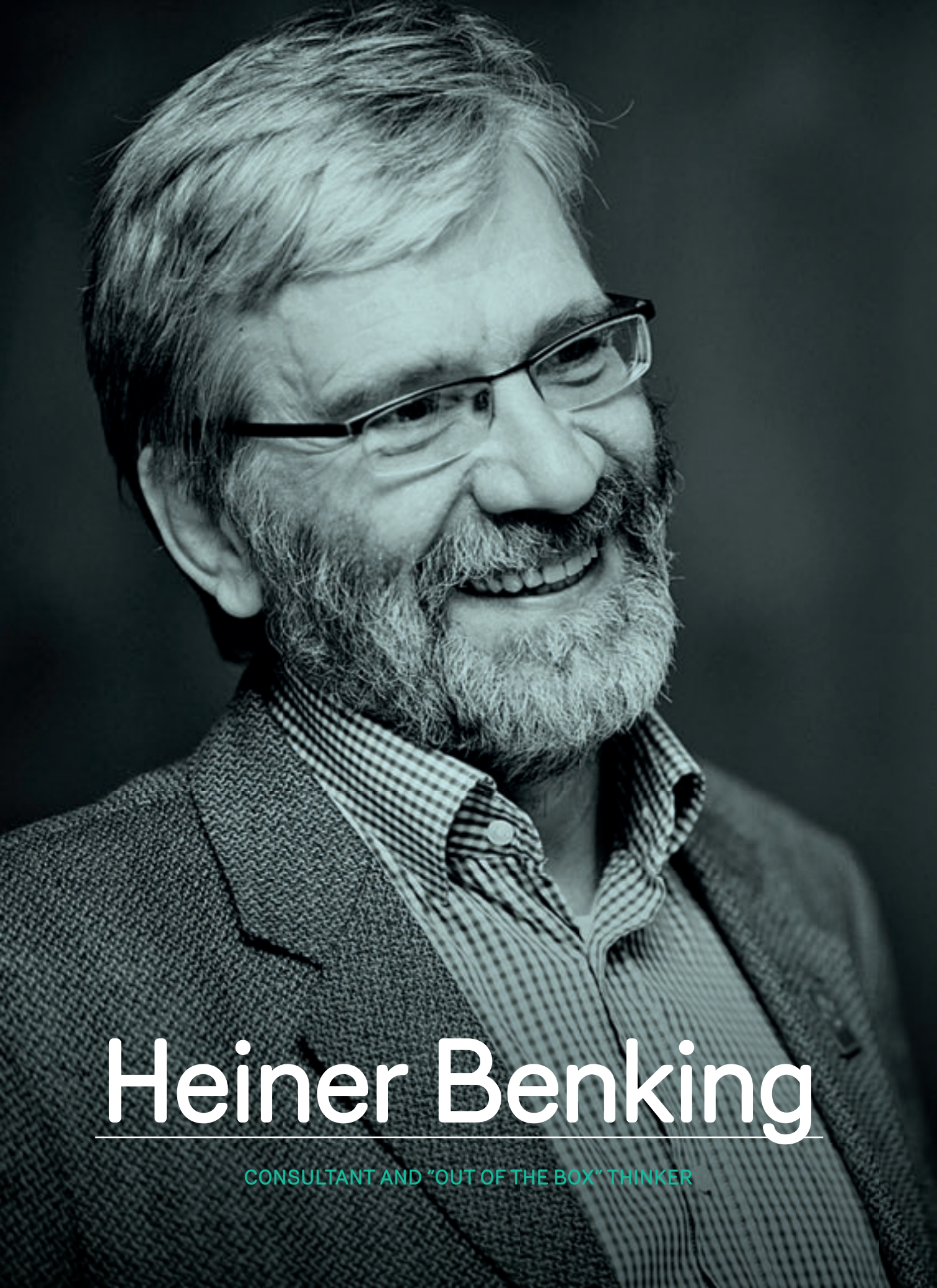
http://blindspot.org.uk/about



Heiner Benking

CONSULTANT AND "OUT OF THE BOX" THINKER

Sustainability is often stated simply but it is actually an extremely complex issue that can be approached from multiple perspectives. The three classic dimensions of sustainability (environmental, economic and social) are useful for a quick understanding but sustainability is an area where health, education, culture, and many other fields of knowledge meet.

"Oversimplifications distract us from necessary realizations and actions"

Do you think that the emergence of the concept of sustainability was inevitable in the course of human history? The idea of limitations was absent during the progress made in the nineteenth and twentieth centuries.

HB. Nowadays the word sustainability is often heard in connection with numbers, limits and boundaries. I personally think sustainability is more based on literacy and numeracy, and at the same time goes beyond this, helping us not only to know, connect and transcend, but also to realise shared positive actions. This is true when you think in terms of "ought implies can" and become open to finding a shared orientation and purposes for broader prospects.

You can only come to grips with numbers, indicators, terms and concepts if you see them in their original context and cultural settings.

Nature and culture have been present since very early on. In preparation for the 1992 Earth Summit in Rio, the originally-united UN programmes UNDP and UNEP followed the trend for segregation and made it so that the UNEP was primarily in charge of the United Nations Conference on Environment and Development (UNCED). This would have made sense if we had wanted to talk about the changes we inflict on natural and cultural systems, but several developmental trajectories got lost along the way. I mentioned "Can implies Ought" earlier. Keeping this in mind, today's sustainability has to go beyond the three ecology, economy and social pillars of AGENDA 21 and the human and cultural dimensions. The question is how we humans can, via the slightest "butterfly effect", trigger or even superimpose natural cycles that downgrade and destroy living systems in what is nowadays fashionably referred to as "Anthropocene".

It is important to confront environmental and cultural change. We have to come to terms with the scale and what are fashionably known as "rebound" or "boomerang effects", which make it obvious that the carrying capacity is endangered and show that we are living as bank robbers by stealing Mother Nature's "funds" and that our footprints leave nothing for future generations. You might want to call it an "externalisation" of costs or risks, but it is all very much the same.

There are definitely thresholds, just as there are natural and material limits and realities, such as how you cannot jump into the same river twice, or swallow something larger than fits down your throat. This was the important message issued in the Club of Rome's first report: "Limits to Growth".

In dynamic biological and cultural systems these processes are not linear and predictable: there are not only prognostic, but also participative and normative futures. We have to realise and negotiate our positions and perspectives. The first figure in "Limits to Growth" displays the dimensionality. Are we talking about our individual and short-term ›

interests or do we also include societal and cultural long views, different scales and sectors? This question was addressed when we presented System Earth as something we need to outline and negotiate. See my Cognitive Panorama and Blackbox Nature design below.

In order to underline the need for specific *and combined* views on different scales and in shared frames of reference, terms like "sustainability" are needed. *To reduce sustainability to a conversation primarily about "boundaries" is counterproductive*. The "Problematique," as already laid out in the early Club of Rome studies, is complex and perplexing. Over-claims and oversimplifications are only a skirmish to distract us from necessary realisations and actions to live in balance and harmony and not overexploit our resource-base and rob others of their future.

It is indeed fashionable today to use words like sustainable, systemic, holistic, organismic, resilient and upcycling. Such terms, just like metaphors, images or stories, can be very misleading, as they make you think you know, when you do not.

I recommend that you read the International Encyclopedia of Systems and Cybernetics in which each systemic term is defined and used with examples of different meanings in the various subject areas. It is far too easy to fight only over words or indicators, ignoring the specific situations, scales and values involved. Adding and combining positions in shared frames may be achieved by using new visualisation and negotiation approaches, by bridging scales and mindsets, breaking through imagined "boundaries" and stepping out of the "pictures".

You are opening up a very broad perspective here that is a challenge to set forth. What do you think of the 2030 Agenda and the agreement made by the Nations on Sustainable Development Goals (SDGs) last September?

HB. I see the process of the UNCED in Stockholm in 1972 and in Rio in 1992 was not focused primarily on numbers or boundaries; it was as its name suggested on a much broader subject: Environment and Development. It was only later on that the UN programmes in charge (the UNEP and UNDP) were separated and this is a trend we have to observe carefully.

The question is: do the Sustainable Development Goals (SDGs) continue this trend towards more and more segregation or is the trend now leading towards integration and more systemic approaches as the terms we use today indicate?

I feel the Earth Summits those days were about much more: cultures, values, rights, survival and diversity. Director of UNEP-RONA in New York and Administrator of the Rio'92 process Noel Brown *stated repeatedly that those days elders were concerned about finding "Common Frames of References", while in the early days of such treaties, Margaret Mead and Gregory Bateson had a long-term vision in mind with anthropological and human dimensions far beyond "limits"*. I also feel that the rhetoric goes round in circles and that we should check carefully if we are up- or downcycling.

In my view, the trend to bring all nations and stakeholders to the table is a very positive one and modern communication makes a lot possible. But there are certainly great dangers on the horizon when you vote on priorities with certain interests or check the influences and try to address root causes and where to intervene in systems. Donella Meadows referred to "leverage points" in contrast to being mesmerised into tipping points and boundaries. *Thor Heyerdahl* is often quoted with: "Borders I have never seen. But I have heard they exist in the *minds* of some *people*".

I think I should expand upon the SDGs and boundaries between silos and goals and modern multi-track deliberations and negotiations in the actions and recommendations section later.

I understand that you have worked as an engineer, consultant and journalist in various environments and fields. How did your professional life begin both locally and globally? Is there a common thread that connects your work to sustainability?

HB. As a trained surveyor and geoscientist I worked in construction, town and state-planning, facilities management, environmental research, computer graphic design, consulting and market research, knowledge processing and organisation, future studies, education, communication strategies, dialogue facilitation and journalism.

As you can see there is some "spread-think" and some very broad experience there. Maybe surveyors are generalists by training and I was definitely with the nomads for years.

Not only environmentalists, but every one of us must be aware of being witnesses not only to certain sectors and times, but on different scales. Geoscientists make their maps for better

presentation and communication on different levels of resolution and abstraction multi-dimensionally and thematically. They are aware of the "in-between": the spaces between people and their identities, positions, perspectives and values. This is where I feel my contribution is: exploring how can we negotiate across cultures, sectors and languages, taking on multi-modal ways to communicate, present and negotiate with overlapping coarse checked and fine grained conceptual resolution (panning and zooming even on oblique views). In German we have the word "kleinkariert" meaning small- and petty-minded, so why not add "großkariert" to refer to a general rough orientation, maybe using "big- or wide-minded..?

There are many cross-cutting fields, not just environment, but also health, security, climate, culture, economy and peace... and so sustainability may gatecrash many other fields when widening the scope to life sciences, health and medicine, agriculture and cultures.

I feel that any isolated approach only serves certain interests in a given period and place. So how do we approach this "web of life" and the patterns between people, meanings, expectations and assumptions? Well, this might be my thread in life, to communicate and bridge, sharing maps and models for better futures. What I can bring to the table is adding contexts via specific maps and models and nurturing a special focus on how we translate and transform across ways of presentation and communication individually and collectively by harnessing the wisdom of stakeholders.

"It is indeed fashionable today to use words like sustainable, systemic, holistic, organismic, resilient, up-cycling... Such terms can be very misleading, they make you think you know when you do not"

What do you mean by communicating and negotiating with maps and models? Tell us your story. What kicked everything off? What do you do differently and what are the challenges, outcomes, prospects and experiences you want to share?

HB. The transition point when my subject space began widening and also to conceptually *pan&zoom* was when I was invited as an individual – not as a representative of a national research agency or scientific, industrial policy institution – to contribute to the GLOBAL CHANGE Challenges to Science and Politics exhibition in the German Chancellery in 1990. I just happened to be involved in environmental research, data acquisition and visualisation projects with many of the other exhibition partners and also worked for the Alfred Wegener Foundation establishing the Geotechnica Fair (1991).

One central issue and contribution was to set the stage for the exhibition, defining "System Earth", "ecology" and the challenges to policy-making and public understanding. All the science and policy people had their own terms, disciplines and turfs in mind and there was no way to find something they could all agree on to fit the space and format of the first exhibition poster. "One picture and 5 sentences" was the outline for about 40 posters in 5 sections.

So what is System Earth? I remembered that I had learned during my studies that "ecology is what ecologists do" and that "scale is more than size, it includes proportions and consequences".

So in the design, any list, text or diagram alone was dismissed as not enough.

In the end I came up with a poster with a text-block plus a grid/picture and a build scale model (3D). Just as architects and artists build to present and help negotiate design features, I called this exponat "Blackbox Nature", "Rubik's Cube of Ecology" or "Eco-Cube", an immersive Blackbox/Whitebox with the axis: disciplines, magnitudes and time scales, as this is what I had learned: ecologists bridge and interact along and across these scales. So what we did was to "position" views and frames and their "commons, differences and overlaps. Such a conceptual joint negotiation, panning and zooming in on a thematic model known as a "virtual, immersive, embodied reality", lead to the description of a Cognitive Panorama in 1990, although maybe this was much too early. Consider the Systems Encyclopedia mentioned and how 25 years later the depth of this cube was called "GLocal", finally picked up at this point by the political sciences. ›

And how is this applied?

HB. Obviously, as a "map is not the territory", neither is a "model the reality", although it can help us to try to understand, negotiate, change and test from a distance with a very coarse and "artificial" resolution. Call it a multimodal approach, where you can use various forms, ways, sign-systems, and senses to add meaning and relations in order to subsume and resonate. Today I would call it "Futures Design".

When applying this mental model or scaffolding and considering it a skeleton for overview-style knowledge and orientation, I learned to think in parallel. First with my own eyes and then with a "bird's" eye, adding the general orientation of shared mental landscapes. I learned that animals like spiders have many eyes and I learned about deep-sea fishes having a macro eye to check for predators, and the micro-eye also for other bandwidths and other senses! What a smart move by Nature! But we humans continue with our "business as usual" approach within our "mono" and "single" mode.

The difference is that I use thematic landscapes (Cognitive Panorama) to give a place for knowledge and meaning so I can remember, combine and even communicate and negotiate with others. See recent articles on Ontologies. The difference is that I liked to "play" it in "out-of-the-box" and "paradigm-mapping" workshops and I also changed myself, not just participants. I was told to be different and innovative, with strange new ideas, combining on the surface what people would have never thought of or imagined. Some kids called it "wise": I just consider it to be combinational with a broader orientation matching different kinds of things, and coming to other conclusions. Others have called it alien and strange. I hope it is creative and unsettling. The Problematique asks us to open our horizons and even think and share twice when in doubt.

The years after 1990 were very exciting, exhausting and rewarding, as I had to show how this model-cube links to the physical-geographical world and to worlds of knowing in different languages and cultures. You find all this as a "Cognitive Panorama" or "Conceptual Superstructure" in systems encyclopedias. I have also presented in the fields of Knowledge Organisation and Ontologies. Maybe check "Our View of Life is too Flat" or the "paradigm mapping workshops" already mentioned, or New Ideas in Science and Arts, New Spaces for Culture and Society with the Council of Europe in 1995, where I presented a "meta-paradigm".

There is no panacea. Maps and models are not the solution but can be helpful. Sometimes you need to look back and revisit a "General Model Theory" (Stachowiak) as it can support a "General Systems Theory" (Bertalanffy), although it may seem like mission impossible. We had sessions in Berlin in 2009 in a gathering of international Nobel Peace Laureates about "Breaking down New Walls" and it was clear that we need NEW SCIENCEs, NEW LANGUAGEs and NEW THINKINGs as the Problematique which was laid out in the first Club of Rome reports in the late 1960s went on to explode, while the discussion on Human, Social and Cultural needs, rights, and responsibilities got going in the last 20 years.

The question is whether we should explore new means of covering shared immersive real and virtual model solution spaces and realities, constructions and models, sign and symbol systems, feelings, aesthetics, cultural expressions, or instead muddle through.

Let's leave aside for a moment your model-constructions of shared contexts and common frames. You mentioned the Sustainable Development Goals (SDGs): are they a breakthrough in the international Agenda? Do they provide a means for burden-sharing and serve as joint solutions towards poverty alleviation and ecological justice, as well as promoting the maintenance of a healthy and stable planet from a mid-term human perspective?

HB. Mark Twain is often cited as saying, "When we lost our direction we doubled our efforts". I mentioned before that we need to watch our words and metaphors or goals, as even a story or image can be very misleading. I referred to this once as over-claims through oversimplification leading to under-complex failed solutions. Agreeing on goals is quite easy. But what if achieving one goal is like going in only one direction and detrimental to other goals? Besides this, it is hard or often impossible to go in many directions at once, so where should you start?! But it is definitely good to get going on common grounds.

I had the questionable "pleasure" of being in funders and policy gatherings where the arrogance of some "thought-leaders" was incredible. They asked to be given "the first five largest problems" in order to throw at these TOP 5 issues incredible amounts of money. Some economists seem to be educated this way. They "externalise risks" and make short-term promises without any mid- or long-term comprehensive strategies and this seems to be contagious nowadays, as even policy-makers seem to follow such funding strategies. You need to revisit "seed financing" and "haircuts". In German we illustrate this with the "watering-can" (Gießkannen-) and "lawn-mover" (Rasenmäher) principle. You only have the lever of investing or divesting, being ruled by "bulls and bears". The result: you burn lots of money, waste time and lose trust as the environmental situation worsens dramatically as you fail to address the critical issues. I believe what needs to be done is to link goals and address deep drivers. To apply solutions which are triggers for other areas in demand is what I mean; we call them "Leverage Projects" and "Leverage Solutions".

It is good to have a set of values and clearly agree on Positive Ends. But have you heard of dilemmas? Strategic Dilemmas in Sustainability Dialogues were tabled before Rio by the UIA, UNU in the Inter-Sectoral Dialogues at the Earth Summit, under the auspices of the International Facilitating Committee for the Independent Sectors in the UNCED Process (chaired by Ashok Khosla) and it is clear that we have to be much smarter and wise to see how the issues connect in the deep. How can you get to the deep drivers? How can you approach goals which when solved also help to achieve the others?

I belong to a group of Global Agoras and manage the 21stCenturyAgora website where we assemble practitioners and their projects worldwide which apply the method of structured dialogic design where you not only "harness the collective wisdom of the people" (or, even better, participants or stakeholders) and also harness the original tradition of the Prospectus of the Club of Rome and the Predicament of Mankind to look not only into prognostic futures (Limits to Growth modelling) but also normative and participatory futures.

The method I have in mind is called Structured Dialogic Design, based on the early work of the Club of Rome, such as in "Problematique" and "Predicament of Mankind", as it is now used in international multi-track diplomacy and peacemaking projects. You create an influence map by having stakeholders see which actions towards one objective serve another one. It is not a "quickie": you have to make informed decisions by re-checking the meanings and influences and come to agreed actions. This was done for example by young people for the Millennium Development Goals (MDGs), as well as in conflict resolution, and was proposed for the Millennium Projects "Human Challenges" or in developing Funding Strategies for European Commission Projects. This article with a special focus on the SDGs provides details.

It is good to have widespread agreement on the goals and sub-goals, but now the work has to start and we have to tackle them effectively and wisely. The problem is that burden-sharing means that you look not only into where you are and what you can do, but also consider how to be fair – when situations are different as the means should be different – as long as your goals are positive and you consider the "common frames of reference" and adopt new approaches towards our "appreciation" culture and how we adjust to the need for "authentic" communication.

You mentioned Dialogue and Deliberation as well as Sharing and Gifting. Do you see ways to use modern internet and communication technologies with voting and debate as an aid to clarifying situations and coming to informed decisions and collective actions?

HB. In the German Positive Nett-Works e.V. NGO we have been working for years via the Open-Forum on dialogue and large group facilitation. We feel that society has lost the patience to listen and deliberate, making deals even when we call it sharing and compassionate listening and unconditional gifting gets lost. We do not encourage and empower but fight over attention and time and develop more and more in-groups that are like gated communities in their filter bubbles.

I mentioned before with the Structured Dialogic Design that the situations are complex and that there are so many isolated views and "solutions" on the table that we can easily get overwhelmed. Modern ›

deliberations and facilitation approaches can help us navigate and explore influence patterns. But the issue of attention is widely neglected. We need tools to help us create structure so we do not get overloaded. The issue of our human attention span and cognitive overload was recently raised in the European Commission's DIGITAL MANIFESTO – see the contribution by my colleague from the Future Worlds Centre Yiannis Laouris.

Breaking issues and influences into smaller "chunks" in order to oversee and outline for oneself and the group of participants/stakeholders is essential, but I was forced to realise that this is not enough. We are not on an "equal footing" in group processes due to influence, power, media and position, with volume and rhetoric also influencing opinions in obvious and subtle ways. And again there is definitely no panacea.

We called such processes with Barbara Marx-Hubbard "co-creation": an open-ended empowerment and joint transformation on larger scales. Such group capacities, taking individual viewpoints out and subsuming and resonating, are essential for the next step of deliberation, evaluation, capacity building and execution. And this is what I mentioned before: the continuous critical problems (CCPs) are what we have to consider in light of the MDGs over the last 15 years and the SDG until 2030.

Your present focus is very much on Sustainability Education. Where do we start?

HB. Words and fashionable slogans can not only be meaningless, but worse, can hide progress, if there is any. Besides environmental education and environmental awareness are other lifestyles and other production processes, infrastructures and transport systems and buildings. Let us first agree that we need a comprehensive and lasting approach.

Germany established the German Advisory Council on Global Change (WBGU), which was a predecessor of the GLOBAL CHANGE Secretariat from the late 1980s (see footnote GLOBAL CHANGE exhibition). So I feel I can look at the developments over a time and definitely say that we have not made the progress envisaged 25 years ago. But where do we need to start with our robust paths and steps to a difference in view of all of the rebound and scale effects which we have known about for a long time? There are dilemmas as we know and have covered before. It is easy to play the "Contrarian", opposing everything as a single measure will not solve all the problems.

Most of us will answer: IN EDUCATION. But where in Education? In our Kindergartens, in Higher Education? In vocational training or lifelong learning programmes? And don't forget the question before that we need to diversify and not throw all the money into one silo! The NRC produced a collection of GRAND ENVIRONMENTAL CHALLENGES after Rio and we were full of hope, and yet...

I already answered that we need another pragmatic spin rooted in living socio-cultural processes where we consider the life-cycle, rebound effects, scales and dynamics involved.

We discussed this and called it a "Meta-Paradigm", as Hugo Kühlewind as an educator requested approaches where the paradigms connect. It is helpful to include the footprint in our curriculum, how much we use or consume per area so we have a chance to compare and orient ourselves in our lifestyles. But we also need to communicate the rate of change and efficiency, the handprint. Maybe see it as the other side of the coin of the footprint. In the Decade for Education Sustainable Development (DESD), we added also the mind print, as measures work well when comparable, when they can be agreed and standardised. There are interesting innovative cultural approaches which use surprising, never thought-of "dolphin solutions" (as I mentioned earlier).

I am supporting activities in an Institute for Sustainability in Education, Work and Culture (INBAK) in Berlin. The focus is not just on Vocational Training projects, but on community building and media. What is recycling and upcycling? What are old and new media? Can we contribute to community building and cultural education? Can we create

"My contribution is exploring how we can negotiate across cultures, sectors and languages, taking on multi-modal ways to communicate"

a whole story where people across generations, cultures and sectors have something in common? And where do we bring together different parts of society by making the idea of SUSTAINABILITY real and alive? There is a brochure with European projects for this BücherboXX. I am involved with the German Councils of Towns and Regions to look into their Challenges and we organise art interventions or projects with youth groups on ADD, ADD Townships and AND, so I feel education only works if we use projects and move beyond categories, resorts or silo boundaries.

We looked at skills capacities with the UNESCO DESD Decade but I feel we need to take and use EDUCATION to go on the meta and super "level" and maybe produce from all this words, meanings and analyses to synthesis and share collective answers and actions.

You did a "tour de raison" in an "ars memoriae" encompassing scales, ways of thinking, reasoning and activities. But where do we go from here? We need analysis and synthesis and actions: so what are our futures? What should we do?

HB. As always, there is a spectrum between extremes like care versus control or mass extinction or transformation and transcendence.

I have been on the Millennium Project since 1993 and there are many futuristic alternatives, so we do not need to wreck the planet. On the other hand I do not believe in boundaries, there are none in nature. There are tipping-points and leverage points and if we reach certain thresholds, systems change by moving into other relatively stable equilibrium phases, although perhaps these phases will not be able to accommodate the human species.

Lynton Caldwell, ambassador and founder of the US Environmental Protection Agency EPA and predecessor, or better for whom Elinor Ostrom inherited her professorship in Bloomington, was very concerned with this exact question, and for his ninetieth birthday he invited, like you do in this series of interviews, a number of diverse thought leaders and activists to say whether or not they believed that humanity is destined to self-destruct. Only constructive responses came in; many were quite concerned twenty years ago. My little piece was "Show or Schau?" - so I could answer here: Redo the old stuff! But let me be more constructive. I think we have to watch out for certain avenues which we should jointly engage in. Leverage points where we can make a difference when going beyond isolated quick fixes.

So what should we do and explore? Do some points of departure come to mind?

HB. *1)* We should look into models and systems at the same time. Humans are "model-making animals" (UNESCO). We create Solution Spaces then we jointly combine and inhabit them. The moment we make use of model-spaces, we can with Helmut Plessner (philosophical anthropology) negotiate ex-centric positionalities (which means not only to see with your eyes but also to see with other eyes from different real and conceptual locations). To combine conceptually different perspectives, senses or modes is what animals do, but we humans stick to our physical "outfit" trying to use our close-range "outfit" to solve long-range and cross-scale problems. In short: Revisit the General System, Model and Geography Theory.

2) Harnessing the Collective Wisdom of People/ Participants by using other ways to dialogue and deliberate, negotiating influences and developing action agendas.

3) Look into Dialogue and Group Facilitation, Sharing and Gifting in Conversations and how to scale them. Mother Pelican – A Journal of Solidarity and Sustainability article in progress **** check:

4) Look into multi-positional approaches. People do not operate only on different scales but work with varying levels of detail, being a specialist here and a generalist there. I mentioned "T" personalities and what we call transdisciplinarity, translating between languages. We should better include the social and cultural domains of expressions and be more aware of "vague subject areas" (what people mean where) instead of believing in a one-for-all final definition for all cases.

5) Revisit the current "Big Data" hype, which I called "Big Noise" long before terms like "Smart Data" and other concepts came up. There is not only data, knowledge and wisdom but we should see how to handle these "forms": knowing, collecting, ›

connecting, translating, transforming, transcending. Number Crunching is alpha-numeric only. We have to bridge not only coded and non-coded (images) data but also a lot of other forms of sensing and reasoning. The Animal Kingdom provides lots of examples, but we continue with binary, dualistic and narrow concepts to conceptualise, present and negotiate.

6) Focus on education in general, across formats and life-long and generational and cultural learning systems. There was a general mapping "theory" developed in praxii, when Carl Ritter was with Pestalozzi. At this point I can only point to the Humboldt Institute for internet and society presentation and feel that such general systems and model-theory thinking has to be based on map- and model literacy.

7) Revisit policy-making, governance and multi-track diplomacy in view of the scale and subject of challenges presented towards structural and pragmatic Earth Literacy.

8) Explore and navigate Leverage Projects/ Leverage Solutions. Projects where investments are not for "silo-islands in isolation" but for benefits across scales and sectors and have results in clearly defined time-horizons (epochal, not episodic short-term "benefits"). See the growing collection of Leverage Solutions presently collected around the SDG implementation strategies.

9) Bridge between modes, the short and long term, not just glocally the micro-meso-macro perspective. Maybe with the concept of "Ecocide" we can reach higher levels of causation and impact. We can influence not only human and social spheres but impact the living spheres far beyond us "Earthlings". In German we differentiate between Gesinnungs- and Verantwortungsethik. An ethics for the individual mentality and attitude, and ethics taking into account the long-view impact of Responsibility Ethics (time and space horizons (Hans Jonas) and even beyond the framing of traditional spaces, senses and media. Maybe everybody should take on an extra view and consider the broader impact and happiness and suffering involved. Why not? Maybe we should avoid blaming others by repeating "that is not my field" or "I am only an industrialist, politician, engineer, citizen, lawyer... etc". Instead we could show that we are One: sentient beings which can change our focus, mentality and reach.

The call for people to take a long view of responsibility was first voiced decades ago. Do you feel it has traction and that people are able to respond?

I wonder whether the call is asking for the impossible and we should instead call for long-view responsibility to be brought into the current moment via our culture and economics. Then we are asking which mechanisms to use rather than expecting people to behave differently with the existing self-destruction mechanisms.

I would love to see people become more sentient, but have to say I see the opposite every day at all levels. I think we've collectively 'lost the plot', but we keep ourselves busy writing stories about how well we're doing and how things are just about to get better. x

Heiner Benking is an "out-of-the-box" thinker. He is by training a "map and model maker" to have worked in engineering, construction and planning. He also has experience in consulting, marketing, market research, environmental research and management, knowledge organisation, systems and future studies. He now works in Berlin as journalist, facilitator and curator, with a special focus on environmental education, culture, media and civil society youth and artistic interventions projects.

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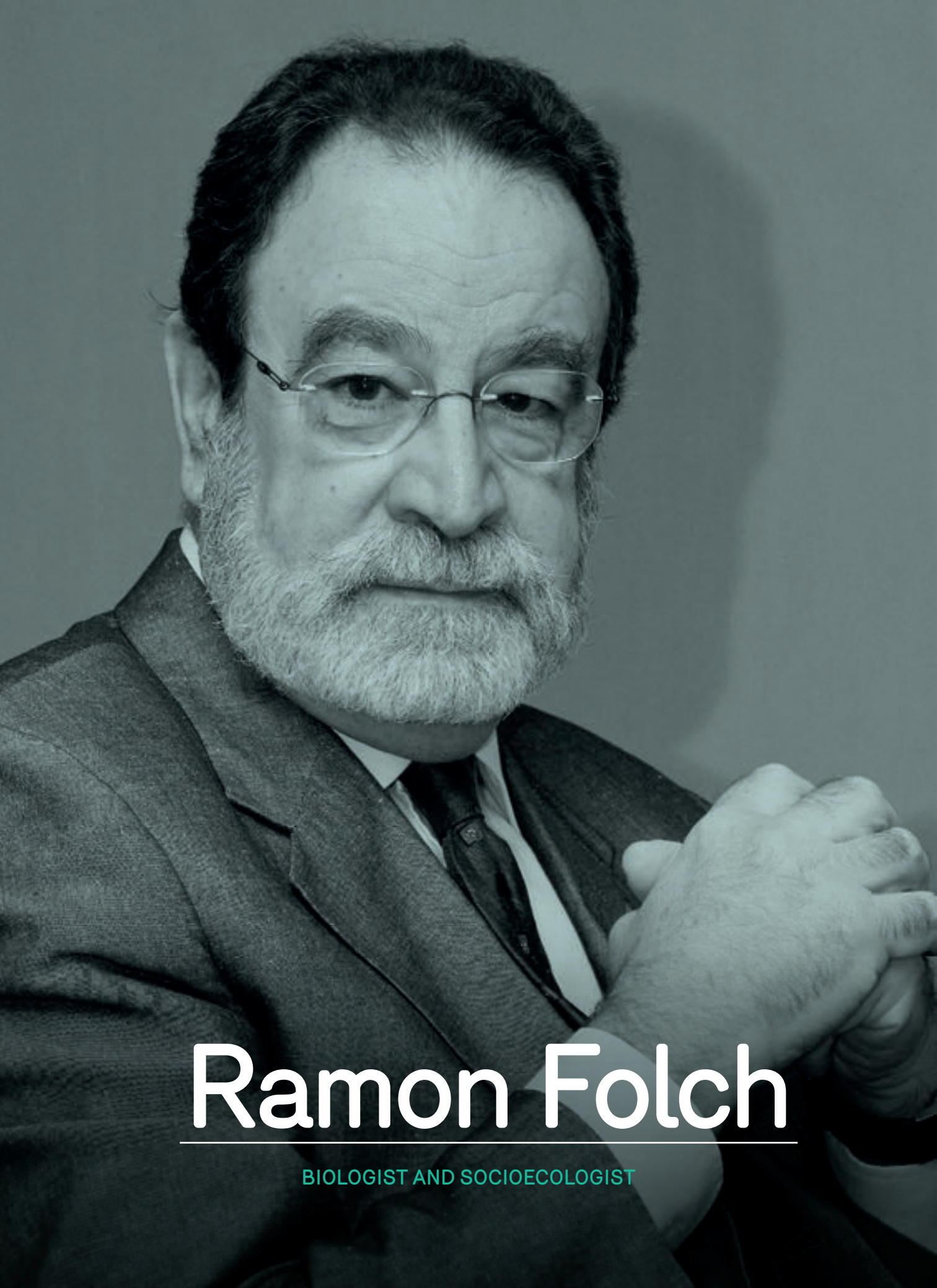


Ramon Folch

BIOLOGIST AND SOCIOECOLOGIST

Sustainable development is not a revealed knowledge but a concept formulated in a precise context that should be analyzed and discussed. Criticism is the only way to discover the limitations of sustainable development and thus improve its approaches and perspectives.

"Everyone has interpreted sustainability in a different way"

Ever since the concept of sustainable development was formulated in the late 1980s, it has been subjected to criticism and trivialisation. Let's talk specifically about the criticism levelled at the Brundtland Report definition of sustainability.

RF. Indeed, the current idea of sustainability was "introduced to society" by the famous Brundtland Report, endorsed by the global authority that is the United Nations, and stating that, in short, our present needs must be met without compromising the ability of future generations to meet their own needs. In fact, rather than serving as a definition, it is instead a slogan that expresses what we would like to happen without saying how to achieve it and which theoretical bases would be used to face the challenge. This is undoubtedly a major weakness in the starting point. It didn't originate from a well-defined academic concept, and is rather a set of concerns, reactions and attitudes that arose according to the global reality in the 60s and 70s, and that over time has built up a body of knowledge which is slightly incoherent and not very well articulated.

What has been the result of this building of knowledge about sustainability?

RF. Everyone has come to interpret sustainability in a different way. It is assumed that there are three main dimensions to sustainability (environmental, economic and social) and each author has emphasised one aspect or another based on their own background. In my case, for instance, I am an ecologist by education and my initial approach to sustainability was in terms of the environment, but I think I have made an effort to understand and appreciate the other dimensions. But other people's points of view are exclusively marked by their original framework and therefore fail to get off the ground, so to speak. These attitudes generate limitations and contradictions. It happens every day, such as when certain economic interventions are qualified as "sustainable" without a consideration of the effects on the environment. And I would even say that language becomes twisted. The media often talks about the importance of ensuring "sustained growth", as though this were a synonym for "sustainable growth", when in fact sustained growth is the most unsustainable type, if growth is defined as a quantitative increase in size. If we take growth to mean an increase in capacity, then it is different.

Can you explain and provide an example of the different implications of *increasing in size* and increasing in capacity?

RF. Life gives us a very clear example. Every year children get a little taller and heavier until they reach a certain point and stop growing. If we didn't stop growing, it would kill us. Instead, in life, we continue to grow qualitatively: we train in professions, improve our social skills and delve deeper into the meaning of things. We do this without an impact on matter. Our body stays more or less the same. I think that this is not a metaphor but an isomorphism. If we look back at history, we can see that we have gone through periods where material and quantitative increases have been very important but, over time, increases in capacities have been more prominent: just as in the transition from childhood to adulthood. There are objective limitations to the quantitative increase of the body such as the poor viability of an organism ›

of an enormous size. Moreover, there are many advantages to developing different skills. In the old economy, physical force was important but it is not anymore. It is not about being able to lift bags, but about having the skill to handle the machine that performs this function.

Is the concept of sustainability therefore a consequence of acknowledging this change in the course of humankind?
RF. Yes, I think the idea of sustainability has been shaped by the fact that humankind has experienced the situation I have just described first hand. It has also become evident that the greatest benefits are obtained more on a third or fourth level than primarily and secondarily. Returning to the earlier comparison, I would say that mankind has already been through its adolescence. But I must insist that the "discovery" of sustainability has not been extracted from a thesis, but from a sum of insights and ideas that have not been academically structured. That is why eight out of ten times the word sustainability is mentioned – and I don't think I'm exaggerating – it is used in a biased or distorted way that is contradictory to its real meaning. The epistemological deficit of the concept has therefore allowed for this constant distortion. As Montesquieu said, "to define is to avoid making mistakes."

It has also been said that "sustainable" and "development" are conflicting terms.
RF. This is only when "development" refers to unlimited growth. I made an attempt at a definition by saying that sustainability is a cost-benefit maximisation as long as all costs and all benefits are included. Therefore the costs must take into account not only the price of raw materials, but also the dysfunctional environmental and social effects to have occurred.

Another very important issue that is often lacking in definitions of sustainability is scale, and yet it's fundamental. Sustainability only makes sense when it is considered in a given space and time scale. First of all, if the time scale is absolutely indefinite, then sustainability is nonsense. The idea of sustainability was not raised in the twelfth or eighteenth century because it was only in the twentieth century that humankind realised that its activity generated dysfunctional effects. What we are sensing is that it seems unlikely that our current model of development can be maintained in the future. But prospective formulations more than 70 or 100 years away from now make no sense. Because we haven't got a clue what the needs or desires of future generations will be. Just look at how naïve science fiction or futuristic movies seem only a few decades later. In terms of the space scale, if humankind were to colonise other worlds then the prospect of sustainability, which takes into account the physical limits of the Earth, would obviously change radically.

This is an unusual vision, but at least it focuses the discussion.
RF. Yes, this is basically a positive thing because it tackles the grandiloquence of the issue and considers it on the pragmatic grounds of *here and now*. I think that those who have made modest and honest contributions to thought on sustainability have done so in order to build effective tools to solve problems in the context that we can manage. So I do not want to speculate beyond the twenty-first century, as doing so would make unjustified predictions.

Another ambiguous element in the Brundtland Report definition is the mention of *human needs*. What exactly are we talking about?
RF. This is a very important observation. Apart from the absolute necessities to survival, human needs are conventional. If "meeting our needs" means following today's consumption and consumerism patterns, then we are lost. Because, according to current patterns, our needs are practically unlimited and therefore impossible to meet. Many people say "in the past we were sustainable" but they are absolutely wrong: in the past we were limited in our ability to consume, which is a very different thing.

One issue that is often associated with sustainability is population growth. What do you think of this relationship?
RF. Contrary to popular belief, the world is not overcrowded. There are plenty of vast empty spaces on the planet. The problem is not how many there

"Contrary to popular belief, the world is not overcrowded. The problem is not how many we are but what we do"

are of us but what we do. It has been estimated that, in order to survive, a human being consumes energy at a rate equivalent to a 100W light bulb. Our present living standards require that we use additional cultural energy (clothing, travel, instruments, etc.) which is up to 100 times greater. Therefore in terms of energy, it is as though there are at least 700,000 million people on the Earth. This problem demonstrates why we cannot define sustainability without considering the living patterns that we call necessary. This highlights the weakness of the 1987 definition with its mention of "present needs".

Can the economy provide answers to the key challenges of sustainability?

RF. Today's economy has a problem: it still thinks in the same terms as the eighteenth century and considers humankind as though it were 10 years old. Many economists criticise the sustainability vision – whose weaknesses I have already admitted to – but they should also apply such criticism to their own thinking because they have not been able to develop a theoretical model allowing for an economic system with qualitative rather than quantitative growth. There are many examples, with tourism being particularly well known. It may seem that the number of tourists visiting a place depends on the number of hotel rooms available, but it really depends on keeping up the place's appeal to visitors. The proof is that if we put as many hotels as we want in a place with no appeal no one will go there. Balance sheets do not factor in such a thing as the appeal of a place, and this is in fact essential.

Another interesting example is air pollution, which does not feature in any equation because the air is considered to be an infinitely available resource. No one feels this entails damaging an economic resource. Climate is also never taken into account, when in fact it is fundamental to natural systems. This is why it is so difficult to tackle climate change. But this could change: land wasn't owned for millennia, it was only then that it acquired an economic value. It's hard to think of air having private owners, but it would be feasible to give it a value as a common human heritage.

We can therefore recognise flaws and weaknesses in sustainability and by doing so are entitled to point out the complete inconsistency, if not stupidity, of certain economic approaches.

These flaws and conceptual weaknesses do not of course mean that the problems related to sustainability are less important.

RF. This epistemological weakness means that nobody working on sustainability has been able to develop a theoretical corpus, but I agree that this does not make the concept itself weak or misguided.

From ultraconservative points of views – especially in the United States – issues about sustainability or climate change are denied.

RF. These are tendencies that stem from a kind of *revealed thinking* with very few arguments and a lack of knowledge, serving as a modern form of superstition. It may seem petty and ridiculous, but the truth is that they have an enormous potential for influence through power.

Sometimes developing countries are tempted to ignore the debate on sustainability because they see it as an obstacle to their progress goals.

RF. Visions from developing countries are different to those of sceptics or deniers. These societies want to go exactly the same way we've come and to do so the same way we did. Our temptation is to tell them not to follow this path because we now know that this will generate problems involving unsustainability. Both temptations are strong. The problem is considerable, but ways to solve it without slowing development may be found. For example, in many countries today telephone services are being implemented directly via mobile phones without the need for a landline network, therefore avoiding the impact on the territory. Here we can see how the main, reasonable objective of promoting communication between people may be achieved without cutting down trees to turn them into telephone poles and without consuming copper. There may be other similar examples.

Globalisation is another phenomenon that is often placed in opposition to the possibility of achieving truly sustainable development. There is no shortage of reasons, including the need for increased transport and energy consumption associated with fossil fuels. What is your view?

RF. I am a fervent supporter of globalisation. The success of life on this planet is based on globalisation on a genetic basis. There is one undeniable fact: the expansion of life on the planet has not led to the standardisation of life forms but to greater ›

diversification. From a shared genetic basis, living beings have adapted to all contexts. So I think it would be good for this idea to influence sustainability: this means of thinking of global solutions that are good for humanity beyond all geographical and cultural variations. This territory is still unexplored but I think it is a line of thought with enormous possibilities. Historically, there have been attempts and universal aspirations but always via the hegemony of one part of mankind (political empires, religions) at the expense of the subjugation of others. New thinking should say something like "what is not appropriate for all mankind is unsuitable". This would be a novelty in our evolution and would open up the possibility of building genuine twenty-first century thought. The fundamental axioms for a thought of this kind would certainly be radically different from everything we've seen so far. This approach may be trivialised and dismissed as naïve, but the truth is that it is a new horizon.

Sustainability thinking is influenced by cultural backgrounds and trends, or even by the *zeitgeist*. How does that affect our relationship with facts?
RF. These cultural influences are a bit difficult to predict, resulting in *pessimistic optimism* or, if you prefer, *optimistic pessimism*. What do I mean by that? We have to assume that some things happen inexorably and other things only if we make them happen. We cannot influence the first ones, but we can influence the second ones, and these are the ones we have to worry about. For example, mankind is currently injecting a large amount of energy into the atmosphere and logically the atmosphere reacts with dysfunctional effects. Sustainability must therefore address all the issues on which our actions have tangible effects.

To what extent can technological developments help us in this goal you just stated? Is there a range of technological solutions?
RF. Here we must distinguish between different types. One would be the contribution of technologies that allow for actions that didn't exist before, such as talking from a distance over the phone. A very different type would be technologies that have to be invented in order to address the dysfunctions generated by technological progress. This second type differentiates between faith in progress and reliance on luck. Faith in progress helps us to learn

"In sustainability we have not been able to develop a theoretical corpus, but this do not mean that the idea itself is weak or misguided"

and improve. Reliance on luck leads us to believe that "something will help us out when we need it." This does not hold. Nor do I believe in the resigned attitude shown by some environmentalists who prefer to do nothing because "nothing bad will happen." I think it's an intellectually very poor and humanly wretched attitude. In essence, it's just the other side of the coin of those who are not afraid to do anything because a technological solution will be found anyway. These are two extreme attitudes. But, in short, I would say that technology is not a problem in itself. The problem occurs when it is separate from critical thinking and from the reasoned will of the community.

IT stands out among modern technological developments. In fact, its meteoric evolution in recent years has meant that techno-optimism has grown in terms of its ability to be useful in all kinds of challenges, whether social, environmental or cultural. Do you share this view?
RF. I think that today's hyper-connected society is not an informed society. The first problem that I see is that what circulates through the thousands of channels of communication is often redundant. Most of the content sent and received is nothing: just noise. This is worrying because we are making important technological and economic efforts to increase connectivity and although there is a beneficial outcome, it is not proportional to the investment made. We are therefore looking at networks that are effective for communication, but inefficient from the point of view of their cost and considering what we get from them. Secondly, there is a more serious issue: most of the participants in the phenomenon of digital communication believe

they are truly informed. Many people who only produce and receive noise are convinced that they belong to a higher sphere than their parents or grandparents. They don't share the prudence that people of other generations had when they felt they did not master a particular subject. This is risky because today plenty of people think they are able to talk about any given subject without any kind of sound basis, and we are only at the beginning: we have not yet seen the final consequences of this. This situation tends to eliminate the principle of authority over knowledge and dangerously views all types of content as equal in worth.

Why must we still pursue the objective of sustainable development?

RF. For the same reason explained in this joke. A boy tells his father: "Dad, Dad, I don't want to go to America." And the father replies: "Shut up and keep swimming." We have no choice: we either swim or drown, and we can't turn back. Not advancing in sustainable development is so catastrophic that however badly we do so, it will always be better than doing nothing. x

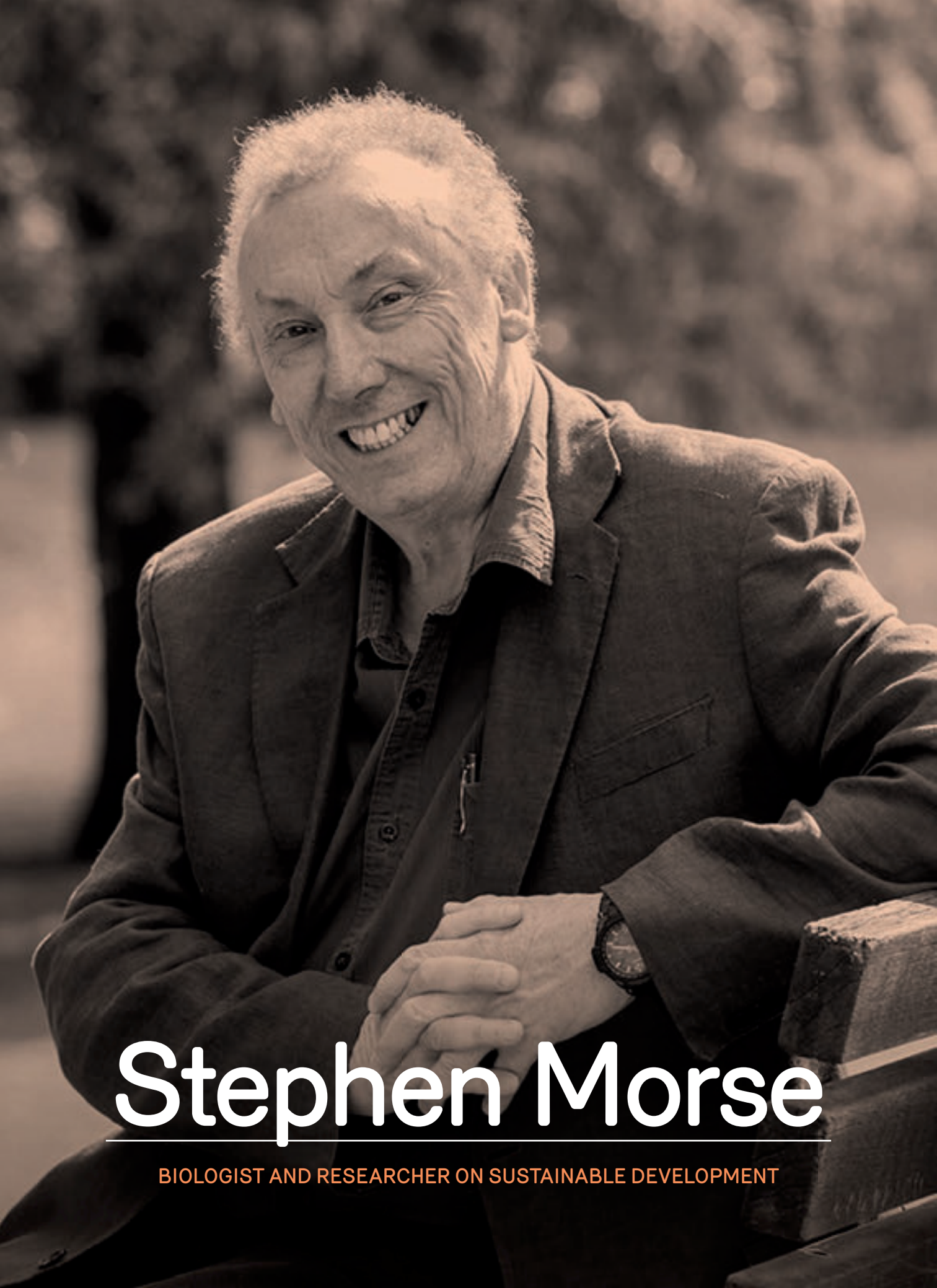
Ramon Folch is a socio-ecologist. He holds a PhD in biology and in 1994 he founded ERF (Estudi Ramon Folch & Associats SL), an environmental and energy consultancy based in Barcelona. He has been president of the Social Council of the Polytechnic University of Catalonia (2004-08) and secretary general of the International Advisory Council of the Latin American Forum of Environmental Sciences (La Plata, Argentina) and also professor of the UNESCO/FLACAM Chair for Sustainable Development (1989 -2006). As a professional, he has focused on research and land, urban, and energy management from a sustainable approach that he has helped to define and develop in both a theoretical and applied fashion.

http://www.erf.cat/en

Sustainability may be defined as a philosophy or attitude towards the world; however it is also linked to tangible facts such as the consumption of energy and resources or the impact of human activities on ecosystems. These facts may be measured and analysed obtaining data that is useful to science or in the development of public policies.

Measuring sustainability

Stephen Morse | William E. Rees



Stephen Morse

BIOLOGIST AND RESEARCHER ON SUSTAINABLE DEVELOPMENT

When talking about sustainability the term *indicator* seems to open the door to a whole universe of possibilities: there are indicators for almost all aspects of sustainable development. However indicators are not an exact expression of reality. They are an approach to phenomena in which many variables are involved and help to understand those phenomena from a quantitative point of view.

"Sustainability indicators do not measure like a thermometer"

Sustainability figures in many people's minds as a philosophical idea rather than as a scientific matter, and this is reinforced by the ambiguity of the concept and its different meanings. Sustainability can however be measured via indicators allowing us to use numerical values to synthesise its various aspects. What are these aspects? Carrying capacity? Environmental pressure limits? Flows of matter and energy in cities? What else would you include?

SM. There are many Sustainability Indicators (Sis) covering all aspects of sustainable development. Space doesn't allow me to go into all of them here, or even a reasonable sample. Hence I will make a few more general points.

A key starting point here is the definition of what we mean by the term 'SI' and inevitably this takes us to a definition of sustainable development (SD), as these are intrinsically related. If by the latter we mean development that takes into account not just this generation but future ones, then Sis are a tool to help us achieve this. Given that 'development' is primarily a social process underpinned (at present and for the foreseeable future) by economic transactions – and that this should not take place at the expense of future generations (hence the need for the environment dimension) – we can see that SD covers an extremely broad range of concerns and this is reflected in the range of Sis we see. Thus, I for one am happy to regard traditional economic indicators such as GDP as part of the SD mix, and hence I am comfortable with regarding them as Sis. SD is, after all, about development of human beings. Others seem to reserve the terms for what are in essence indicators that are basically about the environment and our interaction with it. For me it is not the label that matters but the principles...

As SD is all about people – no people then no SD – and as we are a diverse lot differences in emphasis are also almost inevitable. For example, some on the neo-liberal end of the spectrum assume that if we can maximise the economic 'gains' then wider social development will follow, even if the latter takes place via a 'trickle down' of benefits. It is also often assumed that we can trade-off production for losses in natural capital: that some environmental degradation is acceptable if we get benefits in terms of economic growth. These different emphases result in some Sis being promoted/used more than others.

The inevitable subjectivity that underpins all Sis is something that still receives very little attention in my view. There is a tendency to see them as 'hard' and objective 'things' that measure sustainability in the same way that a thermometer measures temperature. But SD is such a contested term having much richness, especially in its social component, that the idea that it can be so easily captured by even a suite of Sis is akin to trying to find the end of a rainbow; we think we know where it is but it has a habit of shifting as we move. Given the nature of the process that Sis are trying to gauge we will never have the equivalent to a thermometer. ›

Paul Stead

Given the specific examples asked about in the question:

(a) Carrying capacity in a human context is complex given that we have the ability to change it... Improvements in agricultural production, for example, have dramatically increased carrying capacity.

(b) Environmental pressure limits. I think one of the most useful frameworks that has emerged recently is Planetary Boundaries... Not because I think the PB framework and its indicators are technically excellent – they are not and indeed have been heavily criticised by some – but for the simplicity of the message that helps to capture the attention of a wider and non-specialist audience. But I have colleagues who take a very different view and argue that because the basic assumptions behind the indicators are wrong (at least for some of them) then the PB framework represents poor science. This is a dilemma for almost all Sis, as by definition they all embrace a degree of simplification...

(c) Flows of matter and energy in cities. This is an interesting field of current research... I have just taken part in a research proposal focused on the notion of a 'Zero Loss City' and the development of a 'City Calculator' to represent complex urban systems'. It was certainly an ambitious proposal but did not go down well with reviewers. While they applauded the idea, they seriously questioned achievability within the confines of a single research project. This highlights another issue with Sis and indeed SD. The punctuated nature of research funding – with defined resources and time to achieve a defined set of targets – does make it hard to embrace the multi-dimensional nature of SD. Hence we end up focusing quite narrowly on deliverables set out within a 'blue print' often established via a logical framework or some such device.

How accurate are the indicators that we have developed in describing reality?

SM. 'Accurate' is a loaded term... It means very different things to different people. The same also applies to 'reality'. That is one of the central challenges of Sis: they are created by people to reflect what they see as important in sustainability. Some may see them as accurate measures of some aspects of sustainability while others will disagree.

> "Have we finally arrived at Sustainable Development? No, but I think we have made progress at decoupling social development from environmental impact, at least in some places"

Any Si has to have an associated method to help 'populate' it. We can, of course, find that a single SI will have a range of methods championed by different people. This even applies to Sis that we think of as being well-defined... A carbon footprint, for example, can be assessed in a number of ways leading to significantly different results. Air quality for a city depends upon where we place the sampling devices and the time series of the assessment. In West London, where I live, this is becoming a hotly debated topic given recent developments over the building of a new runway at Heathrow airport... The airport owners – using one set of indicators – interpret them as suggesting that all will be well, while opponents – often using different indicators or interpreting the same ones differently – come to a very different conclusion.

We can also find that important issues of data availability and quality will be present, including the need for these over time and not just as a one-off. These are 'bread and butter' issues that receive nothing like the attention that they should... Far more creative effort goes into conceiving and designing new Sis rather than the more unglamorous tasks of creating good quality data – over space and time – to populate them. The collection of such datasets is arguably a more routine and unglamorous enterprise that perhaps would not readily find its way into high-impact journal papers, but it is at the very heart of SI-ology.

The indicators always end up simplifying a complex world but at least they should help to: *a)* produce synthetic information *b)* set targets and *c)* monitor compliance with these targets. How useful have indicators been so far in sustainability policies on a local, national and European level? Are they really taken into account? How are they used by political agents?

SM. There are many SIs, as noted above, and some of them, especially the socio-economic ones, are currently used a great deal within policy at all scales. In my view it is a myth that there is little use of SIs. Think of measures of unemployment, crime, etc. as well as measures of economic performance. SD is not just about the environment: it also includes the social and economic spheres. Some SIs in the environmental sphere – such as carbon footprint – also receive a lot of attention these days. Hence there is instrumental use of at least some environmental-focused SIs. For me the question is not so much about whether SIs have been used but about whether we make use of a suite of SIs to help make SD a reality... It is that bringing together of SIs that matters and here our record in policy terms is not great. We certainly have suites of SIs and indeed individual indices, but we still see an overly strong focus on parts of the picture rather than the whole.

Regarding the use of Sustainability Indices – when an index is the combination of a number of SIs – our record has not been good. The few attempts to develop such an index – and there have been a number of well-meaning efforts with much time and resources going into them – have produced mixed results (e.g. EPI and ESI).

I see SIs as having many uses beyond the instrumental implied here... They can also help spark an interest and facilitate debate. SD can be so nebulous that people will often ask what it means in practice. SIs help provide a more tangible side to SD – tangible 'things' that people can understand – even if they may disagree over the choice of the SI and/or how it is measured. It is this softer side to SIs that often gets ignored. Part of this is of course their use in politics.

Finally, I do think the question raised here is an important one that deserves much more research. We simply do not know enough about how SIs are used and why it may be that some are used more than others. This is a complex field but one that should receive a lot more attention.

More specifically, in what sectors is the use of indicators more common? Agriculture? Transport? Industry? Can you give us some examples of the successful implementation of indicators?

SM. It depends what is meant by success. Success assessed in what way, by whom and for whom? An SI may not necessarily be 'used' in an instrumental way by policy people but it may be picked up by the press and may help with influencing the thinking of the public towards SD. The much maligned Ecological Footprint is an example. The EF has attracted a lot of 'technical' criticism but it has captured attention about how our consumption impacts upon the planet. If it does that then I believe it has done a good job even if we can critique some of the assumptions upon which it is founded.

The carbon footprint is certainly an SI that has become important in many policies, especially within the energy sector. Other SIs that cover economic (GDP) and social (crime rates) components of sustainability are also often quoted and used. Then we have SIs that address issues such as recycling, pollution and biodiversity etc. Overall, I think my vision of 'success' goes beyond a focus on instrumental use of an SI but into the wider realm of influence. It is a much fuzzier vision I must admit, but I think we have seen successes over the past 30 years or so since the Bruntland Commission. It is easy for us to lose sight of that significant progress. Have we finally arrived at SD? No, but I think we have made progress at decoupling social development from environmental impact, at least in some places.

In terms of indices – where an index is composed of a number of indicators – there are success stories such as the Human Development Index (HDI). ›

In light of the fact that the hegemonic economic discourse uses exclusively "classic" indicators such as GDP, why do you think sustainability indicators have still not become mainstream?

SM. Well GDP is still an SI as I argue above. It is still part of the picture in sustainability and will remain so for the foreseeable future. The problem is not so much with GDP per se but an over-emphasis upon it at the expense of other indicators. It is important not to demonise or indeed to reify the GDP. It is a measure of monetary flow: nothing more and nothing less. It is not GDP that is the problem, but how we use it and whether we consider other SIs alongside it.

I would argue that there are many SIs that are mainstream, but the challenge is in putting them together to cover a holistic vision of SD. It is the integration over such a large breadth of coverage that appears to be problematic.

You have published several papers on sustainable development in China. Could you explain a little bit about their content? As you know, in the Western World people tend to think that China does not consider sustainability to be important. Having studied the country, do you agree with this Western vision?

SM. Most of my work in China has revolved around Corporate Social Responsibility and I am currently helping to write a textbook on the subject. China is such a fascinating place with so many contradictions when it comes to SD.

Environmental degradation is certainly an important concern in China as the country has tended to focus on economic growth almost at the expense of all else. China is not unusual in that regard, but its size and reach do put all of this onto a global scale. It is not just a matter for us in the West but also for other countries such as those in Africa where China is becoming a major player, especially in the extractive industries.

You have made a significant contribution with a number of participatory Methodologies for sustainability assessment, including Triple Task. Could you describe for our readers what Triple Task is?

SM. TT (Bell and Morse, 2012) is a new approach to participation developed in a previous EU FP7 project (Policy Influence of Indicators; POINT): *www.point-eufp7.info/*, and further developed and applied within a current FP7 project entitled 'Servicizing Policy for Resource Efficient Economy' (SPREE): *www.spreeproject.com/*. It is derived from the epistemology inherent within 'soft systems' approaches to participation designed to problem solve within institutional contexts (Checkland et al., 1998, 2000, 2006). It has proved to be very successful in allowing practitioners to arrive at a shared deconstruction of issues and identification of constraints and ways forward. TT (and indeed all soft systems approaches) is designed to maximise the generation of emergent (unexpected) ideas and also to facilitate learning between participants. It does this within a structure based upon small groups analysing the system with as much freedom as possible. This freedom contrasts with other participatory approaches, such as the 'Focus Group', where participants are asked a series of specific and sequential questions, perhaps after a presentation (or presentations), and asked to discuss each of them in turn. While very useful under certain circumstances, the scope of discussions in such structured engagements can be constrained and largely follows the direction set by the organiser. Soft Systems approaches are designed to avoid such overt 'direction' other than providing a broad outline to process, hence much control is handed over to the participants and they can take their discussions wherever they wish within the context of the question set at the start.

"We do not know enough about how Sustainability Indicators are used and why some are used more than others. This is a complex field that should receive a lot more attention"

The TT method involves three phases:

1. Primary Task where groups are asked to explore a question. For example, they may be asked to explore potential SIs in the energy sector;
2. Second Order Task whereby the workshop facilitators observe and analyse workshop dynamics;
3. Third Order Task whereby participants review their own and their groups' workings.

The theory in TT is that by combining the three tasks we will be able to go beyond the traditional soft systems epistemology and provide a better understanding as to why groups are saying what they are saying and thus provide an aid to content analysis of the workshop outputs. Hence TT is unique amongst participatory processes in that its structure allows for a comparative analysis of outputs and also aids in interpretation of any commonalities and differences that emerge between them. Most participatory processes end with the outputs created by those involved but TT attempts to go a lot further than this by making comparisons between outputs and attempting to understand why similarities/ differences may have happened.

Are there additional difficulties to building indicators on the social dimension of sustainability? Or putting it another way: is it more difficult to analyse the socio-cultural world than the physical world?
SM. Well, both are challenging... The socio-cultural world tends to change very fast and values, needs etc. can become transformed within a year. They are also highly variable across and within cultures. Arriving at SIs that can capture all of this is not an easy task. But while our bases for livelihood carry a great deal across the planet, we all still want much the same thing; to live well and to prosper (as a famous alien once said!). This is all very pithy, of course, but it does highlight the contradiction. At one level we are all the same and building SIs to capture that 'sameness' is not difficult. Life expectancy is an example of this, especially as it proxies important factors such as healthcare and living conditions. But at other levels we are different. An indicator based on the performance of Chelsea football club as an import contributor to my sense of well-being may not appeal to everyone (unfortunately).

It is worth noting that the so-called 'physical' world is something of a human construct. There is a physical world outside of our heads of course, but the ways we measure it (how, by whom, where, when) are set by us. Thus something 'physical' such as air quality is defined and assessed by us and different definitions and assessments can lead to different results. These decisions are influenced by factors such as funding (number of monitoring sites, technical excellence of the samplers, how often samples are taken). Hence even apparently 'physical' measures can become contested, as we have seen only too clearly with the debates over human-induced climate change. This is all very frustrating for scientists, of course, as disagreements over the best ways to measure and interpret 'things' are seen as a very constructive process, but others can see it very differently.

Another interesting issue to discuss is the co-existence of various types of sustainability indicators developed by different agents. Do you think this plurality benefits our knowledge of reality or instead increases confusion? Secondly, do you believe it is possible to arrive at a universal agreement on one consistent set of indicators?
SM. I personally see such plurality as inevitable – without a world government that dictates such things from the 'top' – and actually a positive rather than a negative. What matters here is motivation.... If plurality of SIs is being used to counter perceived undesirable SIs then that is obviously an issue, but if plurality reflects a genuine desire to 'do better', then fine... As I have said above, all SIs have an inherent subjectivity and this has to be embraced and made transparent rather than ignored or hidden. I see SIs as being exposed to a process of natural selection, with successes and failures. SIs that do well are those that survive and are used, be it in policy or even in the wider media. They change our consciousness. Other SIs may not be used as such, but their creators see them as important and will continue to promote them, as they are seen as successful measures by this group even if no one else agrees. Just because an SI is not used by policy makers it does not mean that it should be discontinued; it can be a way of educating that group and making them aware of something. ›

I doubt whether there will even be an agreement on a universal set of SIs although there have been efforts to do this: the Planetary Boundary framework mentioned earlier is an example. It is hard to see how a set of SIs can be developed that would be applicable everywhere on the planet. Thankfully we are far too diverse. I can see some SIs having a very wide appeal because they capture something that appeals to us all – that is why I think the HDI has had the exposure it has had – but we will always need local flexibility and indeed flexibility to accommodate changes over time.

Do you dare forecast how sustainability indicators will have developed by the middle of the century? Where are we headed to in this field?

SM. This is a tough one. I have seen so much change during my lifetime – some of it anticipated while much of it hasn't been – to try and predict the future with any confidence.

Where I think we will go is more of the same: an evolution of the SI ecosystem as new ones emerge, others die and some get picked up and 'used' in a variety of ways. Is this necessarily a bad thing? I don't think so. A natural selection process operating in this way is very healthy and – for me – is a great way of spurring discussion and debate as to how we can make SD a reality. I would like to see more transparency around this process, especially in terms of data availability and quality which, after all, underpin any SI. These are areas where I think there will be great strides, and technologies such as earth observation will help a lot with that. I also think that technological change in general will provide new opportunities and indeed threats in SD. It reminds us that SD is inevitably going to be a state of flux: it is not an 'end point' like a railway station where we can arrive at and relax. The principle of allowing for human development to continue remains the same, but the challenges this involves and means of addressing them will keep changing. x

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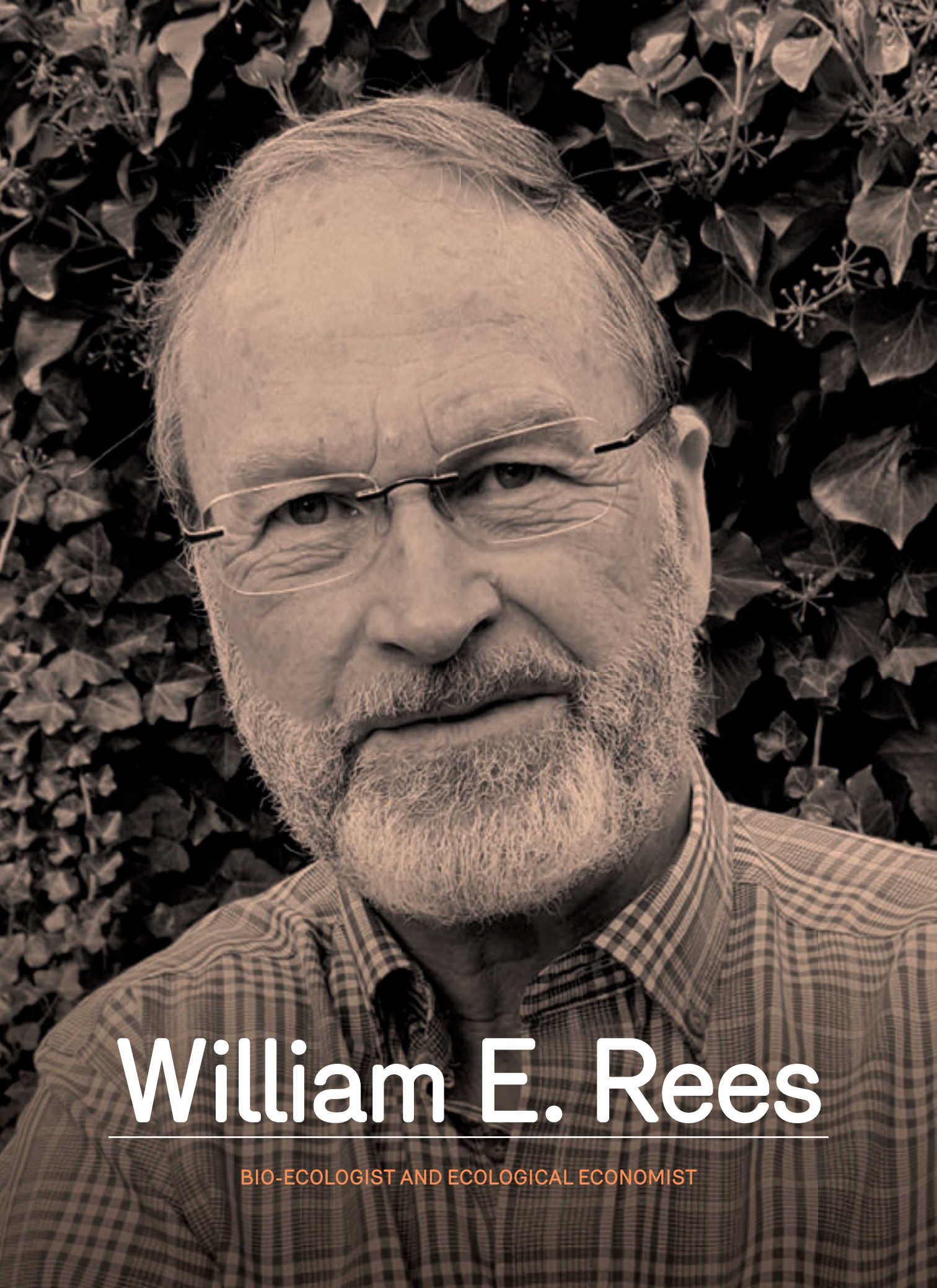
www.surrey.ac.uk/ces/people/stephen_morse



William E. Rees

BIO-ECOLOGIST AND ECOLOGICAL ECONOMIST

The ecological footprint is a measure of human impact on the Earth's ecosystems. This measure has reached beyond the academic world and it is used today by the media. It reinforces the idea that, following the current consumption patterns, the world population is depleting natural capital at an accelerated pace.

"Economies should thrive within the ecosphere"

What is the ecological footprint and what does it measure?

WR. The ecological footprint is an index of human demands on nature's 'goods and services'. The method uses available data on material and energy consumption for any specified population and converts these data to a corresponding ecosystem area. Thus the ecological footprint (EF) of a study population can be defined as "the area of productive land and water ecosystems required, on a continuous basis, to produce the bio-resources that the population consumes and to assimilate its associated carbon emissions." Because of natural material flows and trade, the ecosystem area used by virtually any human population is scattered all over the planet.

A major strength of EF analysis is that it enables us to compare human demand to nature's supply ('biocapacity'). We say a population is in 'ecological deficit' if that population's EF exceeds its available biocapacity.

Many countries' demand for biocapacity has overshot domestic supplies. In fact, the whole world today is in 'overshoot', running an increasing annual ecological deficit. This means that the world community is living, in part, by depleting even renewable natural capital and over-taxing the waste assimilation capacity of the ecosphere.

How is it calculated? What methodology is used? Are there different views on this calculation or does everyone accept one single standard or method?

WR. In general, population EF estimates are based on the final demand for goods and services. The first step in calculating the EF of a study population is to compile and quantify, from national government and international agency sources, the annual consumption of all significant commodities/consumer goods used by the study population. (The method is obviously data intensive.)

For accuracy, consumption data should be trade-corrected whenever possible. Thus the population's consumption of wheat can be represented as follows:

$$domestic\ consumption_{wheat} = domestic\ production_{wheat} + imports_{wheat} - exports_{wheat}$$

The second step is to convert consumption of each item into the ecosystem area required to produce that item by dividing total consumption by land productivity or yield. (In the case of non-organic items, we estimate the ecosystem area needed to assimilate the carbon wastes emitted in the production process—see below). In general:

$$ai = ci / yi$$

This gives us the ecological footprint of the individual item where: ai is the eco-footprint of item i in hectares, ci is total consumption of item i in kilograms, and yi is the yield of item i in kilograms per hectare. Thus, for wheat:

$$awheat = cwheat / ywheat = kgwheat / (kgwheat \times ha\text{-}1wheat)$$

The aggregate or total ecological footprint of the population, (Fp), is determined by adding the footprints for the 'n' individual items:

$$Fp = \sum_{i=1}^{n} ai$$

Finally, we can estimate the average per capita ecological footprint, fc, by dividing the total population footprint by population size, N:

$$fc = Fp / N$$

The carbon component of a population's eco-footprint (carbon footprint) is the area of dedicated carbon sink ecosystem that would be required to assimilate the population's carbon emissions, including the carbon wastes generated by producing the goods and services the population consumes. To estimate the carbon footprint, the carbon assimilation rate per hectare and year in growing forests is substituted for y (yield) in the formulation above.

While most published eco-footprint estimates include the carbon sink component, this does not imply that there is an adequate supply of assimilative ecosystems. Indeed, carbon dioxide accumulation in the atmosphere is evidence of overshoot: human demand for this ecosystem service (the carbon sink function) exceeds available supply.

Eco-footprint analysts avoid double-counting whenever possible. For example, some consumer products such as leather goods are the byproduct of another industry (such as beef production). In such cases, one would generally count only the primary land requirements (the grazing and grain lands required for feeding cattle).

In general, analysts err on the side of caution in making EF estimates. For example, if there is dispute over, or several estimates of, land productivity, we use the higher estimate (this reduces footprint size). Most ecological footprint and biocapacity calculations are therefore likely to under- rather than over-estimate.

In practice, both population eco-footprints and available biocapacity are usually estimated in terms of global hectares ('gha' or 'hectares of world average productivity'). In converting ecosystem areas to gha, analysts use yield factors to reflect national differences in land productivity and equivalence factors to account for differences among ecosystem types. For example, if Country A's cropland is twice as productive as world average cropland, and world average cropland is twice as productive as world average landtypes, then one hectare of A's cropland is the eco-productive equivalent of four gha. Conversely, if country A has an estimated per capita cropland ecofootprint of two gha, this is equivalent to just .5 actual ha of A's domestic cropland biocapacity.

Converting national consumption data to gha simplifies EF estimates because we do not have to identify the sources of trade goods or locations of waste sinks, or determine the productivity and assimilative capacities of the corresponding production/assimilation areas. This is important, as using a common base yield facilitates comparison among countries and comparisons of individual countries with the global total EF.

While there are variations on EF calculations and special cases (e.g. it is sometimes useful to represent national EFs in terms of actual productivity at source rather than in ghas) the majority of EF calculations follow the methods and standards developed and are continuously updated by the Global Footprint Network (full details are available by following the links at: *www.footprintnetwork.org/en/index.php/GFN/)*.

How did you come up with the concept of the ecological footprint? Could you please tell us the story of the origin and development of this idea?

WR. The genesis of ecological footprint analysis (EFA) can actually be traced to a hot July day in the early 1950s on my grandparents' farm in eastern Ontario, Canada. I was seated with my grandfather and several cousins around the table on my grandmother's big summer porch at noon. We were just in from the fields and about to enjoy lunch. I was eight or nine years old, dirty, sweaty and proud to be just one of the regular hands.

The mid-day meal was a full dinner: beef, chicken, new potatoes, spinach, baby carrots, a great leafy salad, and just about everything else that the farm had produced so far that season. Actually, there was nothing special about the meal – we had a big farm lunch just about every day – but I have never forgotten that particular occasion.

"The genesis of ecological footprint analysis can actually be traced to a hot July day in the early 1950s on my grandparents' farm in eastern Ontario, Canada. We were just in from the fields about to enjoy lunch. I was eight or nine years old"

I sat there aglow from the morning's exertions and found myself staring absent-mindedly at my heaping plate of food. My subconscious must have been working because it slowly dawned on me that I had helped to grow or raise everything on my plate. Once fully formed, this thought struck me like nothing I had previously experienced. I was swept away by an accelerating sinking sensation as if on an elevator in free-fall. But at the core of this rush was a profound realization: I felt in my bones that, through the food I had helped to produce, I was deeply connected to the land. No science here. This was the raw experience of truth, my personal epiphany! Years later, I recalled this moment when deciding which stream of the 'life sciences' to pursue in my studies at the University of Toronto. It was a determining factor in my eventual decision to take a PhD in bio-ecology en route to becoming a human ecologist.

Later still (in the 1970s), as a young Professor of Planning at the University of British Columbia, I was assigned to develop a course in ecological land-use planning. Lingering memories of my childhood epiphany again moved me, this time to design a course section on the concept of human carrying capacity (for which I was roundly condemned by growth-oriented economist colleagues!). Successive cohorts of students discovered that the population of the Vancouver region (the Lower Mainland of British Columbia) already vastly exceeded their estimate of its long-term carrying capacity, as we were living largely on imports and by exploiting the global commons. By the 1980s, therefore, the course focus had shifted away from the usual carrying capacity question of "how many people can this region support?" to its inversion: "how much area is required to support the people of this region, wherever on Earth the supportive ecosystems may be located?" The answer to this question was, of course, the regional population's true 'ecological footprint' but the footprint metaphor itself popped into my mind only around 1990 as I was writing about the concept on a new 'tower' computer that happened to have a smaller physical 'footprint' on my desk.

(Through the 1980s I had used the terms 'regional capsule concept' and 'human impact index'. Neither possesses the emotively graphic impact of 'ecological footprint'.)

What makes it different from other measures of human impact on the Earth? Is it more reliable?

WR. EFA is more powerful than other sustainability indicators because the footprint metaphor more readily triggers the imagination; the method focuses on consumption which is common to everyone; and it can sensibly be applied at all spatial scales from individuals and communities to the entire planet. Perhaps just as important is the fact that EFA is a more comprehensive index than most other sustainability assessments and thus poses a direct challenge to our entire material way of life (particularly to the prevailing growth ethic and idea of unlimited technological progress). One is therefore almost compelled to react—positively or negatively—to the EF concept, certainly more so than to other more limited indicators such as ozone levels or GHG emissions.

The ecological footprint has also received some criticism. Could you tell us about that? And more specifically speaking, how do you respond to it?

WR. EFA has, of course, been heavily criticized and rejected, particularly by economists and other growth optimists made uncomfortable by evidence of ecological deficits and overshoot. However, it is clear that at least some of these critics do not really understand (or choose not to understand) the method. It also seems that some critics are responding more to their fear that the implications of EF analysis are correct than they are to fundamental weaknesses in the method. For example, economists often argue that EFA is biased against growth because it does not reflect ›

alternative available technologies or adequately take possible future techno-development into account. In fact, the method is technology neutral. Most routine EFAs produce a graphic snap-shot of 'what is' at the time of the analysis; they represent measurable energy and material flows; they are not simulations of what could be under different circumstances, nor are they predictions based on future technologies. Most importantly, if alternative or new technologies are eventually employed, subsequent EFAs will, in fact, reveal any consequent effect on consumption and the size of our ecological footprint.

Another common criticism is that EFA is biased against trade and globalization. Again, this is a misinterpretation: the method is actually neutral on the subject of trade per se.

That said, EFA does reveal that most densely populated and high-income countries have large national eco-footprints that significantly exceed their domestic biocapacities. Such countries are in national overshoot, heavily dependent on trade in the global commons to maintain current levels of consumption (i.e. prevailing lifestyles).

These findings are simply matters of biophysical fact subject to interpretation. Indeed, some analysts see the extended web of trading relationships as a universal good that promotes growth and global market efficiency. Others will interpret the increasing material entanglement of nations with alarm: excess trade dependence can be geopolitically destabilizing at a time of increasing global ecological turmoil and political unrest. This latter perspective may make expansionists uncomfortable but does not imply a flaw in the EF concept.

Some critics say that that EFA is not comprehensive enough, that it does not measure human impacts such as ocean acidification or toxic contamination of air water or soil. This is true: while providing a broad account of consumptive resource flows and carbon emissions, EFA does measure most forms of pollution. The primary reason is that EFA was designed for impacts that can readily be converted into measurable ecosystem areas, i.e. physical 'footprints' on the Earth's biocapacity. Important impact phenomena such as water contamination and ozone depletion are therefore excluded.

Several observations are relevant here: first, for both theoretical and practical grounds, no single sustainability index can be expected to reflect all relevant variables; second, not all variables are equally important: some can be ignored while others (e.g. chronic overshoot?) are almost sufficient markers in themselves; EFA results, particularly those pertaining to eco-deficits, remain perfectly valid; the absence of key variables from EF estimates suggests that the human predicament is even worse than revealed by existing studies.

A final valid criticism is that, with the exception of carbon emissions, EFA does not measure the degree of overshoot. For example, the method can show that all available agricultural land or fishing grounds are being exploited, but it does not reveal the extent of land degradation or over-fishing. This is a recognized weakness that we are attempting to address. We may eventually accompany EF estimates with a second 'sustainability factor' that accounts for overshoot. (This effort is hampered by poor and missing data.)

Do you think that the ecological footprint gives sustainability a more scientific basis? (The Brundtland definition was philosophical in nature)

WR. The scientific/conceptual foundation of EFA is not in dispute, only details of the method and interpretations of EFA results. Unlike economic analyses based on dimensionless monetary assessments of sustainability and abstract money flows through the economy, eco-foot-printing measures real physical energy and material flows and compares these to the best available estimates of biocapacity. It therefore enables scientifically valid comparisons of human demand and nature's supply; it quantifies national ecological deficits and global overshoot. In short, EFA shows unambiguously that current forms of growth and 'development' are

"Finding a replacement for fossil fuels without appropriate behavioural changes would simply fund the ongoing pillaging of the planet"

meeting present needs (and wants) in ways that compromise future generations' ability to meet even their basic needs.

The ecological footprint can be scaled to countries, cities, communities, companies and even individuals. What is the use of this scaling? Perhaps to raise awareness on different levels? Or is there something else?
WR. The ability to 'scale' EFA to any population, region, country or even individual economic sector greatly increases the usefulness of, and familiarity with, the method. Individuals can compare alternative lifestyles and the effects of different consumption choices; cities can enter friendly competitions to see which can most quickly or effectively become the 'greenest city'; in theory, national governments could use the method to assess trade policy and material security under different development scenarios. Even sectoral and corporate level analyses are potentially useful to decision-makers; for example, we have shown that greenhouse vegetables and farmed salmon have much larger eco-footprints than field grown crops and wild caught salmon respectively.

What the ecological footprint tool shows is a fundamental incompatibility between limitless material economic growth and "ecological security". Do you think it should be compulsory for any human activity (such as investment, building and engineering, crops and transportation) to incorporate ecological footprint analyses?
WR. There is little question that EFA poses a serious challenge to the twin myths of perpetual growth and continuous technological progress. Moreover, numerous other well-documented indicators such as atmospheric greenhouse gas accumulation, climate change, ocean acidification, fisheries collapse, plummeting biodiversity and various resource shortages also suggest that the human enterprise is in dangerous overshoot. We therefore know that sustainability depends on lowering human demand, reducing the energy and material throughput of our economies. In these circumstances, perhaps the best use for eco-footprint analysis might be simulation tests of alternative development strategies, socio-economic policy options and renewable energy technologies to determine whether they will contribute to the needed absolute reduction of humanity's ecological footprint.

What have been the implications of the concept on a policy and planning level so far?
WR. Eco-footprint analysis is arguably the world's best-known (un)sustainability indicator. Many thousands of individuals have used the method to assess their lifestyles; numerous state/provincial, regional and municipal governments all over the world have developed EF applications to assess or guide ongoing planning and development projects; dozens of national governments and international agencies, including the European Commission, have undertaken internal policy-oriented EF applications or national EF reviews with an eye toward enhancing resource efficiency, testing ideas about carrying capacity and reducing overshoot. EFA has proved a uniquely powerful tool in raising consciousness about humanity's ecological predicament. (For descriptions of typical applications see: *www.footprintnetwork.org/en/index.php/GFN/page/case_stories*).

However despite enhanced awareness of national eco-deficits, global overshoot and declining biocapacity, it must be said that major governments and international agencies are still deeply committed to fostering economic growth facilitated by greater economic and material efficiency and enhanced trade/globalization (which actually accelerates the depletion of remaining pockets of available resources). No major country has as yet officially embraced the idea (implicit in EFA) that, for sustainability, the era of continuous material growth must come to an end and that the world should be working toward creating more equitable national and global steady-state economies that could thrive within the means of nature (i.e. within the regenerative capacity of the ecosphere).

Might it be possible sometime in the future to know the Earth's exact limits according to demographics, consumption and energy patterns and other variables? Or it will always be unpredictable?
WR. Both the ecosphere and the human enterprise are enormously complex systems whose functioning is subject to immutable natural laws, particularly ›

the laws of mass balance and thermodynamics. Major characteristics of such complex systems under stress include lags between cause and effect and unseen structural thresholds. If we cross such a threshold —arguably inevitable given the delay between force and feedback – we may well trigger the emergence of previously unknown and unpredictable structures and behaviours hostile to human civilization. Some scientists suggest that we may already have passed the point of no return on climate change and that future effects will impose untold misery for millions (billions?) of people.

In short, it will never be possible to know precisely if and when the human enterprise will cross some irreversible tipping-point and how earth systems will subsequently behave. Clearly, however, the world community should be concerned about the ever-increasing pressures imposed by growing populations, accelerating resource consumption, biodiversity losses and runaway pollution.

You are a founding member and recent past President of the Canadian Society for Ecological Economics. Is Ecological Economics a sound answer to sustainability challenges? Or just part of the answer?

WR. Economic reform is essential for sustainability. The prevailing neoliberal economic paradigm makes no serious reference to the ecosystems within which it is embedded and is a poor reflection of both real human behavior and even the economies that it purports to represent. No one should be surprised that it has been so ecologically destructive and (increasingly) socially inept.

Ecological economics is a great leap forward. Ecol-econ is based on material reality (e.g. irreversible energy and resource flows rather than the abstract circular flows of exchange value) and emphasizes greater equity and qualitative development over efficiency and economic growth. It recognizes human dependence on functional ecosystems and so-called 'natural capital' and, therefore advocates a 'constant, adequate capital stocks (per capita) criterion' for sustainability. (The current system fosters the depletion of even potentially renewable natural capital.) In present circumstances, thinking in ecological economics terms leads toward consideration of a more equitable, dynamic steady-state economy where energy and material resource flows are limited and compatible with the regenerative capacity of nature.

In short, ecol-econ is a greatly improved, more biophysically and socially realistic economic paradigm compared to neoliberal economics.

That said, better economic theory is in itself insufficient for sustainability. We also need a revolution in social human behavior and expectations that reflects emerging biophysical realities. The cult of the individual must be replaced by recognition of community; short-term self interest balanced by concern for the common good; relentless competition leavened by a renewed spirit of cooperation, etc., etc. All of these qualities are part of humanity's natural behavioural spectrum (nature) but it is up to society (nurture) to determine which behaviours are drawn forth and emphasized so as to become social norms.

You are also a member of the Post Carbon Institute. Do you think there is a clear social awareness on what the world would be like beyond fossil fuels? People tend to think that science and technology are able to fix any problem...

WR. In general, people in the developed world take abundant cheap energy for granted. They have little understanding of the extent of techno-industrial society's dependence on fossil fuels and virtually no idea of what the world would be like without them. It is an open question whether technology will be able to 'fix' the energy supply problem. While renewable energies (wind, solar, tidal, hydro) may be able to provide adequate electricity, it is not clear if known renewables will be able to substitute the fossil energy that provides the other 80% of industrial society's energy budget. Efficiency improvements will help, but major lifestyle changes will likely be required for sustainability.

Indeed, we should remember that abundant cheap energy has provided the means by which humans acquire other resources; it has enabled us to plunder the ecosphere. Finding a replacement for fossil fuels without appropriate behavioural changes would simply fund the ongoing pillaging of the planet.

One key word to understanding future challenges seems to be "resilience". Could you explain the meaning of this term?

WR. 'Resilience' reflects the capacity of a system to withstand disturbances while retaining its fundamental structure, essential functions and internal regulatory feedbacks.

What's not to like? On first reading, resilience seems to be a wholly positive quality. Certainly most people hope that human societies have the resilience to cope with climate change and other ecological perturbations without major changes to comfortable lifestyles and our socio-economic status quo.

On the other hand, resilience often works against human purposes: agricultural pests and disease bacteria show remarkable resilience to the application of pesticides and antibiotics (they evolve resistance). Similarly, the systemically corrupt global financial sector has rebounded unfazed in the face of efforts at reform.

Indeed, it is easy to become cynical about industrial society's rapid adoption of the resilience concept. People seem to think that if we can depend on resilience, then we need not worry too much about coming disruptions such as climate change.

As 'resilience' becomes the latest buzzword, we are witnessing a shift in policy considerations from prevention toward 'resilience'. In these circumstances, 'disturbance' becomes inevitable and sustainability morphs into mere adaptation. Ironically, then, society's delight in the resilience concept is itself evidence of the remarkable resilience of the status quo. Society merely assumes the capacity to withstand major shocks while retaining its customary structures, functions and relationships. Is this not a lot like 'business as usual'? x

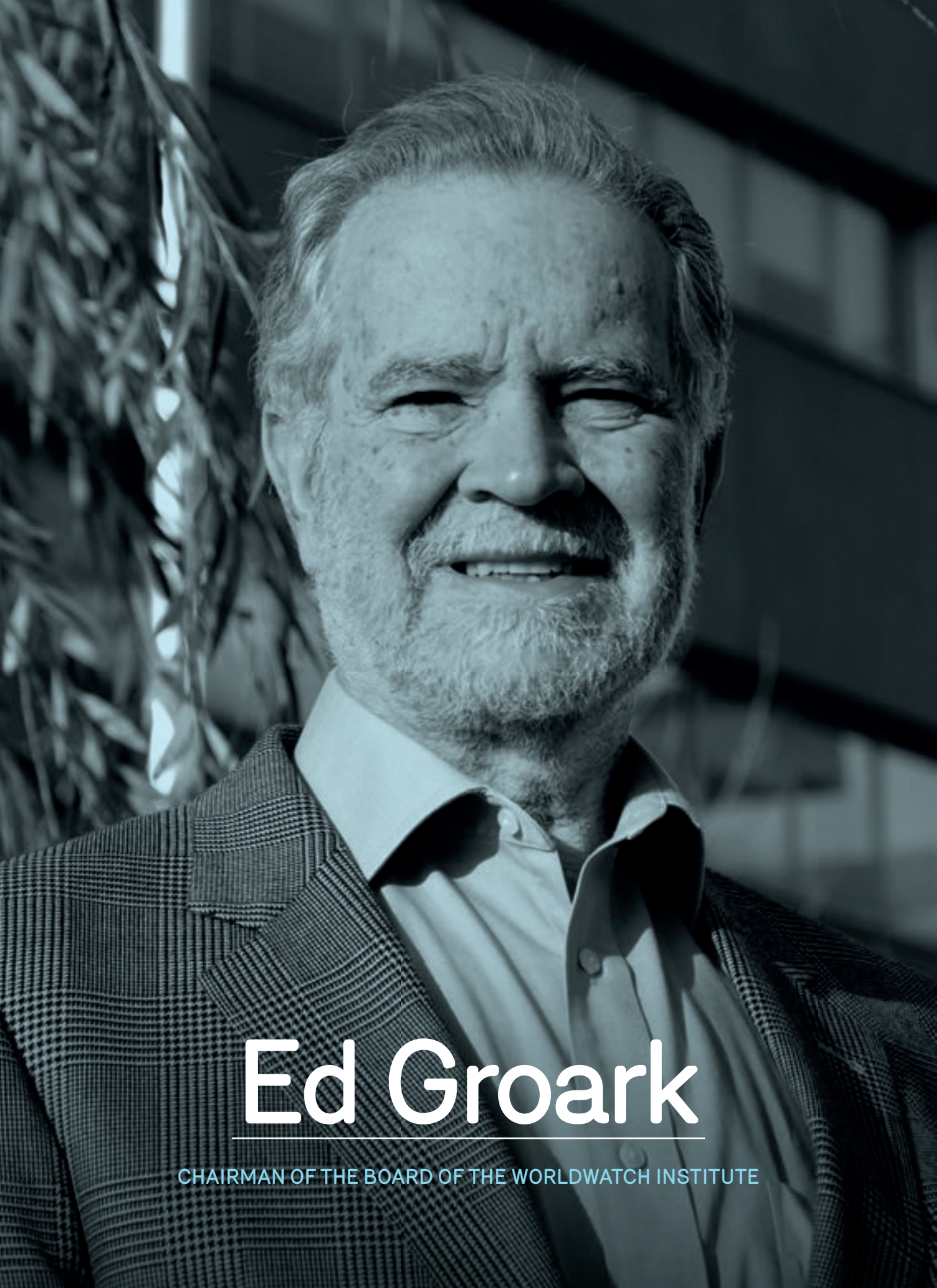
William E. Rees is a bio-ecologist, ecological economist, former Director and Professor Emeritus at the University of British Columbia's School of Community and Regional Planning. His early research focused on environmental assessment but gradually extended to the biophysical requirements for sustainability and the implications of global ecological trends. Along the way, he developed a special interest in modern cities as 'dissipative structures' and therefore as particularly vulnerable components of the total human ecosystem. Rees is perhaps best known as the originator and co-developer (with his graduate students) of ecological footprint analysis, with the expanding human eco-footprint arguably the world's best-known indicator of the (un) sustainability of techno-industrial society. His book on eco-footprinting (co-authored with his former PhD student, Mathis Wackernagel) has been published in eight languages, including Chinese.

www.postcarbon.org/our-people/william-rees/

Current consumption patterns have led our civilisation to place extreme pressure on the planet's (renewable and non-renewable) resources, with this reality producing a need to sustainably manage basic elements such as water, energy and food. In the long term, radically different ways of producing goods will be required in order to drastically reduce the pressure placed on resources without the need to forsake collective welfare.

The resources issue

Ed Groak | Chris Moran | Pedro Sánchez | Mariano Marzo
Arjen Hoekstra | Michael Braungart | Sylvia Lorek



Ed Groark

CHAIRMAN OF THE BOARD OF THE WORLDWATCH INSTITUTE

Good management needs good knowledge. For over four decades the Worldwatch Institute collects data on the evolution of resources, population, biodiversity, health and other vital signs of the planet. Beyond this mission, the Worldwatch Institute is an organization dedicated to action and works with governments to improve living conditions in different regions of the world.

"Resource indicators are generally headed in worrisome directions"

The Worldwatch Institute works to help accelerate the transition to a sustainable world that meets human needs. Do you think the problem with the unsustainability of our civilization stems from a belief in wrong or unrealistic human needs? One example might be the notion that people need to consume more energy and resources to be rich.

EG. The unsustainability of modern economies has many drivers, and a key one of these is the modern preference for reductionism, by which we dissect challenges into small pieces to be addressed without regard for the whole. Chemical fertilizer, for example, delivers abundant nutrients to plants and helped propel the cornucopian output of the Green Revolution. But chemical fertilizer does not provide organic matter and other elements that give structure to soils and provide a habitat for the many microbes and insects that are also beneficial to plant growth. The effort to grow more food in modern agricultural systems focuses on plants and their productivity, rather than on soil health and the larger soil-plant-energy-water system. Modern economies should be guided by a holistic ethic if they are ever to become sustainable.

Another driver is consumerism. The modern emphasis on consumption to fuel economic advances is clearly untenable over the long term. Much of the resource scarcity and environmental degradation facing the world today is strongly linked to excessive consumption. Moreover, the pursuit of ever-greater levels of consumption is known to be futile. Research on happiness shows that levels of self-reported happiness tend to rise as poor people prosper, to then level out again after moderate levels of income are reached. Additional income beyond moderate levels brings little or no additional happiness, making the continued pursuit of consumption essentially irrational.

Your organization has a reputation for gathering data and information on global trends (such as energy, transportation, environment, food and agriculture and population), which you refer to as Vital Signs. Could you tell us about the fields in which these vital signs are the most worrying and why; and also about the fields in which these vital signs are more encouraging? We're looking for a kind of rough diagnosis of Planet Earth.

EG. Findings from Worldwatch's indicator work are consistent with global-level trend research, including planetary boundaries science, ecological footprint analysis, the IUCN's Red List, and social indicators of all kinds from United Nations agencies. Social indicators probably show the most improvement, in part because of the success of the Millennium Development Goals campaign (2000-2015), which galvanized efforts globally to reduce hunger and increase access to water, education, and other vital areas of human development. The MDG successes were generally partial at best, however, and continued advances may be threatened by resource depletion and environmental threats. ›

Indeed, our trends research clearly shows that resource and environmental indicators are generally headed in worrisome directions. Water scarcity, depletion of fish stocks, declines in farmland quality, and increases in deforestation are common findings in our indicators work. Meanwhile, nonrenewable resources often become difficult and more expensive to access. Environmental resources are the foundation on which economies are built; their continued decline spells trouble in a world of expanding population and increasing demand for a higher quality of life.

In our contemporary world, and especially in rich countries, many people take all kind of goods for granted. But the fact is that resource depletion is taking place, with many resources being consumed more quickly than they can be replenished. Most resources are also not renewable. What is the current situation on the world's resources?

EG. Industrial economies rely heavily on nonrenewable resources, yet efforts to conserve resources through reuse or recycling are weak, inconsistent, or even nonexistent. For example, a recent study of 60 metals found that, on a global level, only 18 were being recycled at a rate of over 50 percent.

This casual approach to nonrenewables is irrational given the ongoing signs of increasing resource scarcity. Extracting new oil finds – which a century ago required little more than the construction of a simple well – now requires extraordinary efforts such as deep-sea drilling or the processing of dirty sources such as tar sands. The metal content of many ores is also steadily declining, meaning that more and more energy is required to extract and process a given amount of metal. The copper content of ores, for example, hovered at around four percent a century ago and is now at around one percent in many mines.

Access to renewable resources is also becoming more difficult, with the share of people living in water-scarce countries expected to double by 2025, for example. Logging is becoming increasingly common in forests, and fisheries are being overexploited, often because of irrational policies. Governments provide tens of billions of dollars in fishing subsidies annually, which mostly increases the capacity of fishing fleets, even as fisheries are increasingly depleted.

"Additional income beyond moderate levels brings little or no additional happiness, making the continued pursuit of consumption essentially irrational"

Scientists have said that resource productivity must increase by 80 percent to build sustainable economies in rich and poor countries alike. This audacious goal requires far more than increased curbside recycling. Meeting it will require the creation of "circular economies" in which products are designed for durability, disassembly, and refurbishment. Economic demands are increasingly met through the use of services rather than goods, and production must be designed to minimize waste through the co-location of factories that feed off each other's waste. It will only be through a comprehensive approach to reducing material use that sustainable economies will be created.

The Vital Signs data is provided in annual reports available to anyone to consult, meaning both ordinary citizens and decision-makers can have access to key information. To what extent does the dissemination of this global data influence positive actions (from activism to policies across all scales)? Could you give us some examples?

EG. This is a good question and one that we ask ourselves regularly. It's very difficult to connect the dots from providing information to a broad general audience and a decision somewhere down the road. We are proud that our name is associated with credibility, so that data we provide into a crowded marketplace of ideas is viewed as more credible that other data. This is important in a climate with so much intentionally and unintentionally incorrect data available.

Unprecedented growth has occurred in renewable energy in recent years, however the energy transition from fossil fuel consumption to cleaner alternatives seems to be moving more slowly than expected. Is hydraulic fracturing responsible for this? Do you think that the outcome of the Paris Climate conference can boost the energy transition process?

EG. The Paris Agreement gives a strong moral impulse to renewables, but we have a long way to travel to wean ourselves off fossil fuels: renewables accounted for only 10 percent of world electricity in 2015. Nevertheless, 2015 was also a landmark year for renewables. Investment in renewables hit a new high, even as fossil fuel prices declined, and for the first time, renewables accounted for the majority of global energy investment. Moreover, in 2015, investment into renewables in developing countries outpaced investments in developed countries for the first time.

However, more rapid progress will require more consistent and favorable market signals to renewable energy. New fossil sources, such as gas obtained through hydraulic fracturing, is a disincentive to the development of alternative energy. Nations serious about advancing renewable energy will set favorable and consistent incentives for the sector.

Water, food and energy are inextricably linked, although many people are unaware of how they are connected. Could you explain more to our readers about this complex relationship?

EG. Agriculture accounts for roughly 70 percent of global water consumption, making it by far the greatest user of water in the global economy. This figure suggests that efficiency in agricultural production could free up a great deal of water for other uses. Agriculture is also an energy guzzler: the production, processing, and distribution of food accounts for some 30 percent of total energy use.

On the other hand, bioenergy depends on agriculture. Biofuel production requires nearly 40 percent of coarse grain production in the US, 50 percent of Brazil's sugar crop, and 80 percent of oilseed production in the EU.

Finally, energy is water intensive, and water is energy intensive. Energy demands account for some 15 percent of water withdrawals worldwide, primarily for power plants that require enormous quantities of water. At the same time, water processing and conveyance require large amounts of energy. In California, for example, the State Water Project pumps water across the state and more than 600 meters over a mountain pass, in the process becoming the largest single user of electricity in the state.

The interconnections of water, energy, and food can be an advantage, if efficiencies in one realm cascade into efficiencies in another. Reducing water wastage at the farm level, for example, can produce upstream energy savings. Thus good design could lead to a "virtual cycle" of savings across the three sectors.

Another key trend is population. Controversy has been building for years on just how many people the Earth can provide a home for, with some experts claiming that the figure is 10 billion and others saying it's around 9. In any case, we are not far off these limits. What is the Worldwatch Institute's view of this important issue?

EG. A simplified but generally accepted understanding of environmental impact (I) is that it is determined by the interaction between population, affluence, and technology (I=PAT). Thus, population levels must figure into any credible analysis of environmental impact. More people necessarily means more impact.

But it is difficult to accurately gauge the carrying capacity of our planet, because it also depends on the other two drivers in the IPAT formula, as well as questions such as how well people would like to live. The Earth can support fewer people at the European or American level of consumption than it can people living at lower levels. Technology is important, too. Modern methods of production and consumption can drive greater or lesser consumption. The element of time also complicates the picture. To the extent that the environmental damage inflicted by humans is cumulative, the Earth may be able to support fewer people in the future than it does today. Thus, estimates of a sustainable global population tend to vary widely with assumptions about consumption and technology. ›

"We know that ever-increasing consumption, especially of the traditional, materials-intensive variety, is simply not sustainable over the long term"

Rather than focus exclusively on the numbers of people in our population research, we also devote great attention to quality of life, especially for women. Research is clear that women who are healthy, educated and free – not mired in poverty and able to make decisions for themselves – typically have fewer children. Thus, a key strategy for moderating the impact of human numbers on the environment is to ensure that women are educated and have access to reproductive healthcare, including family planning services.

Your State of the World global reports are followed every year by a broad spectrum of people. The title of your most recent report is both interesting and intriguing: *Confronting Hidden Threats to Sustainability*. What are these hidden threats? Can they be overcome?

EG. In the report we talk about many unheralded challenges to sustainable development, and some of these are beginning to attract greater attention. Consider infectious diseases, for example. The Ebola virus in 2014, and now the Zika virus, are diseases to have been stoked by environmental change, wreaking terrible human and economic damage. As our world becomes more interconnected through trade and international travel, infectious diseases are an environmental and health problem that will increasingly require attention and action.

Another looming challenge is "stranded assets": the idling of economic assets, such as oil wells, for environmental reasons. As the environmental damage caused by fossil fuels becomes ever clearer – especially because they drive climate change – investment holdings in fossil fuels become riskier and subject to greater volatility. Other assets such as factories and farms can also be considered stranded, at least temporarily. For example, water scarcity has caused power plants to be taken offline in China, and cropland to be idled in California. The extent to which assets may become stranded because of environmental liabilities is unknown and a wildcard in the world of global finance.

The 2012 title of the report sounded more optimistic: Moving toward Sustainable Prosperity. Is prosperity possible without sustainable development?

EG. Prosperity has traditionally been understood to refer to ongoing increases in per capita income, which implies ongoing increases in consumption. We know that ever-increasing consumption, especially of the traditional, materials-intensive variety, is simply not sustainable over the long term. Thus, the only way prosperity can become sustainable is if the prosperity itself is recast.

Sustainable prosperity refers to advances in quality of life and opportunity, not so much to material advances (especially in wealthy countries that are already saturated with material goods). Meeting basic needs, enjoying employment security, having ample opportunities for personal growth and enrichment and making time for relationship building with family and friends are the faces of sustainable prosperity.

The Worldwatch Institute does not just collect information, but is also engaged in various programs around the world to help different countries on different areas. Could you tell us about the spirit and the working methods characterizing these programs and also about some success stories?

EG. Perhaps the best example of our on-the-ground impact comes from the Caribbean, where we have created renewable energy roadmaps for the Dominican Republic, Haiti and Jamaica. Our method is to assist the countries in mapping their wind, solar, and other renewable resource potential as a foundation for building a renewable energy future. We also assist the governments with an economic analysis of conversion to renewables, including estimated capital costs, employment potential, and other key dimensions.

The idea is that we can, in partnership with technical specialists, help small-country governments begin to envision a renewable energy future, laying the groundwork for implementation. We are excited that partnering with Worldwatch has become a credible first step to a new energy future in a growing number of Caribbean islands. x

Ed Groark is Chairman of the Board of the Worldwatch Institute. He spent his career in the technology industry helping clients align their technology with their business strategy. Since 2001, he has consulted primarily with non-profits, helping them leverage their mission using the Internet and social media. Prior to that, Mr. Groark was President of Riverbend Group, Inc., a technology consulting and integration group focused on networking personal computers for corporate computing that he founded in 1983.

www.worldwatch.org/worldwatch-institute-names-new-leaders

Chris Moran

DIRECTOR OF THE SUSTAINABLE MINERALS INSTITUTE

Although mining focuses on non-renewable resources, this activity has been able to develop processes and strategies within the wide framework of sustainability. The Sustainable Minerals Institute at the University of Queensland in Australia is leading the research in this field providing knowledge and solutions for companies.

"It is critical that we reuse the products of mining"

How would you define sustainable mining? As the first thing that comes to mind when considering this subject is the fact that many natural resources are not renewable, it would be interesting to know how the idea of sustainability fits in these cases.

CM. Overall I conceptually deal with the issue of non-renewability in terms of the forms of capital that society requires for development and to maintain quality of life. These forms of capital are social (interactions between people and groups and the infrastructure needed to support it), human (our knowledge), manufactured (infrastructure and equipment), natural (renewable and non-renewable) and financial capital. Natural capital provides the raw materials for us to develop societies by converting it into the other forms of capital. Some forms into the obvious indicators of development, for example buildings, cars, etc, and others in a more intangible form of information in brains and coded into society's formal and informal rules/laws. Non-renewable natural capital, such as ore bodies, is a form of capital that we only have one opportunity to convert from its "in-ground" form. So we must focus on doing this well and ensuring a just and equitable distribution of the value that is created when this is done.

It is also critical that we reuse the products of mining once we have gone to the significant efforts required to win them from the earth. This is more than just recycling what we can. It is important that society begins to take a very close look at the design of manufactured capital with a view to the reusability of the metals, in particular, that we embed. Currently, we are becoming far more aware of the recovery of metals, but the problems associated with releasing these metals from things such as building or electronic wastes are expensive and require far too much energy. We need to have a massive increase in collaboration between designers, engineers, scientists and those with governing responsibilities to create a step change improvement in metals recovery and reuse.

I define sustainability, as it relates to mining and metals, in terms of a hierarchy. At the bottom of the hierarchy are the basic *unit operations* that are used to extract minerals from rocks, for example, load and haul operation and comminution and flotation. When these are aggregated into a production chain I refer to *tasks*, which in turn aggregate into *whole operations*, for example a mine site or refinery that exists within spatial regions in countries controlled by companies, many of which are multinational. Ultimately, the global impacts and implications are at the top of the hierarchy. I define *sustainable development* to be the distribution of the value (not just money) generated by mining in terms of people, time and places. Put simply: who gets what and when? Sustainable development is dominant towards the top of the hierarchy with important considerations at the regional level and the issue globally. From the bottom of the hierarchy, we are concerned with how the activities are undertaken. It is critical to society that we work efficiently and that we are diligent in extracting the majority of the resources because damage is done in the process. It is very important that we work on and apply the least damaging methods in terms of environment (renewable natural capital) but also in terms of all the forms of capital. Governments, NGOs and companies have an important responsibility to ›

ensure that local communities benefit from the activities of mining and that poor practices are eliminated, thereby also avoiding the consequential damage to communities that can result when poor practices are allowed.

Do we have certifications in this field equivalent to the ones that recognise sustainable wood production, for instance? If so, are they useful and reliable?

CM. We do not have formal regulations in terms of sustainability. There are a number of schemes that are being proposed and/or developed. Quite a few companies comply with the Global Reporting Initiative (GRI). Another significant voluntary initiative is the Extractive Industries Transparency Initiative (EITI) that, put simply, looks to match the money paid to governments with what governments report as having been received. Most of the large multinational mining companies are members of the International Council on Mining and Metals. This membership brings with it substantial public reporting and transparency requirements as well as a commitment to the ten principles of the ICMM that were developed through an extensive process early in the century known as Mining, Minerals and Sustainability or MMSD. In Australia, the Mining Council of Australia (MCA) has a local guide to implementation known as "Enduring Value" that all members must agree to comply with. There are also ratings such as the DOW Jones Sustainability Index that rates and publishes ratings of company performance. Companies tend to see this as very positive and market this success widely. There are also some important international standards that some companies choose to comply with in areas such as environmental management and, again, these bring reporting and transparency compliance. One step behind companies is the developmental support provided by the financial industry, and many financial institutions and banks comply with agreements such as the Equator Principles. Individual company leaders also choose to make a statement by committing themselves to things like the CEO Water Mandate under the United Nations Global Compact.

At the local and national levels, the environment is protected by the application of formal licenses to operate in terms of allowable releases to the environment or acceptable operating conditions in terms of management of ecosystems. These vary from country to country and in some cases mining companies choose to apply more rigorous environmental standards in a particular place because they feel that better protects the company's reputation. Other than self-reporting, there is no overarching assessment and auditing of this. As noted above, when a company reports under the GRI it is more effective if all jurisdictions are operating well, because one or two poorly performing areas can tarnish the company's overall performance.

The question of reliability and usefulness is a broad one. For sure, it is better to have various companies agreeing to operate and comply with reporting than various initiatives that can be tracked over time. It is reasonable to expect that companies that are signing up to multiple accords and sets of principles are going to produce better on-ground results than if no such agreements were in place. It is important for society to see that companies are focused on their standards and are prepared to invest to achieve good results. Mining occurs in almost all climates and topographic situations globally, under every existing governance system and from the most remote of locations to those embedded in major urban areas. We could speculate that some sort of policed and audited standards process might produce better results, however, the challenges of getting sign-up to such multinational compliance regimes would be considerable. Could we achieve such a situation in a reasonable time and could we be certain of producing a more effective mining industry as a result? Perhaps the answers are yes in both cases, but personally I'm not sure the time delay would be worth the effort. There are some advantages to self-reporting and voluntary initiatives.

In terms of effectiveness, it is also important to take into consideration that the mining industry tends to be judged by the poorest performances, not necessarily the overall performance. Perhaps society should be more effective at ensuring when major negative impacts occur to environments and communities that the responses to those events are seen to change the industry practices broadly. A current example is the management and monitoring of the security of tailings facilities. There is a role for academic institutions in writing up and communicating leading practices and pragmatic guidelines to assess performance against there so that reasonably effective assessments of performance can be undertaken and communicated. In taking such a position, it is also important to

"Governments, NGOs and companies have an important responsibility to ensure that local communities benefit well from the activities of mining and that poor practices are eliminated"

consider the access to information that is required to assess good practices. If data are not mandated as part of the approval to mine then it may be very difficult to access, or even have companies make measurements of important data. So, there is an important role in checking whether environmental approvals to mine are holistic and protecting the environment and not solely focused on end-of-pipe limits and measures. There is much that could be done to improve the ways in which we conceive, design and monitor mine sites that would not necessarily be more expensive than the current end-of-pipe focus, but could be considerably more effective.

Can all kinds of mining be managed in a more sustainable way, or, in some cases, is it very difficult or impossible (given specific circumstances or characteristics)?

CM. As I have discussed above, we need a very big improvement in the way we use metals to ensure they can be recovered and reused efficiently. Our use of "on-off" resources such as fossil gas, coal and oil is also very important. Society should be far more aware of the efficiencies with which we use these precious substances and there should be more pressure put upon governments to properly regulate their use. The multiple benefits of doing this include reduced greenhouse gas emissions, more value per unit of effort from their recovery and, of course, a much longer timeframe over which society will be able to benefit from their extraction.

It is important to recognise that many more people are involved globally in artisanal and small scale mining (ASM) than the activities that the public generally associates with mining. ASM covers a vast range of people and activities and is very poorly regulated in both the formal and informal senses. So if we are to take a comprehensive view of the sustainability of mining and metals, it is very important to think through how ASM can be better included in governance and good practices.

Do we have the necessary knowledge to develop sustainable mining today? What obstacles remain in our way to achieving this? And how can they be removed? (It is important to clarify if we are mainly talking about a technical issue or a political one.)

CM. The mining industry has highlighted the importance of one area above all others: the safety of the workforce. There has been a very significant decrease in fatalities and injuries across the industry. There is no case for complacency on this, but it is a very good outcome and has been driven by intensive research, development of pragmatic approaches and workforce education, as well as gradual embedding into the culture of mining.

Technically, we are now able to conceive significantly better ways to undertake mining and metals refining. We are by no means able to implement all that we can conceive practically. One major constraint is that mining is very capital intensive to get started. That is, a mining company must generally make a very large upfront investment in manufactured capital (plant and equipment) before any cash flows from the mine. This becomes a constraint in terms of innovation because it is not likely that future financial capital investment will occur after the initial investment. This technology lock-in can last for decades for very large mines. Consequently, it can look, at any one point in time, that operating mines are not using the latest technologies and leading sustainability practices.

Another constraint might be termed the "mining company social contract with communities". A very important part of securing the formal and social licence to operate for many mines is the employment opportunities for local people. If technology becomes available that could conceivably change the sustainability of the operation from an efficiency perspective, the employment opportunities might decrease. In such cases, the mining company will need to reframe its social contact with the community. Many opportunities exist in building human capital in the communities, such as education and business skills building, but they will be different from the traditional direct employment. One might speculate that the best environmental stewards over the long term for a mining project would be the local ›

community. So perhaps building the skills and supporting technologies for the community to be the environmental managers during operations and the stewards after mining would provide a long term social contract attractive to the communities.

What are the main costs of unsustainable mining, whether social, environmental or economic?
CM. If mining continues without applying and improving leading practices, negative environmental and community impacts will grow. Furthermore, legacies will grow and leave problems for decades or even hundreds of years for future generations to deal with. It is a challenge because decision-making must take into account costs for future generations and this can provide an apparent conflict with the company shareholders of today. What is needed is to continually improve the application of known good practices where they are not being applied, and also to continuously improve these leading practices themselves. A key challenge for researchers is to develop practices and approaches that reduce, rather than increase, the financial burdens. It is increasingly important that meeting the financial requirements of sustainable practices is seen as a return on investment, rather than an additional cost for a company to bear.

Ultimately, if mining does not continuously improve practices there will be constraints to the supply of important commodities. This will likely have the effect of slowing the development of economies, and therefore the quality of life in those economies will not be improved as rapidly as it otherwise might be. As mentioned a number of times in this article, there is a tension that arises in this situation between those that benefit from the mined products and the local communities and national populations from where the resources originate.

Getting reasonable equity between the supply countries, those purchasing the commodities, the mining companies themselves and the future generations is the key balance required for long-term sustainable mining to be considered successful. If there is inequity and one or other of these four parties is overly advantaged (or disadvantaged) then one could be confident that the mining is sustainable. Unsustainable mining will inevitably mean that one or other of these parties is disadvantaged. If it is the mining companies, then supply will stop. If it is the countries making the demand, then development will slow. If it is the supply countries, then supply may be constrained. A key challenge is to ensure that the future generations are properly represented in the equity discussion. Governments generally would be considered the custodians of the future; however, in some cases non-governmental organisations are playing this role where society has concluded that governments are compromised, particularly because of reliance on mining revenues today to meet budgetary pressures.

One issue is how to rehabilitate the land after mining activities have been concluded in a specific site. Could you explain to us a little bit about the importance of this process? Can the land return to its original state?
During your career you have advised governments. Considering this first-line experience, would you say that politicians are really aware of the importance of this subject?
CM. Land rehabilitation is one important aspect of the closure of a mining operation. Of equal importance are the water issues and the community legacies. In technical terms we know a lot about land forming and the materials management that is needed to maximise the chance of good outcomes. However, there are challenges associated with operating a mine that can compromise the application of this knowledge.

Land rehabilitation regulation is widely variable around the world. There are many different mechanisms used by governments to try to assure that the mine is properly rehabilitated. There is an active debate in many places as to what constitutes an acceptable final landform and who should decide what is acceptable. At the Sustainable Minerals Institute we advocate that final landforms and rehabilitation should be a progressive ongoing activity and not left to the end of mining. This can be challenging for a mine. A significant operating cost for all mines is the movement of solid materials. In most cases, there is a very large component of cost associated with movement of overburden and/or waste rock. Movement of solids at this scale is very expensive. It is very difficult to find the money to move material twice. Unfortunately, conditions arise where it is financially better in the short term to

move materials a short distance from the mine so that mining rates can be maximised, particularly in times when processes are high and the mining rate translates directly into an increased positive cash flow. This means that materials are not sorted as well as they might be and it raises the prospect of double handling in the future.

It is also very important to manage tailing facilities well. Tailings are the fine particulate matter that is the residual when commodities are separated from ore. Tailings contain a lot of water and oxygen. Many issues arise from the safe management of tailings. The storage facilities must be constructed to standards that maintain safety for centuries and beyond. There, stability must not only be physical but also geochemical. Many tailings contain particles that if oxidised when exposed to air of oxygenated water produce acid and heavy metals that can then be transported through the environment. There are many practices that can be developed to reduce tailings risks into the future and this is an active area for research today.

In some cases, we still need research at a fairly fundamental level to determine whether certain desired final land use outcomes are feasible. We have not yet successfully carried out the necessary experimental work in all geographies and climates. These are reasonably achievable expectations but the investment is needed to ensure we have clarity with governments and local communities as to what is possible in various operating environments.

Coming to the question specifically, I do not think I can comment as to whether individual politicians understand the significance of rehabilitation. I doubt many politicians have a very good understanding of the significant issues that surround the management of tailings. Therefore, it is even more important to have a good regulatory system supported by excellent technical skills. I think it is up to regulators to inform politicians of the risks and consequences of poor rehabilitation and to ensure that appropriate risk mitigation is built into regulations and policed properly. These challenges are being met variably around the world today.

Mining is linked to many precious resources, with some widely known such as copper and others less well known but equally important, such as rare earth elements. Which mineral resources are critical in status (i.e. the most depleted and in danger of exhaustion) and which ones are still abundant today (2015)?

CM. All metals are abundant in the Earth's crust. We do not have a foreseeable scarcity from the point of view of existence. However, we have some real economic and geopolitical constraints. In some cases, we are challenged by the rate at which various metals might be needed and the rate they can be discovered and economically mined and refined. For example, if we are to meet a radical increase in the use of renewable electricity generation over the coming decades to mitigate climate change, and to deal with air pollution by moving to more electric vehicles in cities, we will need to increase the supply of strategic metals and metalloids. Similarly, if we are to continue the rate at which mobile communications technologies are available, increases in demand will occur.

When considering these demand increases, it is important to take into account where the known resources and reserves exist. Such analyses have been conducted and global maps of criticality have been produced. Some commodities such as rare earth, lithium and niobium have significant geopolitical hazard of supply if the countries that hold the reserves choose to constrain supply. If electrification occurs as some expect, then even the rate of supply of copper might be constraining.

Do you think that economic liberalisation and globalisation are for or against greater sustainability in mining?

CM. This is a very complicated area to discuss, as the distribution of value from mining and the ways we go about the practice of mining and metal production can be influenced in many ways by trade and globalisation.

Globalisation has resulted in many countries gaining investment from mining companies that have a global footprint and who are exposed to potential share value damage if they compromise the reputation of the company. Consequently, these ›

"The mining industry has highlighted the importance of one area above all others: the safety of the workforce. There has been a very significant decrease in fatalities and injuries across the industry"

companies tend towards leading practices wherever they operate. This means that mining is often carried out with better practices than the local regulations might require, which can be beneficial. In some cases, global leading practices in community engagement result in superior outcomes because local regulations do not exist for community benefits. There is a very lively debate regarding how much of the value of mining should go to local communities and in what forms and via what vehicles. Modern communication technologies, one aspect of globalisation, make information instantly available from one community to another and therefore can raise the expectations of what might be delivered by having a mining project in a given community. Another dimension of global companies operating in a variety of geopolitical domains is that skills get transferred around the world. There can be a very significant increase in human capital in places that would otherwise not have access to the training and learning that mining can bring. Again, there is a healthy and lively debate about how much local knowledge building is appropriate, but I maintain it is an indicator of a good situation that the debate is being held. Silence most likely indicates that nothing is happening.

Globalisation and economic liberalisation raises philosophical debates about appropriate ownership of the resources in the ground. It is a challenging discourse because one side argues that the resources are without value if they cannot be exploited as reserves. Others argue that they represent a store of value for the future. So, depending on your outlook and economic philosophical stance you might see the short term conversion of resources into development wealth as beneficial but another person may see it as unattractive. Multinational companies share a primary alliance to the owners: the shareholders. Consequently, they believe that all decisions should be made on the basis of maximum return to the shareholders. This is problematic in cases where company decisions, structures and strategies appear to create situations that move financial capital to the benefit of the shareholders, but not the local communities or the countries that were the origin of the non-renewable natural capital. An example that has received a lot of attention in recent years is transfer pricing. This is where a company creates structures with intercompany loans and repayments located in countries where the taxation overall is optimised. Companies do this carefully and within the law, however, individuals may not agree that it should be possible to create arrangements that provide advantages to the shareholder at a cost to the owner of the resources.

What role do social activists play in developing more sustainable practices in mining? Do they have real power to influence companies?

CM. It is difficult to generalise the impact of activists in terms of sustainability. This is because not all activist groups have the same motivations. Some work genuinely towards improved practices and outcomes for environment and local communities. However, others use the impacts of mining as a means of supporting a broader agenda that might be related to opposing development generally or views on issues such as climate change and fossil fuel mining. Activism also works at many levels. For example, there are activist groups that target financial institutions and their investment in mining can be in that scope.

When activists work for the good of local communities and their environment, often good outcomes can be the result. For example, assisting local communities to organise their leadership and representation in negotiation of agreements with mining companies can be beneficial. Activist voices have been very important in achieving progress with transparency notably through the development and application of the EITI.

Are there any examples of sustainable practices around the world that you consider as good reference points? Could you tell us more about them?

CM. Leading practices in mining occur all over the world. It is not possible to list the implementation in any sensible fashion. Perhaps a better question is

to ask whether there are any mines in the world that exemplify the implementation of all conceivable practical sustainability opportunities. I cannot name such a mine. However, I am cautiously optimistic that we are seeing increasing implementation of leading practices. I say "cautiously" because we also continue to see unacceptable events occurring that should not. Fatalities associated within mining are too high, negative environmental impacts are still far too often in evidence, and the number of conflicts between communities and mining are increasing.

You are the Director of the Sustainable Minerals Institute (SMI) at the University of Queensland (UQ) in Australia. What is the institute's main objective? And what are the main lines of work?

CM. The objective of the Sustainable Minerals Institute (SMI) is to provide the knowledge and implementation pathways for that knowledge to be implemented in such a manner as to enable mining companies to solve their sustainability challenges. Ultimately, we would like to see the fingerprints of the SMI research and education on a discernible reduction in the footprint of mining. Our main lines of work are categorised in those practices that affect production, people and environment. We have six research centres and 12 programmes of work that cut across those areas.

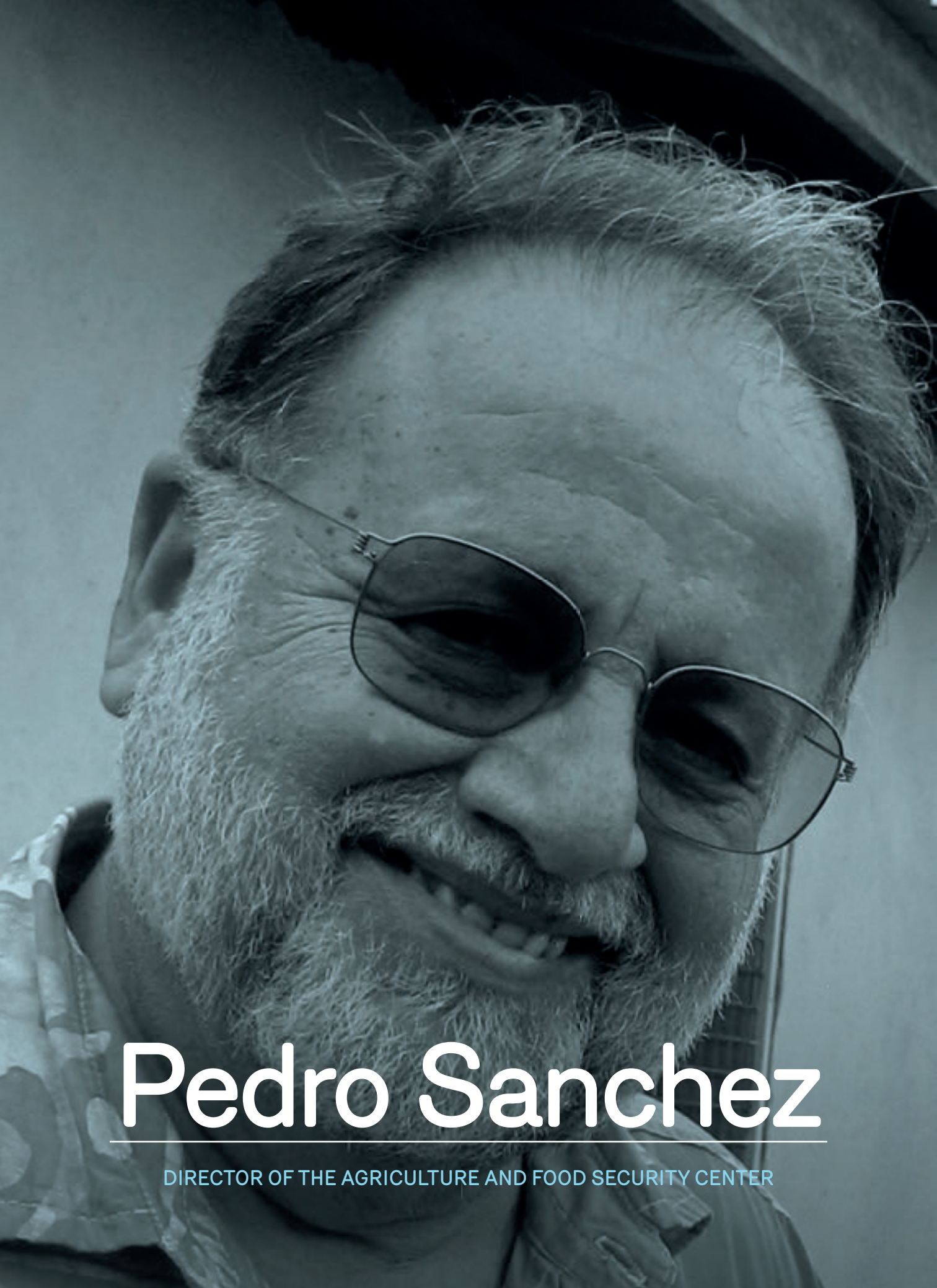
Our research centres are: mining and geology (SMI-BRC), mineral processing (SMI-JKMRC), mined land rehabilitation (SMI-CMLR), water (SMI-CWiMI), social responsibility (SMI-CSRM) and risk/safety (SMI-MISHC).

We aim to use our deep disciplinary skills to create interdisciplinary opportunities that no other group can conceive. We do this in an applied research environment where our target is mine site level implementation. We like to work with specific mines, not just the parent companies, because this brings us close to those with the decision flexibility to move towards sustainable practices.

You can find out more about SMI at *http://smi.uq.edu.au*. Please access our website and contact our people. They work here to create positive change in the mining industry and would love to hear from you.

Chris Moran Professor Chris Moran is the Director of the Sustainable Minerals Institute (SMI) at the University of Queensland (UQ) in Australia. Previously, he was the Founding Director of SMI[1]s Centre for Water in the Minerals Industry, which conducts research towards achieving sustainable water management in the sector. Professor Moran has published widely in scientific literature and broader media. He serves on various government panels and committees, as well as UQ boards. He was a Director of the International Mining for Development Centre (IM4DC), and has had formal advising roles for state and federal governments on nutrient management, groundwater, coal seam gas and underground coal gasification. Professor Moran's objective is to connect the multiple disciplines involved in minerals and energy to meet the challenges of supply and demand into the future.

www.smi.uq.edu.au/user/16



Pedro Sanchez

DIRECTOR OF THE AGRICULTURE AND FOOD SECURITY CENTER

One of the recurring questions about the future of mankind is whether we will be able to feed a rapidly expanding population. In reality there is no definitive answer to this important question. Everything will depend on the evolution of science and technology, economics, politics, and not least, cultural patterns.

"The planet could increase its capacity to produce more food"

Demographic projections by mid-century indicate that the world population will increase by about 3,000 million people. Besides, economic conditions are expected to improve in many parts of the developing world. This will raise the global demand for food. Do you think that the planet can provide food for everyone?

PS. I believe that the planet may well increase its production capacity. My answer has a "provided." The planet will have this capacity provided there is peace and stability on the planet and the political will to do so. This tension we are living now makes it difficult. Since the 60s and 70s food production has doubled several times so this is nothing new. In Africa, where there is a huge amount of land and farmers, the average yield of corn (taking it as an indicator of all grains) was roughly 1 metric ton per hectare 10 years ago. Now yields have increased to 1.5 tons per hectare. It is the first time since data collection started in 1961 that yields in this region of the world increase. We have the technology and knowledge to make these yields increase even more but many farmers still do not know how to do it. Another important region of the world in this regard is South America. There are some huge land areas in Brazil, Colombia and Venezuela, which are not ecologically fragile from the point of view of biodiversity, as Amazonia. In those lands we have seen an impressive increase in food production in the last 30 years. Only in Brazil these areas cover 300 million hectares, of which about 200 million are cultivated. Of those 200 million, half are degraded pastures but there are techniques to recover them are being implemented. Therefore, in Latin America we have a lot of land that we can use for agriculture in the near future where yields could reach 5 tons per hectare. In developed countries land productivity is 10 tons per hectare. Together we can produce a huge amount of food.

The United Nations has established the Sustainable Development Goals by 2030. The second goal after the eradication of poverty reads "Ending hunger, achieves security food and better nutrition, and promote sustainable agriculture." In the report prepared by the British government *The Future of Food and Farming*. It literally reads: "*925 million people experience hunger: they lack access to sufficient of the major macronutrients (carbohydrates, fats and protein). Perhaps another billion are thought to suffer from 'hidden hunger', in Which Important micronutrients (vitamins and minerals: such as) are missing from Their diet, with consequent Risks of Physical and Mental impairment*". What is the true extent of hunger in the world?

PS. There are currently more than 900 million malnourished people. Basically they lack calories and proteins. This figure was even higher and has declined in recent years, taking into account the population increase. Then we have *hidden hunger*. One billion people are estimated to suffer from it and many of them are also included in the malnutrition group. Hidden hunger means the lack of the four micronutrients that nutritionists consider basic for health: iron, zinc, iodine, and precursors of vitamin A. ›

Lack of iron causes anaemia and iodine deficiency in adults causes goitre. In children under two years iodine deficiency causes abnormal development of the brain which is irreversible.

30 and 40 years ago hunger stood at the center of social concern. The situation has improved in recent decades?
PS. Yes it has and we have good data that indicate that there has been great progress since 1990, but the problem persists due to the quick increasing of world population. Perhaps now the issue is not so much in the media because global terrorism and war get all the attention.

Why do you think that hunger still exists? What has gone wrong?
PS. The point is that today we know how to solve this problem. Technically we have better seeds and better ways to fertilize the soil. Micronutrients can be added as in the case of the iodized salt we eat. This can be done with all other micronutrients. Besides we have Genetically Modified food...

What is you view on GM Food? Is it safe?
PS. My position is that the controversy over GM Food is political not scientific. Science is very clear. As a scientist and agronomist -and although GM is not my speciality- I can say that there is no evidence that GM crops represent additional risks to human health or the environment. It is scientifically proven: we haven't had any problems so far. Certainly some people fear these transgenic varieties fear but methodology to create transgenic is equivalent to what nature and ourselves have been doing for millennia to have better seeds. Instead of doing it randomly as nature does, or by selective crossing of some plants with others, now results can be predicted. The rejection of GM Food is not based on knowledge but on faith-like feeling.

Food production involves enormous pressure on resources and sometimes harmful environmental effects. Some of them are: loss of soil fertility, excessive water consumption, pollution, etc. Is it possible to develop more sustainable food production systems?
PS. Yes, it is perfectly possible. We can increase the efficiency of organic or mineral fertilizers and we are advancing in this field. I have been working on it. The same happens with the use of water. Flood irrigation systems are 50% efficient. This means that only half of the water is used by the plant. Sprinkler irrigation, used in large farms, is up to 75% efficient. Drip irrigation, invented in Israel half a century ago, is becoming increasingly popular and brings efficiency to 90%. In the case of fisheries, the key is to control fish stocks. Scientific data are here and politicians must act according to this basis of knowledge.

Meat is one of the most controversial elements not only regarding whether or not is healthy, but because of its great impact on the consumption of water and energy. Is this criticism fair?
PS. It is true that beef production has a great environmental impact with high water consumption. Moreover it has been subjected to the same industrial feeding system for poultry and pigs. Certainly, this has helped to obtain more meat but this meat contains a greater amount of fat and cholesterol that is causing health problems. We must not forget that there is a cost to society when people consume less healthy meat. This does not happen when cattle eat in the pasture. I was invited by the journal Science to write an article on the subject. At the beginning I only saw the shortcomings of this system but later I discovered some nuances that must be underlined. Industrial feeding generates benefits and provides meat for everyone. In the pasture system methane emissions from cattle are greater than in the industrial system. We should learn to balance between the two without discarding industrial feeding. The problem is that now industrial system dominates completely. I think we can get to a situation where bovine animals from both systems coexist in the market as different products. This is difficult balance where you have to make decisions. I want to add something else to this discussion. Nutritionists have told me, "Peter, it's silly that a small child is a vegetarian". The reason is that they need a lot of iron and that amount can be found in beef.

"More than 900 million people are currently malnourished. This is a figure that was higher and has declined in recent years and we must also take into account the increase in population"

Currently, as in many sectors of the economy, much of the food production is globalized. In your opinion this results in the unsustainability of the food system? Do you think the countries and local communities should promote food self-sufficiency?

PS. If you do a good analysis is much better for the environment and the economy, import sheep or sheep meat from New Zealand to New York than bring it from a place located 20 km from the city. Sometimes if everybody wants to eat local that can cause a problem. I'll give you an example. I was one day in Colorado discussing this very issue and someone said that all must be proximity consumption. I replied "and how can they make wine here?" It is clear that not everyone can have everything, that's what exchanges are for. Besides local product are not always the best. Local vegetables are better because they have to be fresh but in other kind of foods different alternatives have to be considered. Concerning organic products they are usually more expensive and there are people who are willing to pay a little more. On the other hand I do not think that organic products are different from conventional products in the sense of being healthier. I would say even that in some cases there have been problems of bacterial contamination in organic food in Germany and the United States. I am a specialist in soils and I can state the plant does not care whether an ion of phosphate or sulphate that absorbs from the soil comes from urea or manure or whatever. I am against replacing science with ideology. I do not like extreme positions. I am in favour of common sense and I want that different options can coexist.

According to the European Union each year about 100 million tons of food is thrown away only in this region of the world. This data also reveals the unsustainability of the system in the sense that there is a clear overproduction. How should this problem be addressed?

PS. This problem occurs in both rich places like the European Union and the United States and in the poorest regions of Africa. It is interesting to note that the percentage of food that is lost is the same in both cases: between 30% and 40%. Of course, the losses in the two cases occur for different reasons. In the rich world they are due to poor domestic management of the food in the refrigerator. In the poor world, the cause is mismanagement of the grains after a harvest. In the first world the deep cause of this problem is bad education not so much overproduction. Regarding the solutions, it is interesting to note the initiatives in municipal politics. For example, New York City is doing a lot in this field with selective collection of waste and its subsequent management and also promoting urban agriculture. Of course urban agriculture will not have a global impact, but it is very interesting as a means to raise awareness about the value of food. It has a pedagogical effect. In recent years people from large urban centers have lost their connection with rural and agricultural roots. In New York some children believe that food comes from the supermarket.

What is the relationship between Climate Change and the world food system?

PS. We see that what was possible has become real. The effects of Hurricane Sandy here in New York in 2012 were something new, and in other places drought has appeared. Climate change is fact. From the agricultural point of view, parts of Africa will become drier and others, such as the east of the continent, will get more rain. Both developments can be terrible for Africa and nothing good can come of this for food production. More generally, I can only see negative effects from climate change. It is true, on the other hand, that in certain latitudes of Canada or Russia agriculture can be viable where once was impossible, but I think this will have little impact on ›

"As a scientist and agronomist I can say that there is no evidence that GM crops represent additional risks to human health or the environment"

the whole. In this situation we can expect only a good combination of science and political decision. We can move crops from one region to another depending on the new climate conditions. For example, sorghum tolerates drought better than corn and here we have an element of choice. However, I cannot say whether all efforts will be enough.

The most concerned people against Climate Change haver always sought a major international agreement. Do you think that it would be possible to find an equivalent agreement among nations to meet the challenges of food in the coming decades?

PS. Climate has local effects but all of us, wherever we are, share the same atmosphere, so an international agreement makes perfect sense: no matter where greenhouse gases are emitted, everyone will have the same consequences. But agriculture is not the same. If we could achieve such an agreement there is a risk of imposing a single vision of how agriculture should be. That is not possible because agriculture involves many different and complex worlds, with its traditions and characteristics, which are strongly linked to local cultures, different ways of seeing the world. If you tell me that such an agreement will focus only in aspects that can be easily shared, such as improving irrigation efficiency, then it is okay, because they have universal interest. But if it deals with decisions over what to reap, for instance, then it would be very difficult. Given the circumstances, a specific dialogue should be started in each location to reach agreements.

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http://agriculture.columbia.edu/about-us/people-at-agcenter/full_time_staff/psanchez

Mariano Marzo

PROFESSOR OF ENERGY AND PETROLEUM GEOLOGY

The world economy could not function as it does today without fossil fuels. This scheme will necessarily be altered sometime in the 21st century, although the transition to a new energy model, with great presence of renewable energy, seems to be gradual. This prospect could be changed by the influence of geostrategic factors and powerful scientific advances such as cold fusion.

"There will come a time when it will be meaningless to extract oil"

Why are we so dependent on oil?

MM. Oil has a lot of energy per mass unit (energy density). This factor gives power and autonomy and allows us to do things such as crossing the Atlantic without refuelling. How should the plane deposits be with other types of fuel? Enormous! The aircraft would be unworkable. Best fuel cells are far from the energy density of oil. The second reason that explains our dependence is that crude oil is very cheap, even more than water or milk.

Is there enough oil to meet the demand of the global economy?

MM. Until 2008 there was a clear consensus that oil production (low-cost oil that can be extracted with conventional technology) had reached a maximum while demand continued to grow. But in that year the United States was able to implement the technology known as fracking that provides more expensive oil. Besides, its extraction is more complex and generates a greater environmental impact. But this oil has enabled the United States to reach levels of production similar to Saudi Arabia. This leads us to revise the concept of peak oil, that is true for conventional oil, but not for unconventional oil.

Do we know the limits of this resource?

MM. To understand the issue of oil depletion, let's imagine a pyramid at the top of which there are fewer resources but they are more accessible. When we descend to the lower layers of the pyramid there are more resources but they are more difficult to extract. Therefore it is also more expensive to do it: we have to spend more energy for obtaining energy. In this case the environmental impact also increases. With fracking we have gone to the bottom of the pyramid. This has opened up more possibilities for us momentarily (more oil is available) but in a context of greater technical difficulty, higher prices, greater environmental impact and lower energy return. In short, we are already seeing the limits of oil even if the resource is not depleted right now or in the coming years. They are technological, environmental, economic and thermodynamic limits. The conclusion is that we must abandon the paradigm of society that runs on oil, not because oil reserves are exhausted, but because we are facing the limits of this resource and it will make no sense to continue extracting.

At what point extraction will be nonsense?

This is another important issue. It's not the kind of change that will come after a quick instant shock. The curves of peak oil are valid for the top of the pyramid, but if you consider that, as I said, we will go down a little deeper into the pyramid extraction won't stop immediately. The abandonment of extraction is irreversible, even though it may take many decades. Moreover, all energy transitions of mankind have been long-running processes. ›

For the moment it seems that oil prices tend to fall...
MM. Indeed, since mid-2014, oil prices are falling and this poses a problem to expensive producers like Venezuela but in North Africa and the Middle East there are still a lot of oil reserves "from the top of the pyramid" that means cheap. Besides, the new agreement with Iran implies that this great producer will be back to the market. So, prices prices remain less higher than previously thought and this will mean increased consumption. In the United States, for example, this situation of lower prices has resulted in the consumption of 600,000 barrels more per day. This is of course bad news for the environment. However the period of low prices is preparing the way for a future rebound effect.

What role will gas play in the immediate future?
MM. Gas is a bridge to a lower carbon future because it generates fewer carbon emissions. The gas pyramid is much larger than oil's pyramid. In addition scientists are beginning to study gas hydrates which are frozen water molecules in the seabed containing methane inside. For the moment we do not know how to exploit this resource, but it has been estimated that the volume of gas hydrates is about 500 times all fossil fuels we know today. This introduces an unexpected variation in the whole process.

Fossil fuels are not disappearing as soon as some observers predicted.
MM. In summary, oil is showing its limits and new prospects are opening for gas. This happens in a context where emissions must be controlled due to climate change. In this scheme a lot can happen in the next few years but for now we are seeing divestments in the industries with more emissions.

Do you think that global energy consumption will go up?
MM. Around 30% of the world population consumes between 70% and 80% of all energy resources. We know that the consumption of this 30% (developed countries) will not increase significantly in the future. But China and India and many other developing countries will do. Therefore the global energy scenario has multiple variables and not all of them necessarily move in the same direction. For this reason, sustainability has become an issue that needs the participation of many disciplines especially social and political sciences.

The complex scenario you describe is not usually on the media. Is there a danger of oversimplification?
MM. Communication in sustainability has to move forward because today many people have their minds prepared to process many elementary messages like twitter ones, but not so much to process complex information with a huge amount of nuances. The field of energy cannot be seen in a simple way.

Do you think that climate change could accelerate the energy transition?
MM. If you really want to fight climate change you need to do a little calculation. We have to add all the reserves of oil, coal and gas we have inventoried. Then, since we know how much CO2 is emitted by every ton, we can find how much CO2 is stored. The conclusion is that if we are not to exceed 450 parts per million CO2 in the atmosphere, two thirds of oil, coal, and gas reserves should not be used. This is an important fact if we want to be consistent with the issue of climate change. European oil majors are accepting to turn their businesses into gas, put a price on the tonne of CO2 and encourage emissions trading and carbon sequestration. Definitely they want to abandon the low profile maintained on this issue and start being more proactive. Instead, the big American companies

"We have three battlefronts simultaneously: environment, economy, and energy security. If we focus our efforts on one of them but neglect the rest, we will end up with serious problems"

"The complexity of energy options is huge, so it is really amazing when someone approaches these issues and proposes quick and magical solutions"

do not want to hear about an emissions market or anything like internalizing costs: they want business as usual. Therefore there is a schism in the industry at this time.

The amount of CO2 of anthropogenic origin linked to the use of fossil fuels is a fact. One can think: "Let's remove fossil fuels and end of the problem". But it can't be so simple.

MM. The amount of CO2 in the atmosphere is the result of multiplying four factors: the global population, economic growth (GDP per capita), energy intensity and carbon intensity in the energy mix. Meetings on climate change focus on the part of the equation corresponding to the energy model: efficiency, lower carbon emissions system, application of natural or artificial techniques for carbon sequestration. But there is no discussion about population growth and economic development. These are two factors that are always going up and therefore CO2 emissions keep on rising. Therefore, demographics and the economic model are the key in this matter. Since 1950 the population has doubled and GDP has increased seven-fold. When it is said that fossil fuels cause climate change is true but the root cause is the socioeconomic model and its dysfunctions.

Fossil fuels are solar energy stored in the earth for 500 million years. Until the industrial revolution people lived at the pace of energy coming from the sun and its influence: wind, rivers, crops. This was a small but steady energy income. Suddenly mankind discovers that there is a source of immense energy that has been hidden so far and then the great social and technological change occurs. It's like mankind had received a large inheritance. I call it solar heritage. From here on population and economy grow as never before.

What are the alternatives to fossil fuels?

MM. Renewable and nuclear energy are low-carbon alternatives. China, United States, South Korea, Russia, and he UK are driving the nuclear option although it is also true that Germany has said no to nuclear. The problem is waste and lack of social acceptance. Sweden, for example, wants to be free of fossil fuels by 2050. This will be possibe with biomass, which is very important there and additionally with nuclear energy. They have convinced the population with social dialogue. The question of Fukushima is on the table, but you cannot ignore the debate and not talk about it. You have to show pros and cons.

There will be more and more renewable energy once and we will see how buildings, which are large consumers, will become energy producers thanks to the Smart grids. But we have to think again in global terms, because sustainability is a global issue, and I must say that a large part of humanity won't benefit from these technologies for a long time. In fact there are still 2,500 million people who don't have access to basic energy services.

Besides we have to remember that 94% transportation depends on oil. The railroad, which runs on electricity, is just 1% of transport in the world. Around 90% of the goods that move across the planet travel on ships that run with oil. Currently there is no substitute for oil in maritime and air navigation.

Could you predict a scenario for 2050?

MM. I think that in 2050 electricity generation will be based on a high percentage of renewable sources, supplemented by nuclear, although here people must decide. All fossil fuels will decrease.

This forecast is made in the context we know. Of course if this cold fusion is achieved that would change everything completely. It would be a revolution as when we find the solar heritage of fossil fuels. At the moment there is a very important experiment in cold fusion to be made in France. The reactor where this experiment will take place is being built. The cost is around 11,000 million euros and like any experiment can succeed or fail. ›

What is expected from cold fusion experiments?
MM. To verify that fusion energy with a positive net return can be produced for a certain time and in a controlled manner. Hydrogen bombs are the uncontrolled manner to do so. These experiments need a very complex design because temperatures reach hundreds of millions of degrees. From here, if the experiment in France succeeds, next phase will be reactor demonstration pilot-programs and this phase would probably last for a generation. Therefore we are talking about mid-century, although this is only a hypothesis now.

How important are geostrategic factors in the world of energy?
MM. They are key aspects. It is very important to know who has the resources and controls transport routes (oil and gas pipelines, shipping lanes). In this regard it should be noted that the Russian influence in Europe, the world's dependence on Middle East resources or the growing self-sufficiency of the United States are all very significant factors. But I want to consider climate change as another geopolitical factor, because it has a huge potential to cause mass migrations, destabilization and changes in economic prospects. Remember I said that if we don't want to favour climate change, we will have to stop using two-thirds of the reserves of oil, coal and gas we have inventoried. That means large producers have only a third of the wealth they believe to possess. This affects entire nations but also companies. So climate change is a geostrategic factor, because if many countries realize that they are less wealthy than they thought this can cause divestments.

In you conferences you mention usually the trilemma energy. Can you explain the meaning of this concept?
MM. We have an energy trilemma. There are three battle fronts simultaneously: the environment, the economy, and energy security. The trilemma is that if we focus our efforts on one of the fronts but neglect the rest we will end up having serious problems.

For instance, we can prioritize the environment, but if we lose the energy supply that will be bad. So this is all about looking for a dynamic equilibrium, which will vary from time to time. What is clear is that we must not turn all our attention at one of the three fronts. This trilemma is not the only possible for energy resources, there is also the three "a": availability, affordability, and acceptability. We can have a resource and be able to get it but if society refuses to do so this is as we hadn't it. What is not acceptable in any case is Wishful Thinking.

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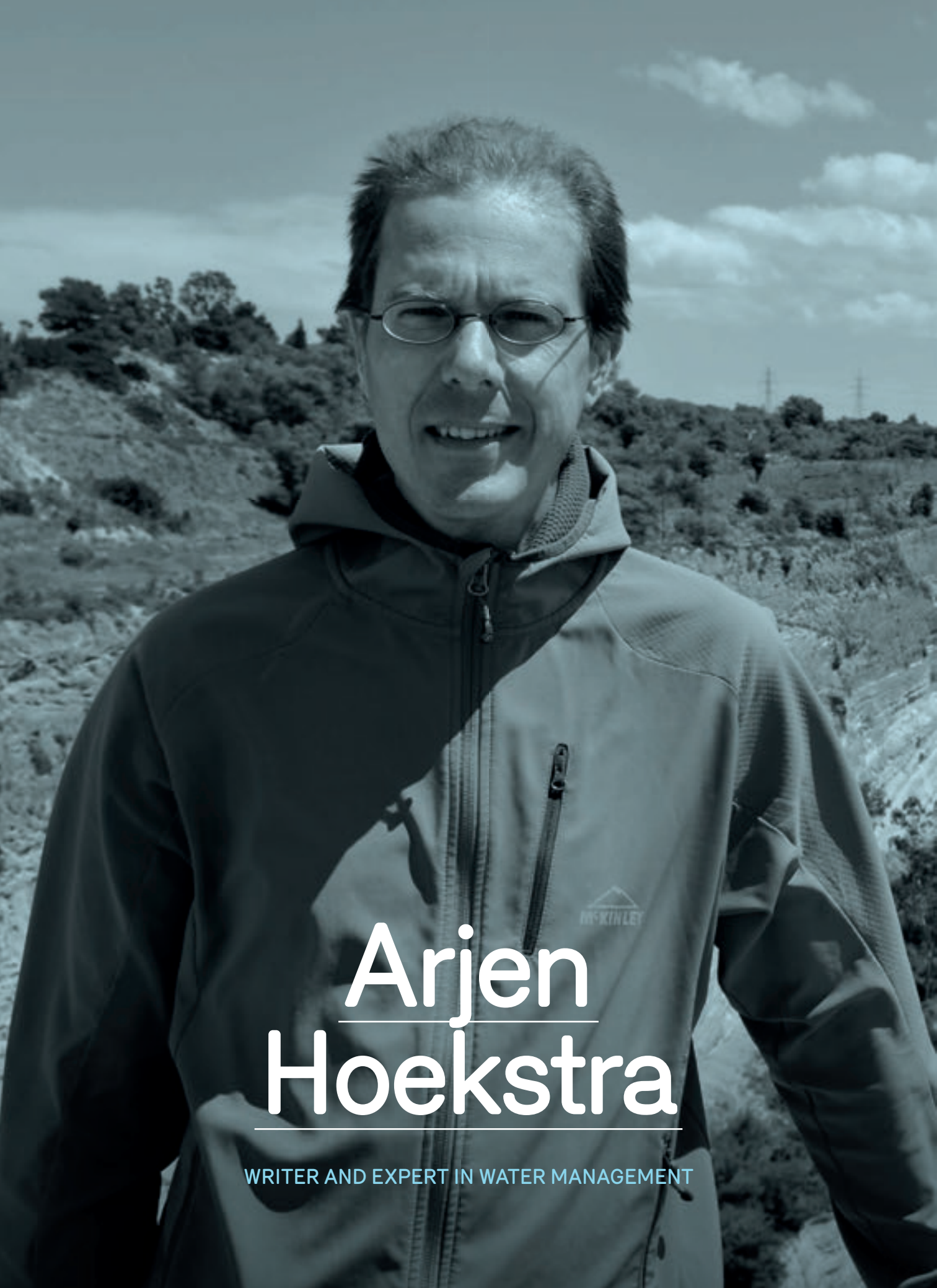

Arjen Hoekstra

WRITER AND EXPERT IN WATER MANAGEMENT

The Earths' freshwater resources are subject to increasing pressure by consumption and pollution. In some regions of the world water is wasted whereas others suffer from severe scarcity. Water doesn't deserve so much attention from the media as energy, when in fact it is a vital resource for industry, agriculture, and everyday life.

"Freshwater scarcity is a major risk to the global economy"

If water is a renewable global resource, why are so many people suffering from water stress and scarcity? Is there enough water for all mankind considering the 2050 demographic prospects for 9/10 billion people?

AH. Water is a renewable resource, but its renewal rate is finite and determined by the annual precipitation over land. That's why there is a limitation to our annual water consumption. In many regions in the world, our water footprint exceeds the maximum sustainable level, which leads to river depletion, shrinking lakes and declining groundwater levels. Currently, about four billion people live in areas that experience severe water scarcity at least one month per year. Instead of reducing our water footprint, we are actually still increasing it.

Why have you developed the concept of water footprint? What does this concept tell us about the relationship between the Earth's freshwater resources and our current production and living model?

AH. I developed the water footprint to show the relation between consumption and water use. When most people think about their water use, they think about their water use at home, but this is only a tiny fraction (4% as a global average) of their total water footprint. Most water use relates to the water used to produce the food people buy. Many countries have externalized their water footprint to a large extent to other countries, thus becoming dependent on water elsewhere, which is a concern if the water in the export country is being depleted, which is the case in many export regions. The UK, for example, has a huge water footprint outside its own territory (75% of its total water footprint!) and about half of that is in places with unsustainable water consumption rates.

How is a water footprint calculated? Are national accounts of water footprints accurate enough?

AH. We distinguish between a green, blue, and grey water footprint. The green and blue water footprints measure water volumes consumed and the grey water footprint measures water volumes being polluted. The difference between the green and blue water footprint is that the former measures the consumption of rainwater stored in the soil, while the latter refers to the consumption of groundwater and surface water. The basic building blocks of all water footprint accounts are the water footprints of single activities or production processes. The water footprint of product is the sum of the water footprints of all production processes. The water footprint of national consumption depends on the water footprints of all products consumed within a nation. Data are still rough estimates, but enough to show that we are heading the wrong way.

Is it possible to determine whether a particular water footprint is sustainable?

AH. The amount of water available per river basin is given by the precipitation within the river basin. We cannot consume all of it, because we need to leave substantial volumes of water in the system to maintain the aquatic and terrestrial ecosystems that depend on the presence of water. The water available for human consumption is therefore the ›

precipitation minus the environmental water needs. We have rough estimates of water availability across the globe at a rather high spatial resolution level.

How can our water footprint be reduced? What are the key aspects for achieving this goal? (The answer must also include the role played by the key actors: consumers, companies, and administration.)
AH. According to the World Economic Forum, freshwater scarcity is a major risk to the global economy. Since supply chains are so international nowadays, it involves us all. Therefore, governments should better regulate water use to avoid over-exploitation, companies should invest in their operations and supply chains to reduce water use, investors should include water sustainability in their investment decisions and consumers could reconsider their consumption pattern. Regarding the latter, lowering consumption of meat and dairy will be of particular help to reducing our global water use, since about one third of global water consumption relates to the production of animal products.

Do you think it would be feasible to develop a water label for products? What products would be at the top of the list with the highest water footprint? What kind of effects do you think this information could have?
AH. Ideally we wouldn't need product labels to show that products are sustainable; unsustainable products should be banned altogether. But we are so far from that reality that for the time being product labels are helpful in informing consumers. They also provide an incentive to companies to improve their products. I think that we can best integrate water criteria into existing labeling schemes, like the European label for organic produce or other eco-labels. For some specific products it may be useful to have a separate water label if integration into existing labels appears to be too slow a process. Products for which it could be useful and relatively easy to introduce a sustainable water label are for instance cotton products, beverages, rice, sugar, and cut flowers. There is a strong movement advocating free trade, but we should be able to discriminate in trade between sustainable and unsustainable products. We need labels that show what is sustainable and what is not.

"When most people think about their water use, they think about their water use at home, but this is only a tiny fraction (4% as a global average) of their total water footprint"

Given the fact that water knows no borders, should water management become a supranational issue?
AH. Water has traditionally been regarded as a local resource, to be managed locally, preferably at catchment level. It has only been recently that an increasing number of people have started to understand that many local water problems relate to the way we have organized our global economy. Many water problems can indeed be solved at local level, but local measures need to be supported by international agreements for us to be able to implement them. Putting a price on water is a local issue, but it will not happen if there isn't an agreement that water pricing should be implemented on a large scale, because otherwise there is no fair competition. For the past 10 years, I have been arguing that we need an international water pricing protocol, because water is not being priced properly, so that even in places with the greatest water scarcity, water often remains free. In this way, the cost of water is not translated into the cost of a product and there is no incentive in the economy to use water wisely. The price of water should of course vary from place to place and time to time to reflect spatial and temporal variability in water scarcity. I have also pointed to the need to start discussing national water footprint reduction targets. This requires international collaboration and negotiation.

Do you think that in the near future we will see water footprint reduction targets like the ones we are used to in greenhouse gases?
AH. Given the difficulty of the global community on agreeing on carbon footprint reduction targets, I don't expect it will be easy to achieve something meaningful for water in the short term. But at lower scale levels I expect we'll see water footprint reduction targets very soon, for example with

individual companies that set their own targets, or countries or river basin authorities that set geographical water footprint reduction targets.

How can climate change affect the world's water resources?
AH. Climate change is expected to increase the incidence of droughts in many areas, and because of that it will increase water demand as well. Water demand and supply are counter-cyclycical, which means that water demand is generally highest when water availability is lowest. In many areas, climate change will thus increase water scarcity in dry periods of the year, while it may increase the frequency of flood incidents in the wet periods of the year.

As an expert in water management, don't you think that sometimes the water issue seems to be understated in comparison with the energy issue? How do you explain this?
AH. It's not that the attention placed on energy is overrated; the need to move away from fossil fuels requires urgent action. But indeed, our dependence on unsustainable rates of water abstraction and water pollution deserves due attention as well. Fossil fuels have a price as long as water is free, and that makes a big difference in our perception. The global economy gives all sorts of signals when oil prices go up or down, and we have seen the quick adoption of renewable forms of energy now they have become cheaper. The global economy doesn't give the slightest indication of the rate at which we are depleting various rivers, lakes and aquifers around the world, because it's all free. Water is a huge blind spot for most economists. The good thing though is that a few years ago, the World Economic Forum pointed to water crises as one of the biggest risks to the global economy, so there is reasonable hope that increasing awareness at some point in time will materialize into action. x

Arjen Hoekstra is Professor in Water Management at the University of Twente, the Netherlands. Hoekstra was the first to quantify the water volumes virtually embedded in trade, thus showing the relevance of a global perspective on water use and scarcity. As creator of the water footprint concept, Hoekstra introduced supply-chain thinking in water management. With the development of Water Footprint Assessment he laid the foundation for a new interdisciplinary research field, addressing the relations between water management, consumption and trade. Hoekstra is founder of the Water Footprint Network, was the organization's first Science Director and is now Chair of its Supervisory Board. Hoekstra's scientific publications cover a wide range of topics related to water management and include a large number of highly cited articles and book chapters. His books have been translated into several languages and include *The Water Footprint of Modern Consumer Society* (2013), *The Water Footprint Assessment Manual* (2011) and *Globalization of Water* (2008).

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Michael Braungart

CHEMIST AND ENVIRONMENTAL THINKER

Cradle to cradle is a biomimetic approach to the design of products and systems that seeks to create production techniques which are essentially waste free. In this approach all material inputs and outputs are seen either as technical or biological nutrients.

"Cradle to cradle eliminates the concept of waste"

Cradle to Cradle is a radical change in the way that environmental issues have been addressed so far. What is the conceptual basis of Cradle to Cradle (C2C)? And why it involves a change of paradigm?

MB. The messages we get are all about reducing our consumption of resources. It's all the time minimizing damage on the environment. That's like if I tell you: beat your child 5 times instead of 10 times. So there is a traditional misunderstanding about our role in this planet. If we make the wrong things perfectly then they are perfectly wrong. The idea behind cradle to cradle is to see humans as an opportunity for the planet not as a burden. We have to celebrate human life in this planet. This is a big cultural shift.

Traditionally people think from cradle to grave. We see life-cycle assessments on a coca cola bottle but first of all there is no life in that bottle. We need to define use periods: things are consumed and need to be designed to support the biosphere. Cradle to cradle means to reinvent all products. These products have to be designed of products thinking in nature's processes where there is no waste. Materials have to be seen as nutrients. This will create systems that are efficient and waste free.

What is the relationship between C2C and Sustainable Development?

MB. If we take the definition of Sustainable Development by the Bruntland Comission it says "fulfil the needs of the present generation without compromising the needs of the futures ones". It is sad to come home and say to your children "oh I don't want to compromise your future needs" What I have to do is support your children. Sustainability is over. It is History. Another approach is possible. Humanity has a lot of wisdom and we have to collect it from experts, from indigenous people, from everywhere. But overall humanity must not see nature as an opponent but as a partner. That is the right starting point. Prince Charles or Vandana Shiva say "What do we do to Mother Earth?" I think we don't have to apologize all the time for being here. To be in the new C2C paradigm the whole society must change: economically with new businesses, and culturally with new mindsets and visions. As Einstein said, we cannot solve our problems with the same level of thinking that created them.

Certainly, behind many environmentalist and sustainable development visions lies a strong sense of collective guilt. You defend a more lenient view of human action and also you advocate for optimism, but still in recent years a negative sentiment seems to dominate the environmental discourse. This positive feeling you underline is a consequence of the transformative potential of C2C or it is just you are an optimist yourself?

MB. I am not at optimist. I see that the speed of destruction goes much faster than the positive change. Many species go extinct and we have to spend a lot of money to defend our infrastructures against global warming. Things are not going the right way but we have to put it all in a historic context. In Europe, between the declaration of human rights, and full rights for women it took almost two centuries. ›

Any paradigm shift takes time and having said that it is amazing how fast cradle to cradle is happening because it is the opposite of traditional sustainability.

Why eco-efficiency or recycling -that enjoy so much prestige today- are not long-term solutions?
MB. As I said at the beginning if you do wrong things perfect you are perfectly wrong. In the last 50 years we have had great environmental disasters like Seveso or Bophal. In Bophal thousands of people died instantly and many more were ill afterwards. We have also continuous disasters like the millions of tons of plastic that end up to the oceans every year. Efficiency just optimizes existing things and processes even if they are not sustainable for the planet. Rainforests have been more protected with inefficient machines. Now machines that work in deforestation are more efficient than ever but the result for the earth is worst, you see...

Is C2C an opportunity for Europe in the global scenario?
MB. We in Europe have to decide whether we want to become a big museum for China or build our own strength. In the last years Europe has developed so much expertise that we can now use for innovation but the problem is that people are still thinking on environmental issues like ethical questions. Corporate Social Responsibility is an example of this view. But they are not. The Environment is the only innovation engine that Europe has. Lot of stuff can be produced in a cheaper way in other places of the world. Our challenge is to make far better products. I will give you an example, when you print a catalogue in Europe you have about 50 dangerous chemicals in it at the point that if you burn paper in your fireplace you will poison your neighbours. Now if you print a catalogue in Malaysia maybe it has around 90 dangerous chemicals. It is more lucrative to print in Asia but instead to see only that we have to think that it would be much better to try to innovate and stop making paper in a primitive way! We are the first people in history that can design to go to the biosphere.

C2C products would be more expensive than the rest?
MB. COverall cradle to cradle products tend to be cheaper than the other ones but they are competing with highly optimized wrong products. For instance if we produce a carpet that cleans the air from dust that is definitely a better carpet that is the right approach. We have to go for innovation. It does make sense to make things differently and in market terms it is more profitable. Instead of buying electric cars in the future we would buy 100.000 km: mobility as a service not as a product.

Are we starting to move towards a C2C system?
MB. In July 2015 there was a meeting in Brussels in the European Commission where four commissioners and the First vice president Frans Timmermans committed to cradle to cradle We have the C2C network that brings together EU regions to share regional good practice in implementing C2C principles in relation to waste prevention and management, and do so by producing sustainable solutions, economic development opportunities and social well-being. We are moving forward and C2C is seen as the future of the economy but we need to move faster and people have to learn a lot. There are good signs. For instance Essen will be the European Green Capital 2017 and they got this title because of C2C work.

"C2C approach and thinking is entering the design world. Big chemical companies, chambers of commerce and even some trade unions in Germany speak about it. C2C obviously is not yet into main-stream but we are in good shape to experiment the mind shift that is necessary for that"

C2C approach and thinking is entering the design world, big chemical companies, chambers of commerce and even some trade unions in Germany speak about it. C2C obviously is not yet into mainstream but we are in good shape to experiment the mind shift that is necessary for that. It is going faster than I expected. The fact is that when people understand deeply that less bad is not good then everything goes quickly. A product that ends up in the ocean is a terrible product. We have to keep that in mind.

There is a disturbing question. The complexity and diversity of material flows that are processed by the industry is really huge. It is feasible to close biological cycles and technical cycles with such a degree of complexity?

MB. We have to make an effort and struggle with terminology. Traditional circle economy is nothing else than linear thinking in cycles. If today I have some materials in a car that does not mean these materials have to go to cars forever. Maybe tomorrow they will be used in a piece of furniture, and next time in a building material. The same goes for the aluminum in windows that it could be used in a completely different product in the next 25 years. The technosphere could be organized in this way if we positively define what all the ingredients in it are. In this context companies would become material banks. This is not about build again and again the same things with the same materials in a loop. It is very boring to be born many times as a rabbit! It is about upcycling. Another example: tyres are made of hundreds of chemicals and if we recycle them to do more tyres we are optimizing a wrong thing. What is the right thing? Tyres need to be designed for the biosphere but not recycled. In this case we have to manage nutrients back into nature. What we have to learn is how to take out the nutrients we need from products once they are not in use anymore. That is why it is a question of design and concept. There is no C2C possible when you don't understand the whole system.

There are plans to build incinerators in the next years in many countries of Europe and with that we are losing the nutrients we need. We have now a very strong waste management industry. But the C2C is about eliminating the concept of waste. It is rematerialization not dematerialization.

Design then becomes the most important part...

MB. Yes and everybody can be a designer if people are able to define things positively. Europe is very famous for design but today aesthetics is the most important part so many designers are "beautifiers". So we need to reinvent this profession and all of our activity.

Well, people now talk a lot about the new mobility that will be replaced by e-mobility. But the solution for transportation is not to change combustion engines for electric engines. There are other issues. For instance only 12% of parking areas are used all the time in Madrid we should invent other activities for these areas. This paradigm shift applies to many other things like buildings. Now they are big energy consumers and we know that the inner air quality in them is much worse that outdoor urban air but we can design them to produce energy and clean the air water. C2C implies to be better not less bad as I said at the beginning. ›

Do you think that C2C could change some well-established beliefs about the limits of our world?
MB. We have ageing societies and when millions of people reach a certain age we send them to retirement in this is a kind of human waste management. But in fact society has never been so young because many people at late age are in the same condition that a 40 year old person was 100 years ago. One third of the German Federal budget is for subsidizing the retirement system. In the future we have to rethink completely this because people can engage in many social activities for almost their whole life. As long as we keep healthy we can be long-life active. People in the environmental movement talk about planetary boundaries, but I think this is stupid. We have room for more people as long as we are able to produce materials without destroying nature. I am sure that society will change to Cradle to Cradle. Cradle to Cradle combines the European complexity-oriented thinking with the American attitude to get things done and move forward. Computers were not invented in the States they were created in Europe but they were upscaled in the US.

Mentalities need to be changed...
MB. Not only we need to change mentalities to implement Cradle to Cradle but it is also the other way around: by implementing Cradle to cradle is how we will change them. Listen when you define a person as a problem that person becomes a problem. When people have fear they become angry and greedy and when they fell safe they share things. We humans will go for more simple lifestyles not because someone tells us to do so in an *ecodictatorhip* but because we would feel happier in those lifestyles that give us quality of life back.

C2C obviously is not yet into mainstream but we are in good shape to experiment the mind shift that is necessary for that. It is going faster than I expected. The fact is that when people understand deeply that less bad is not good then everything goes quickly. A product that ends up in the ocean is a terrible product. We have to keep that in mind. x

"We humans will go for more simple lifestyles not because someone tells us to do so in an ecodictatorhip but because we would feel happier in those lifestyles that give us quality of life back"

Michael Brungart Professor Dr. Michael Braungart is the founder and scientific CEO of EPEA Internationale Umweltforschung GmbH, an international environmental research and consulting institute headquartered in Hamburg. He is also the co-founder and scientific director of McDonough Braungart Design Chemistry (MBDC) in Charlottesville, Virginia (USA), co-founder and scientific manager of Hamburger Umweltinstitut (HUI) (a non-profit research center) as well as director of Braungart Consulting in Hamburg. Braungart studied Chemistry and Process Engineering, among other subjects at Konstanz, Darmstadt, Hannover, and Zurich Universities. In the 1980s, he dedicated his work to the environmental organization Greenpeace and beginning in 1982, helped to establish the chemistry section of Greenpeace International, which he took over in 1985. In the same year he received his Ph.D. from the University of Hannover's chemistry department. In order to develop solutions for complex environmental problems, EPEA was established by Greenpeace in 1987. Ever since, Braungart has been involved with research and consultancy for eco-effective products, i.e. products and production processes that work in a loop and are not only harmless to man or nature, but beneficial.

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Sylvia Lorek

RESEARCHER AND CONSULTANT FOR SUSTAINABLE CONSUMPTION

Dematerialization is a concept that refers to reducing the amount of material resources used to meet the needs of production and consumption. It can also be seen as a strategy that aims to influence at the origin of processes, in contrast to the end of process solutions that are currently the most common ones.

"Dematerialized economies and lifestyles will be a reality sooner or later"

How and when the term dematerialization arises and what does it mean in the field of the economy?

SL. Dematerialization has to be seen in the context that quite some of the non-renewable resources we need for our economies, like oil or phosphorus, are running out and that some important renewable resources, like fish and timber, are faster consumed than they can reproduce. The famous book 'Limits to Growth' from the mid 1970s already indicated that we are coming to an end with our resources and the situation is constantly worsening.

The term dematerialization takes this serious and works towards a reduction (in fact a tremendous reduction) in the quantity of materials we use to serve the production and consumption needs of our societies. In contrast to a lot of 'end of pipe' technologies which try to solve problems where they appear, dematerialization is an input-oriented strategy, which approaches environmental problems at their source.

On a smaller scale we can also talk about dematerialization in the context of specific products or production processes. In this case it means to use less or, even better, no material to deliver the same level of functionality to the user. This is e.g. in the context of so called 'product service systems' where products stay in the ownership of a company and are borrowed to the customers only for the time they really use it. This leads to less ownership of products and thus less production.

What is the relationship between the concept of dematerialization and the concept of decoupling?

SL. Dematerialization is often used in relation with the term decoupling or gets even mixed up with it. Resource decoupling means reducing the rate of resource use per unit of economic activity measured in GDP. So, decoupling always refers to the economy and its activities while dematerialization takes the Earth's capacity and its limitations as the reference point. When economists talk about decoupling they differentiate between relative and absolute decoupling. Relative decoupling is already achieved when resource use grows less fast then GDP. Absolute decoupling means that the economy grows but resource use remains at least stable or decreases. Dematerialization, then is a very strict form of absolute decoupling, some call it progressive decoupling some absolute reduction: the resource use goes down in absolute figures towards a sustainable level.

Some nations like Germany or the US claim to have managed an absolute decoupling of their economy (i.e. stabilizing resource use despite growing GDP) as a result of their resource efficiency programs. In reality, the consumption of materials and carbon induced by these countries still increases. This discrepancy between figures and facts happens because they increasingly import goods from developing countries. This way the material needed for the production processes drop out of the statistics of developed countries and now appear in the statistics of developing countries. There is an ›

ongoing global shift, where developed economies substitute domestic mining and production processes which need a high amount of material with imported products.

However, the problem is recognizes and the European Environmental Agency, e.g., has developed programs that calculate economies' material use not on the basis of production in a country but on the basis of consumption of a country. This means accounting the total material required (TMR) in all final products a nation consumes which involves also the previous steps along the production chains - including investments in machinery and infrastructure as well.

Is dematerialization now an ongoing process? Or it is still is a concept with no practical application?
SL. Unfortunately dematerialization is not an ongoing process, at least not in a broad sense because the main focus of economists and decision makers is on decoupling. Economic growth is THE guiding figure and if material consumption grows less fast this is already seen and sold as a success. Globally GDP grew 147% from 1980 to 2008 while material consumption grew 'only' by 79%. This relative decoupling in fact involved a tremendous further materialization of the global economy.

But this does not mean the concept does not have a practical application. In the contrary. Wherever it is applied on smaller scales this is necessary start – at least if it is real dematerialization and not outsourcing the problems to other countries or towards other products. Some examples for at least a good trend towards dematerialization are the reduction of fertilizer use in Denmark, the definition of sustainable fish catch in Iceland or the levy of more efficient use of aggregates in construction in the UK.

"Slight adjustments within the system will not be enough to foster the radical reductions in the use of materials and carbon that are necessary"

Do you think a particular company can consider a dematerialization strategy or this is a process that only makes sense on a large scale?
SL. This goes hand in hand with the previous question. It is the company level which has to start and to show that dematerialization is possible. But of course the concept only develops it necessary size if it becomes a general rule.

Is it possible to carry out a dematerialization of the economy at a large scale in a "business as usual" scenario or is a profound change in the structure and functioning of the economy is required?
SL. If it comes to a dematerialization of economies as such it is most unlikely that it can happen within the business as usual. Here the difference between single/few company efforts and the general way economies/societies are organized becomes obvious.

Slight adjustments within the system will not be enough to foster the radical reductions in the use of materials and carbon that are necessary. We have to realize how huge the challenge is we are facing. Each year the Global Footprint Network calculates the day where the resources available for a year are gone. And each year this day comes earlier (in 2015 it was the 13th of August). So for more than four month we live from reserves. Any good housewife or good book-keeper knows that something like this can't last forever. So it is the solid precautionary principle which calls for turning towards dematerialization soon. But how to do that in an

economy that has growth as the guiding principle? This seems impossible because lots of the small scale success stories of dematerialization are counterbalanced by resource consuming growth elsewhere.

Do dematerialization and decroissance (or degrowth) belong together or are they two different ways?

SL. Dematerialization and degrowth efforts go hand in hand. Still they have different emphasis. Dematerialization concentrates on the throughput of materials, respectively on mechanisms to avoid a further materialization. In theory it appears neutral to the question of economic growth. It is just that statistics show that there is no truly dematerialized economy within a growth context so far. Of course, one can hope for technological innovation which leads to absolute decoupling. But just to put all hope on technology and not to consider that this may fail would be extremely careless. Here a common element to degrowth becomes obvious: both concepts see the prosperity of economies not as the ultimate goal where all other aspects have to subordinate. Instead they accept the possibilities and limits earth (or nature) provide when it is not misused or overexploited and intend to act within. Degrowth in addition also cares more about the social dimension and elaborate on the possibilities to create a good life for all within these limits.

Do you think that public intervention is needed to push for dematerialization or the private sector can move forward in this direction in the future by itself?

SL. The private sector has to move forward, this is out of question. But whether it will to it in the necessary speed on a strictly voluntary basis can be doubted. Dematerialization, as Degrowth, cannot be expected to be a win-win game. So it will need some rules to set more and clearer incentives for companies to size down their material consumption and/or incentives. In this context an appropriate mechanism for absolute dematerialization would be to set upper limits for resource use. This would reduce the possibility for rebound effects – the phenomenon, that resource savings in one area directly or indirectly leads to more resource consumption in another area. Such agreements on resource caps would aim towards an absolute reduction in resource use through the distribution of resource allowances that get progressively reduced year by year. This could constantly transform production and consumption patterns and prove incentives for innovations towards products and services with low material input. First initiatives, like the Resource Cap Coalition, are developing such concepts.

What role has research, innovation and eco-design in dematerialization?

SL. As the challenge we are facing is so huge, every possible contribution should be used and supported. Research on eco-design actually is the most prominent strain where solutions are expected from. Huge funding schemes within the business sector and from public funds (national, EU, etc) are devoted to this, as well as quite some regulations and directives. Nevertheless, the support and development of social innovations is of similar importance.

I like to give an example from a developed country perspective, in this case Germany. Statistics show, that a quite high share of material use/energy consumption/land use is related to (heating) energy consumption per m² living area. Of course, it is important to mobilize creative engineering capacities to develop better isolation, more efficient heating and cooling systems, smart information systems to support smart behavior of tenants and to feed the energy grid with renewable energies. But as long as the m² living area per person is constantly increasing we are not really dematerializing but just keeping the level because the two effects a similarly high. ›

At the same time we see a slight tendency in Germany to move to co-housing, multi generation houses etc. As such projects have a lot of shared facilities like common kitchens, laundry rooms etc. they build another facet of dematerialization. But research on such social innovation – and even more important on policies how to support them – is only starting now and so is seriously underdeveloped. There is quite some potential for dematerialization which can be explored from this perspective.

Will dematerialization bring a radical change in consumer culture and the way people see the material well-being today? In what sense?
SL. This depends on the perspective. If we see our consumer culture manifested in shopping centers, the more and cheaper instead of solid and valuable then there will be a radical change. But what is well-being? There are countless studies from all over the world that well-being of people depend a lot on non-material values as soon as basic material needs are fulfilled. Family, friendship, meaningful work, social acceptance are some of them. The perception that we still need increasing material well-being is quite constructed with a huge effort. That's what all the advertising companies and marketing departments are made for, right. I am pretty sure if the pressure of being a consumer, of being up to date and always consuming more, would be taken from people we would have achieved an important step towards dematerialization as well as to well-being of individuals and society.

"I am pretty sure that if the pressure of being a consumer, of being up to date and always consuming more, would be taken from people we would have achieved an important step towards dematerialization as well as to well-being of individuals and society"

Do you think dematerialization will mark the economic development of the 21st century?
SL. Dematerialized economies and lifestyles will be reality sooner or later - and I suppose it will be sooner. At some time we will be confronted with the fact that some of the essential resources our economies depend on are not available anymore – despite for some very rich perhaps, who still can afford. Latest then we have to learn how to live, to produce, to consume in a less materialized every day. The challenge for now is to take some steps to prepare for a more or less soft landing in such a new situation and to avoid shock or crisis as good as possible. x

Sylvia Lorek Dr. Sylvia Lorek has worked as a researcher and policy consultant for sustainable consumption since 1993. She holds a Ph.D. in consumer economics from the University of Helsinki. Previously, she studied household economics and nutrition (Oecotrophologie) at the University of Applied Science in Munster, with a focus on environmental and consumer consulting, as well as economics at the Open University Hagen, and the Universities of Munster and Duisburg. The combination of these two disciplines provides her with the tools for a well-founded analysis of the contexts in which the scientific and societal discourses about sustainable consumption take place. She also works with the Sustainable Europe Research Institute on studies and is a consultant for national and international organisations such as OECD, EU, EEA, Wuppertal Institute and ProSus Norway etc.

For various years, she coordinated the task force on lifestyle at the Northern Alliance for Sustainability. Recently, she has turned towards more scientific networks, and is currently an organising member of the Sustainable Consumption Research and Action Initiative (SCORAI) in Europe, as well as being on the steering committee of the Global Research Forum for Sustainable Consumption and Production (GRF-SCP).

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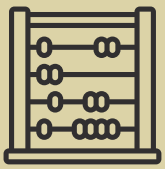
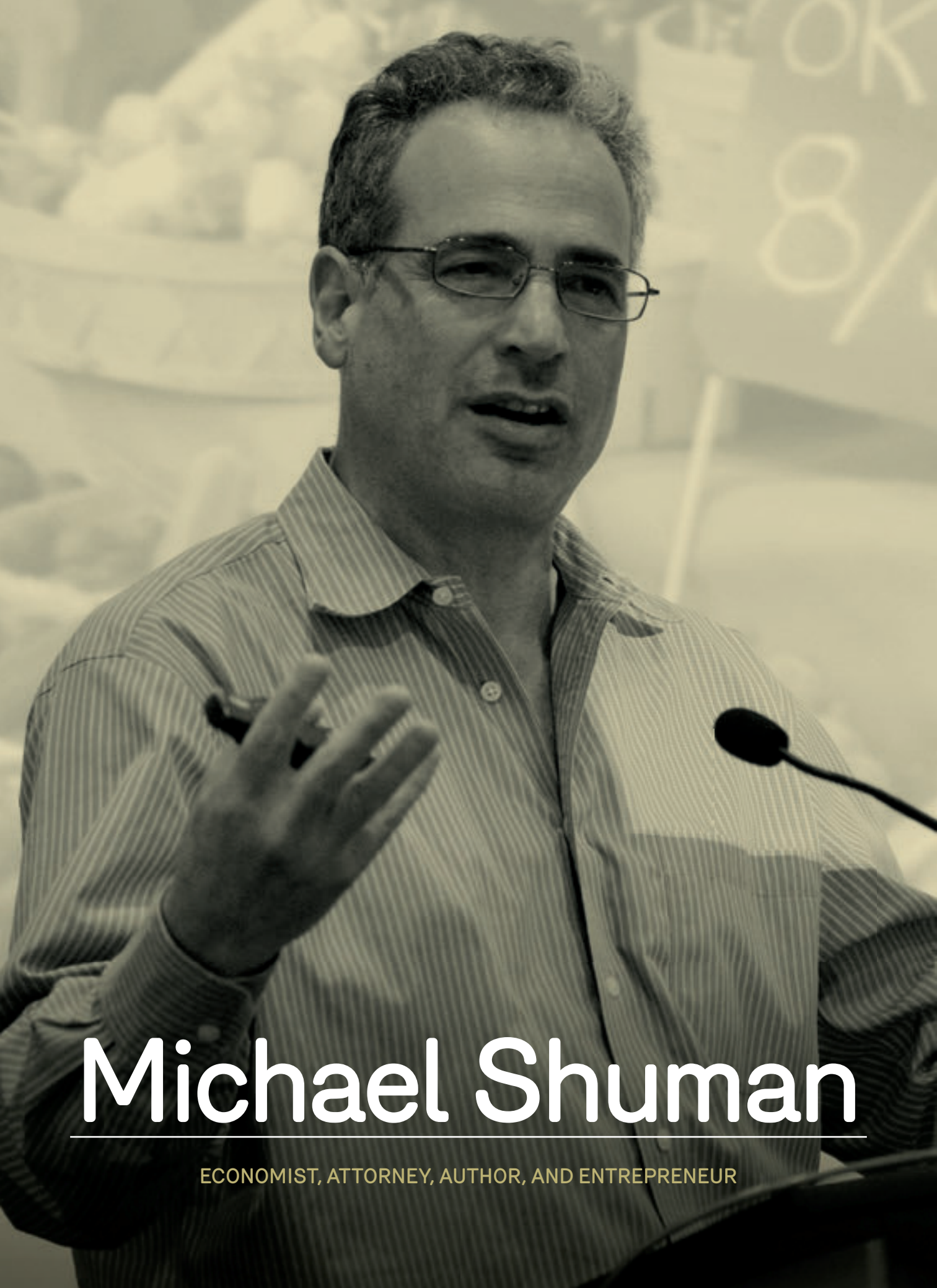
The rich and complex interrelationship between economics and sustainability has generated a huge number of academic papers and essays. One of the major issues of debate is whether one of the fundamental tenets of the current economy, found in the form of indefinite growth, is consistent with the objectives of sustainable development which are strongly marked by the idea of limitations. Is it viable to build an economic model that causes less material impact, preserving the physical environment that supports it?



Towards a new economy

Michael Shuman | Jeroen Van Den Berg | Josep Maria Galí
Federico Demaria | Walter Stahel | Dirk Glaesser



Michael Shuman

ECONOMIST, ATTORNEY, AUTHOR, AND ENTREPRENEUR

In recent years the idea that the local economy can increase welfare and equity in the social field and at the same time can reduce environmental impacts is gaining ground. This kind of economic development is not necessarily incompatible with globalization. In fact it can become complementary.

"The local and the global should be woven in innovative ways"

In the book *The Small-Mart Revolution* you note the importance of local business and the local economy. Considering the book was written in 2006, almost a decade later would you say that the local economy concept and reality have moved forward? Is this a universal trend?

MS. There is no question that the local economy movement has made huge strides in the United States. There's a saying in the United Sates that you know you've made it when you're on the cover of *Time Magazine*. In March 2007, the headline on the cover of *Time* was "Forget organic, eat local."

I visit 40 or 50 communities each year to speak, many in deeply conservative parts of the country, and every place I go, I see signs that say buy local, eat local, bank local, and so forth. I have never seen the sign, "We are not local—buy from us." It's clear that we have won the war over the consumer's imagination. Most Americans now understand, at a visceral level, the value of strong local economies.

We have also won the war of research findings. There is overwhelming data and analysis that local businesses are the best contributors to economic development in the United States. One study published in the *Harvard Business Review* in the summer of 2010 found that local-business communities have a higher per capita job growth rate. Two other studies, one from the *Economic Development Quarterly* and another from the Federal Reserve of Atlanta, found that local-business communities have higher per capita income-growth rates. In other words, if you want to reduce inequality, growing local businesses is a critically important tool.

What are our movement's measurable accomplishments? In the United States, local economy advocates have helped to rewrite securities laws, making it cheaper and easier for grassroots investors to support local businesses. We also have documentation that in cities with good local business alliances, "local first" campaigns have substantially improved the bottom lines of resident local businesses.

Is this a universal phenomenon? I believe that it is, because there are trends in the world economy that are shrinking competitive economies of scale. Households in developed countries around the world, for example, are shifting their consumption patterns from goods to services. Because services require a trusting relationship between the provider and recipient of the service, local services are inherently quite competitive. Rising energy prices are speeding up the spread of local production (to avoid expensive transportation), local utilities, and local energy efficiency. The spread of an increasingly speedier internet means that more and more people are settling in places they love and then doing their jobs via the web.

Several years ago, I worked with the Wallace Center on Sustainable Agriculture to carry out a Gates-Foundation-funded study called Community Food Enterprises. We looked at 24 great models of competitive local food businesses, and in every continent in the world (except Antarctica), we found that the same factors were driving growing consumer and producer interest in local food. ›

Local economies never ceased to exist but you are talking about a new approach to a new type of economy. What are the main features of this new approach? And what are the main benefits of developing and consolidating an economy well rooted in communities?

MS. Most economic development today proceeds on the assumption that communities should "attract and retain" business. To succeed at this strategy, communities must become more "business friendly," which can mean anything from installing more public infrastructure (highways, ports, airports and internet ports) to breaking up unions and weakening environmental protection standards. They should also provide incentives in the form of subsidies and tax breaks.

What's odd about the "attract and retain" paradigm is that it has nothing to do with local business. You cannot attract a local business; that's an oxymoron. And if the only way you retain a business is paying it some kind of bribe, how deep are the roots of that business in the community?

Local economic development, in contrast, focuses on the creation and expansion of locally owned businesses, because for every dollar a consumer spends in a local business or an investor invests in a local business, a community will enjoy two to four times the economic-development impacts, including jobs, income, wealth, charitable contributions, entrepreneurship, and innovation.

The key principles of local economic development, in my view, are really four-fold:

- Maximize the percentage of jobs in locally owned business.
- Maximize local self-reliance, not to withdraw from the global economy, but to engage in it from a position of strength. (Healthy local businesses, grounded initially in local markets, naturally begin to expand sales to regional, national, and global markets.)
- Identify, celebrate, and spread great "triple bottom line" businesses that are simultaneously profitable, good for their workforce, and good for the environment.
- Create an entrepreneurial ecosystem.

"Local economic development improves the old principles of sustainable development by adding the element of place"

This last point warrants some elaboration, and it's the centerpiece of my most recent book, *The Local Economy Solution*. An entrepreneurial ecosystem should be attentive to six concepts that begin with the letter P:

- *Planning*: Identify local needs that can and should be met with new or expanded local business.
- *People*: Train a new generation of entrepreneurs to lead these businesses.
- *Partners*: Create networks of local businesses that are more competitive as a team than they would be working apart.
- *Purchasing*: Mobilize local consumers and businesses to buy local.
- *Purse*: Tap local savings, both short-term savings in banks and long-term savings in pension funds, for financing the expansion of local business.
- *Public Policy*: Remove the many biases in government regulations and subsidies that disadvantage local small business.

It's not just important that economic development focuses, laser-like, on these six Ps, but also that it tries to accomplish as much of this activity as possible through vibrant self-financing enterprises, so you can stretch economic-development dollars farther. For example, rather than begging your local government or a philanthropy to underwrite a buy-local campaign, your community might deploy a local loyalty card like Supportland (in Portland, Oregon), which effectively runs a permanent buy-local campaign that's financed by beneficiary businesses.

I call these self-financing economic development programs "pollinators," because like bees, they take the best each local business has to offer and share it with other local businesses, thereby creating a fertile ecosystem for entrepreneurship. Also like bees, pollinator enterprises do not need a paycheck from nature.

Do you think that in order to be successful, the new economic model needs to question fundamental elements such as the current property or financial systems?

MS. My basic instinct is to question everything, but to celebrate even modest steps in the right direction. So, no, I don't think it's essential to radically change property, financial, or banking systems to accomplish many important "new economy" goals. In the United States, at least, states, cities, neighborhoods, businesses, cooperatives, and civic associates can go very far in legislating their dreams.

For example, I don't regard Wall Street as the problem besetting our financial system. I regard the eagerness of 99% of Americans to entrust their savings with Wall Street as the problem. If we withdraw our money from the Fortune 500 economy – which we are entirely within our rights to do – we will have ample resources to rebuild our community economies as we want. We don't need to Occupy Wall Street. We need to replace it.

What other changes in our present understanding of the world – not just in the economy – are needed to strengthen this new view?

MS. Broadly speaking, I think the world needs to embrace a deeply decentralist vision of internationalism, which requires weaving together the local and the global in innovative ways.

My philosophy is the principle of subsidiarity. Whenever possible, power should be exercised at the smallest level possible. Start with your community. Unless there's a very good reason, your community should address as many collective challenges and opportunities as possible. If there's a good reason to move decision-making to a higher level – perhaps your decision implicates others like a community-run incinerator that belches smoke on neighboring towns – then you do so. But this means that power resides primarily at the local level, less so at the state level, less still at the national level, and barely so at the global level.

One implication of subsidiarity is that you must have a lot more tolerance for other communities' choices. Every community has more power to shape its destiny, and one community's utopia will be another's purgatory. My community might allow gay marriage while yours doesn't.

Another implication of subsidiarity is that nation-states probably need to become a lot less powerful. More and more countries would look like Switzerland, where a regularly rotating presidency lightly governing empowered cantons is rarely noticed by the rest of the world. So I'm very skeptical about top-down "progressive" proposals to redistribute income and wealth at the national level, for example, because they all require strengthening state power.

But in an era of increasingly potent, truly global problems, decentralization is an incomplete philosophy. Every community engaged in increasing its prosperity through localization is duty bound to help other communities follow the same pathway. This will mean communities working together to share successful designs of small business and public policy, or to collaborate on various global human rights or environmental initiatives.

Let me give you an example of what this might look like. In the 1980s, my first organization, the Center for Innovative Diplomacy, organized a treaty-making process involving two dozen Canadian and American cities. It was called the Stratospheric Protection Accord (SPA), and each of the cities pledged to reduce its emissions of halons and CFCs which we knew were eating away at the Earth's ozone layer. This municipal action ultimately spurred national action, resulting in the Montreal Protocols.

Our new mantra might be "Think local, act global."

What public policies should be undertaken to promote the local economy? Do you believe that, generally speaking, the political classes in advanced countries understand that we are facing a real paradigm shift?

MS. In my various books, I've probably written about three or four dozen public policies that can help facilitate local economic development. But here are my top four:

- *De-subsidize global business*. By dismantling the many subsidies that are given to global business today, especially misguided "attract and retain" incentives (which the New York Times estimates are at least $80 billion in the United States), we will be improving the competitiveness of local businesses that are critical to real economic development.
- *Use local banks*. One easy way local authorities can boost local business is by running all their financial services through a local bank or credit union. ›

This way, public money provides the capital for local lending that boosts the local economy. At the state level, for example, North Dakota created a public bank almost a century ago, and now the state has just about the highest level of small business lending in the United States and the lowest level of unemployment.

- *Increase local procurement*. Another easy way local authorities can support local business is by making it easier for local companies to obtain government contracts. One straightforward way to do this is to insist that all contract bidders indicate what percentage of a contract they would spend locally. The public authority would then estimate likely tax collections and adjust the bid accordingly, which would give local businesses the credit they deserve. This tweak of procurement law would not only lead to more efficient contracts, but also to a huge expansion of local business.
- *Create local investment tax credits*. One way to promote local investment is to reward residents who choose to invest locally with a tax credit, as the province of Manitoba does in Canada.

One final point about all four of these policies: all of them actually save the government money! Desubsidization reduces government spending. Local banks charge no more for their services than global banks. Procurement reform would lower the net expenses of public authorities on their contracts. And investment tax credits, if properly designed, can expand a jurisdiction's tax base.

What could bring about such a paradigm shift in emerging countries? (Which, as you know, often reproduce the worst elements of advanced capitalism.) And what could it bring to the poorest countries?

MS. About twenty years ago, I wrote a book called Towards A Global Village (Pluto, 1994) in which I argued that some sister-city and linking programs offered a powerful template for how we might reinvent international development. For many years, for example, the Dutch have carried out much of their development work through municipalities and grassroots groups that facilitate exchanges at every level: women to women, youth to youth, firefighter to firefighter, butcher to butcher. This is how success can be shared by partners in a non-paternalist way.

Another project that I've started to design with the Schumacher Center for New Economies is "Locapedia," an open-source, internet-based descendent of Wikipedia. The idea is to compile basic knowledge from grassroots contributors about local businesses in every sector of the economy. This then informs and empowers entrepreneurs worldwide. If I want to start a small-scale poultry processing plant, I could look up a category like "Manufacturing-Food-Chicken," and I would be able to read about ten examples of successful small-scale poultry processors worldwide. I then could contact the CEOs of these ten companies for further details. Perhaps we might even create a formal network of producers to jointly procure technology or market our products under a unified brand.

The goal with strategies like these is to help the poorest communities in the world achieve prosperity through the spread of local business and self-reliance, just as their richer counterparts are now doing.

Could you explain how this new vision connects with the principles of sustainable development? (On the understanding that these principles basically set out that all human activities should meet present needs while preserving resources for the future.)

MS. Local economic development improves the old principles of sustainable development by adding the element of place. The new principle of sustainability might be stated as: meet the needs of your community, present and future, without compromising the ability of other communities to meet their needs, present and future.

This redefinition of sustainability fixes the older definition from the Brundtland Commission in two ways. First, many industrial communities fancy themselves as sustainable while in fact they depend on nonrenewable resources like oil, gas, and coal imported from elsewhere on the planet. The new definition makes clear that you can't become sustainable yourself at another community's

"A localized world is also one where communities are far more self-reliant, but also far wealthier"

expense. Second, it really places an affirmative obligation on communities to assist others, which we just talked about.

What is the importance of the Transition Towns movement in the implementation of this new economic paradigm?

MS. Transition Towns is one of the most effective and influential promoters of local economic development in the world. Its materials make the field easy to understand, coherent, and fun, and Rob Hopkins has been an extraordinarily articulate and charismatic leader. It is extremely successful at empowering grassroots groups to educate themselves and take action.

To what extent does the implementation of solid local economies depend on the pace of what is known as the Energy Transition?

MS. Probably the first sector that communities seek to localize is food. Part of the reason is that we know, historically, that the very first stage of community development is to be food secure through a strong agriculture sector. But food serves other purposes as well. It facilitates health. It mediates relationships. It makes us happy. It enables us to celebrate our culture. We can viscerally taste the virtues of good local food.

But I would place energy as a close second to food, because energy is really engrained in every aspect of the economy. I agree with Amory Lovins who argues in *Reinventing Fire* that if we are smart in implementing efficiency measures and renewable energy alternatives, we can painlessly move to a low-carbon economy, locally, nationally, and globally. Local economies play a critical role in this transition, because greater local self-reliance, by definition, reduces demands and strains on nonlocal resources around the globe. Local self-reliance also reduces transportation, which reduces a huge source of greenhouse gases. Local agriculture, which distributes fresh food locally with less packaging, also reduces climate stresses, and organic agriculture and ecological restoration can expand carbon sinks worldwide.

Some global companies contribute positively to the communities in which they develop their activities. Are globalization and localization two models that can coexist and complement each other? Or are they intended to be in conflict?

MS. I try to be very careful in my writings and talks not to villainize global companies. My objection is not to global companies per se, but to government money and favors conferred on them. A community should welcome global companies residing in their jurisdictions, since they do provide the community with jobs, income, spending, charitable contributions, and so forth.

Where I disagree with many of my friends who are critics of globalization is this: I believe that, in a freer and more competitive market, local businesses will naturally outcompete most global companies. That's why it's so urgent that we get rid of business subsidies, especially "attract and retain" economic development "incentives" and reform legal advantages they enjoy in the capital markets through obsolete securities laws. And as big businesses begin to face imminent death – like when a number of huge U.S. financial institutions were on the verge of failing in 2008 – we need to have the courage to let them die with dignity.

As we've discussed, I also think that the best approach to localization is through grassroots and community networking proceeding globally.

Ultimately, a localized world will be one where local businesses are the norm and global businesses are the exception. Sure, there will always be a few kinds of industries – like rocket manufacturing – that will require large economies of scale, but the vast majority of industries will have highly competitive local companies. ›

A localized world is also one where communities are far more self-reliant, but also far wealthier. And one of the things they will do with that wealth is purchase more imported goods that are not available locally. When I localized my mortgage a number of years back, I plowed some of the savings into buying my favorite nonlocal Scotch whiskey. Ironically, then, one of the potential results of great localization is *greater* global trade. Which is but another reason it's essential that we have in place carbon taxes that ensure that the trade is relatively carbon free.

In 2001 you and others promoted the BALLE organization. What is its purpose? How has BALLE evolved since then? And what goals has it achieved?

MS. The Business Alliance for Local Living Economies was founded to serve as a kind of alternative Chamber of Commerce, one in which only local businesses were members. It has since grown into 80 networks in North America representing about 40,000 local businesses. And among the networks' activities is the promotion of local economic development, local purchasing and investing, and advocacy on policy issues of concern to local business. Every year it holds a major conference which is a place where members exchange ideas and innovations.

In the early years, we were a tiny organization with a tiny team of staff. At one point in 2009, we received a couple of grants that allowed us to expand and I was hired (after resigning from the board) to develop an economic development program for BALLE. But the board and the executive director did not see eye to eye, so my job changed direction and scale. I continued to work on a few economic development projects for BALLE, but it was pretty clear that BALLE was moving in a different direction, so I left at the end of 2010.

This economic development work is still important, but now it has to be done outside BALLE. And this is one reason I wrote my new book. When you look at the 80 or so networks affiliated by BALLE, the typical network is 50% dependent on foundation funding. BALLE networks that figure out how to self-finance their activities are going to have more impact, hire more people, and accomplish more. The pollinators book presents BALLE network leaders with 28 business models that they might consider bringing into their organizations. In fact, two of the models are from existing BALLE networks.

It is not just BALLE affiliates that need a solid business model. The same argument applies to communities affiliated with AMIBA, with the Main Street Program, or with microenterprise associations. No matter what your focal point of local economy-building is, you should look at the pollinator models for ideas about how to wean yourself off of unreliable foundation or government grants. x

Michael H. Shuman is an economist, attorney, author, and entrepreneur, and a globally recognized expert on community economics. He is one of the architects of the crowdfunding reforms that became the "JOBS Act," signed into law by President Obama in April 2012. Shuman is currently Director of Community Portals for Mission Markets and a Fellow at Cutting Edge Capital. He is also a founding board member of the Business Alliance for Local Living Economies and an adjunct instructor in community economic development for Simon Fraser University in Vancouver. Michael H. Shuman has authored or coauthored eight books. His most recent book, published by Post Carbon Institute with Chelsea Green, is *Local Dollars, Local Sense: How to Move Your Money from Wall Street to Main Street and Achieve Real Prosperity*. His previous book, The Small Mart Revolution: How Local Businesses Are Beating the Global Competition (2006), received a bronze prize from the Independent Publishers' Association for best business book of 2006.

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Jeroen van den Bergh

PROFESSOR OF ENVIRONMENTAL AND RESOURCE ECONOMICS

The concept of growth has become a true myth of modern economy. It seems that without growth nothing is possible. But this myth is being questioned today by accurate scientific analysis. This suggests that in the future growth may no longer be the central element that helps us to assess the progress of the economy.

"We don't need growth per se: It doesn't guarantee progress"

Is an economy based on growth compatible with sustainability?

JVB. Some people claim "sustainable growth" is an oxymoron while others deny it, believing in the possibility of green growth. I think both statements are overly general. My perspective is quite unique, and I refer to it as "agrowth": being indifferent or neutral about growth, not unconditionally in favour of it or against it. I don't want to tie my environmental solutions to growth or to anti-growth. We don't need growth per se as it does not guarantee progress, certainly not in countries where people already have a relatively high income and their basic needs are more than satisfied. We have to be critical of growth as combining it with environmental sustainability is very difficult, but we should not let this turn into simple anti-growth sentiments. A strict goal of permanent zero or negative growth doesn't make sense as such a stance is unnecessarily restrictive. Instead, as a third option, we have to let go of any planning or expectations of growth and be relaxed, even disinterested, as to how growth rates will be affected by necessary policies. Sometimes, and in some regions, we may have growth, while at other times and in other locations perhaps not. This fact in itself should not worry us.

The most serious limit to growth right now is climate change. The reduction we need to achieve in greenhouse gas emissions may put a serious brake on economic (GDP) growth. Whether it will lead to zero growth or negative growth is uncertain, as it depends on so many factors, such as the exact policies and behavioural responses by consumers, producers and investors, and the rate of technological progress. The economy is very complex and at the same time very flexible, but current politics is not making good use of this flexibility to move the economy in the right direction, as it is unable to implement the right policies to steer the economy effectively in a sustainable direction. This is illustrated by the recent Spanish elections in which the word climate was hardly used, despite the fact that Spain is likely to be hit hard by climate change. In general, I am optimistic about the flexibility of the economy to change in the direction of sustainability, but this lack of political capacity to enforce the needed changes makes me sceptical and even pessimistic.

What do you think about the outcome of the Paris Climate Summit? How will it affect the future?

JVB. The positive thing to say about the recent climate agreement that was achieved in Paris is that for the first time all countries have accepted that climate change is a very serious problem. But experts knew 25 years ago. So we are moving very slowly, especially since we have only a few decades to avoid dangerous climate change, while the Paris Agreement is for the moment quite ineffective. The first problem with the agreement is that it is built upon voluntary pledges which most countries will probably be unable to comply with. But even if all countries comply, systemic effects like carbon leakage, energy rebound and the green paradox (oil market responses) would make the strategies ineffective. The reason is that countries will avoid implementing serious policies and instead try to realise the pledges with weak regulation, information ›

provision or technological subsidies. This contributes to rebound and undesirable oil market responses to keep demand for fossil fuels going. Moreover, a lack of policy coordination or harmonisation among countries in the Paris Agreement means there is much room for carbon leakage between countries, that is, a shift of emissions from countries with strong regulations to those with weak ones. Without offsetting this through amendments, the agreement is not going to be effective. So the Paris deal is just the beginning and certainly not the definitive treaty required to effectively tackle climate change.

Can you explain more about why you are neutral on the subject of growth?

JVB. Unconditional growth, or growth-no-matter-what, creates expectations that may not come true and thus will disappoint people, which can trigger behavioural responses that tend to cause crises. If you look at history, you will find that the growth rate is falling for various reasons. The first is that initial investments in education and technological improvements are generally more influential than later ones (diminishing returns, in the jargon of economists). Countries which currently have a relatively high rate of growth generally still have a low income, with their growth pattern starting relatively late. So their investments in infrastructure, education and capital still have high returns, while they can benefit from importing mature technologies from more developed countries, as well as from participating in international trade. But at some moment, these advantages will disappear and also their growth rate will fall, like it has in rich countries.

"Unconditional growth, or *growth-no-matter-what*, creates expectations that may not come true and thus will disappoint people, which can trigger behavioural responses that tend to cause crises"

Another reason why growth is levelling off in many countries is that energy is a very critical input in all production sectors, but it is going to be more expensive if we move large-scale into renewables. This will then restrain the potential for growth. A related point is the fact that an important condition for economic growth is continuous improvements in labour productivity. Up to now we have heavily invested in technologies that have raised this productivity, but if we want to go in the direction of sustainability, we would have to divert investments into technologies that improve the productivity of environmental inputs (materials and energy). This implies shifting investments away from increasing labour productivity to increasing "material and energy productivity", as money can only be spent or invested once. To explore this point further, we could employ this strategy by implementing environmental taxes and using the revenues to reduce labour taxes. Labour would then become cheaper, weakening the incentive for companies to invest in labour productivity improvements. In turn, the basis for economic growth would wane.

What is your opinion on the idea of degrowth?

JVB. I am critical of degrowth or any form of unconditional anti-growth. The first reason is that degrowth is ambiguous, i.e. it has no clear meaning. In one article I identified five different interpretations that I came across in debates and articles about the topic, which doesn't help a serious discussion about solutions to environmental problems. Moreover, some of these represent unclear goals. What does degrowth as "less consumption" really mean? Less consumption in monetary terms, in weight (kg), or according to measures of environmental impact (environmental externalities)? This is never made clear by degrowth proponents. Another interpretation of degrowth is a reduction in working times. But it is not evident that this is good for the environment because it may just mean more people will be employed and income will be more equally distributed, with the likely consequence that people as a whole will spend more money on polluting

products, given that the marginal propensity to consume is higher for lower incomes. Moreover, those who work less will have more leisure time available which could generate more emissions through holidays or air or car travel.

Most importantly, degrowth suggests the opposite of economic or GDP growth, that is, GDP decline. Now I am not afraid of negative growth at all if this is the outcome of good, sensible social or environmental policies. But defining negative GDP growth as a general goal seems to me to be illogical, to put it mildly. Some degrowth proponents say they are not talking about negative GDP growth, but at the same time they claim things that suggest they are in favour of it: for instance, many see the recent economic crisis with stagnation of GDP growth as good for the environment, without even providing a thorough analysis of the long-term environmental consequences (we'll get back to this later on). So in my experience they are not very consistent about whether degrowth boils down to GDP decline.

What is the problem with being in favour of GDP decline?

JVB. It confuses the causality. We implement policies such as carbon prices and renewable energy subsidies to stimulate fundamental changes aimed at making the economy more sustainable. If such changes lead to less or even negative GDP growth, then that is just the outcome, not the aim itself. But degrowth reverses this causality by claiming that GDP decline should be the aim, as it is necessary and good for the environment. This is a far too general statement, however. GDP decline of the wrong type could easily increase pollution, as it depends so heavily on the composition of the GDP changes, that is, the underlying changes in the structure of consumption, production and technologies.

In addition, several degrowth advocates have said that the crisis has been good for the environment as it tempered the increase of CO2 emissions. But this is a very naïve and partial analysis, as it doesn't take into account the total cumulative impacts of the crisis in the long term. Among other impacts, we have to consider that the crisis has given rise to fewer investments in, and public subsidies for, renewable energy. We should also realise that the economic crisis tends to lead consumers and producers to substitute expensive methods for cheap alternatives. The latter are often relatively dirty or polluting, like Chinese products which have been produced with more carbon dioxide emissions than similar products from western countries. So the statement that the crisis was good for the climate is ideological, not scientific.

Can you talk more about this latter conclusion?

JVB. The degrowth movement lacks a scientific approach for various reasons: it does not establish a clear link between environmental goals and associated policies, it lacks a systems perspective and so neglects the net effect and thus effectiveness of many (well-intended) proposals, and it makes many subjective, political statements that are not supported by solid empirical studies.

Many degrowth supporters are motivated by a clear negative sentiment against capitalism, despite the fact that we don't have a genuine capitalist system to start with. What we have in most western countries is a mixed capitalist-socialist system, and it appears in many varieties around the world. Most developed and even developing countries have a lot of laws to assure good labour conditions, health protection and redistribution of income. This does not mean that the inequality in the world, or in particular countries, is defensible, although it might be much worse under a purely capitalist regime. I personally find an anticapitalism strategy a very radical medicine for addressing environmental problems. The medicine could do more damage than the disease, and we cannot even be sure that it would cure the latter, particularly in light of the limited time we have (about 35 years) to remove the climate change threat.

I should also add that a degrowth scenario with non-profit organisations and a larger informal economy, as recommended by many degrowth proposals, will mean that fewer people and organisations contribute to taxes. This in turn will undercut the basis of many public goods such as healthcare, social welfare and public transport. ›

In fact, many radical activists in the degrowth movement seem to strongly favour informal interactions and don't pay taxes but still make use of transport and health systems. They should realise that this wouldn't work if their behaviour were to be upscaled to the entire economy. Then nobody would pay taxes anymore, causing our complex society to disintegrate.

I am open-minded. I am not afraid to discuss communist or non-profit solutions, but let's keep a realistic perspective on what drives humans, why a large number of communist experiments in the world have failed and the system-level consequences of radically different strategies. All three taken together make it difficult to be optimistic about the degrowth strategy. But I am not concerned really as its marketing value is zero. There is no chance that the large majority of people, and by implication politicians, will be seduced by the degrowth plea.

What do you think of pro-growth attitudes?

JVB. Giving priority to growth and being unconditionally in favour of growth is also not a logical strategy. It assumes that growth is necessary or sufficient for welfare and progress, which finds little support for rich countries in the literature on research into happiness. As already explained, pro-growth attitudes create expectations that may not come true and just lead to disappointment. If growth expectations are not realised, economists, journalists and politicians will quickly start using the word "crisis", which only reinforces pessimism, which then leads to less investment and consumption, and eventually to a real crisis. This is an example of a self-fulfilling prophecy, which is due to pro-cyclic negative effects of GDP information.

The solution I have proposed is adopting an agrowth perspective. It will temper any expectations and resulting negativism. If growth is low, people no longer get nervous as they focus solely on other more relevant indicators in the areas of environment, equity and employment. So an agrowth strategy allows us to avoid the polarisation of pro-growth versus anti-growth by being critical of growth, that is rejecting growth-fetishism, but not being against growth in general. Under an agrowth strategy we may sometimes have growth, and at other times negative or (approximately) zero growth. We wouldn't care, as we would be indifferent about growth. Growth is no longer an aim; it is not even considered a means. It is just an irrelevant indicator whose use does more harm than good, hence it deserves to be ignored. If we could ever reach this way of thinking, then making trade-offs between growth and the environment would be possible, and conflict would be tempered.

Can our economic activities stay within environmental limits?

JVB. Many studies show that the environmental impacts of humans and the global economy can stay within reasonable environmental limits. We also have enough knowledge now about which combination of instruments needs to be implemented to effectively alter the structure of the economy to stay within these limits. The only problem is that the current political and democratic systems around the world are incapable of translating this knowledge into actual policies. One might say this is due to a lack of a world government or free riding by countries, or politicians who do not care. But ultimately, the barrier is voters who do not care enough and are insufficiently informed about what is needed in terms of effective policies to solve environmental problems and especially climate change. So in my view, the education of citizens and politicians regarding climate policy, not just climate change, is essential to creating sufficient support for the required policies.

What elements of this knowledge could make a real difference in terms of reducing environmental impacts?

JVB. Very solid insights supported by sound theories and empirics on policy instruments are unfortunately not recognised and thus supported by all social scientists. One example is carbon pricing. It is regarded by many experts as an essential part of the policy solution to solve climate change. But many commentators, especially those coming from sociology and political sciences, dismiss it without showing a deep knowledge of it, and worse, without

"I am critical of degrowth or any form of unconditional anti-growth. A first reason is that degrowth is ambiguous, that is, it has no clear meaning"

offering a convincing effective alternative. We need consilience in this respect, and social scientists should devote more time to communicating and exchanging insights and arguments about effective policies to combat climate change.

At the political level in the European Union there is much support for carbon pricing. As a result, the EU has continued the European Trading System for carbon dioxide emissions. But the negotiations for the Paris Climate Agreement did not consider any form of carbon pricing, whether through taxation or cap-and-trade. So there is a long way to go still before we can expect a definite and effective solution to climate change.

Could you explain how carbon pricing works?

JVB. Carbon pricing means that all fossil fuels will have on top of their market price an additional price component that reflects the carbon intensity of the fuel. This can take the form of a carbon tax or a system of tradable carbon permits. Why is a carbon price so effective? Seven reasons can be given. First, about 80% of all CO2 emissions come from decisions in markets, which suggest that we need to alter such decisions, and price is obviously an important element of any market decision. Second, empirical studies show that higher energy prices unquestionably stimulate energy conservation. Third, carbon pricing stimulates innovations in technologies that make products, services and production processes less carbon-intensive. Fourth, a carbon price means that the prices of all intermediate and final goods and services in the economy, which consumers and firms buy, reflect total indirect carbon dioxide emissions, generated anywhere in the complex production chain. Fifth, carbon prices reduce rebound as any energy and carbon-intensive alternative will be expensive, causing buyers to be discouraged to switch to the wrong (i.e. carbon-intensive) products. Sixth, a carbon price creates a bottom price which means that fossil fuels such as oil, gas and coal cannot become too cheap, even if their markets are characterised by oversupply. Seventh, a carbon price means that companies will automatically include the cost of greenhouse gas emissions in their pricing and accountancy systems, as opposed to, for example, ecolabels. The latter would require a separate system with all kinds of disadvantages such as creating additional costs, and would probably not be effective at altering buyers' behaviour.

What is your opinion about "green economies" and "ecological economics"?

JVB. I don't care much about labels like "green" this or that. You can call the economy sustainable, low-carbon, blue or green or whatever, but what matters to me is whether we understand, and are able to sell and implement the right policy mix, which effectively transforms the current unsustainable economy into a sustainable one. The term green economy is more popular outside than within environmental science I would say, even though some colleagues may use it.

Ecological economics (unrelated to the term "green economy", by the way) has been very influential over the last 25 years, and can be characterised in different ways. Part of its roots is the old criticism of traditional neoclassical economics and growth-orientation. Another interpretation of it is as a multidisciplinary approach to what might be called "social environmental science". Indeed, ecological economics brings together researchers from economics, geography, political science, sociology and even natural sciences, notably ecology via meetings and the publication of a journal. What binds them is the criticism of unconditional pro-growth, ›

with a minority (my guess) explicitly supporting degrowth. In fact, many are critical of both pro- and degrowth, as am I.

The global economy uses large amounts of materials and resources; therefore in this context recycling becomes a must. In what way can it be improved?
JVB. If you compare ecosystems with economies, the major difference is that in ecosystems there is almost 100% recycling, depending on the scale at which you look. In economies we don't have anything close to those recycling rates. At best, in some countries and for some specific materials, such as glass or paper, recycling rates are slightly higher than 50%. As suggested by many academic studies, recycling is an inevitable part of the solution to environmental problems because it creates less pollution as well as reducing the need for new resources. But for recycling to be able to become an important activity it needs to have a clear economic rationale. Take aluminium, for instance. It is already widely recycled because bauxite extraction is a very energy-intensive process and consequently expensive. So here we have a case in which, even without specific policies, a resource can reach a high recycling rate. For other resources the solution is to make sure that virgin materials become more expensive than the recycled materials. Resource pricing, capturing the environmental and social costs of resource extraction and waste dumping, would be effective here as it would simultaneously stimulate recycling and reduce the use of virgin materials.

Take another example: renewable energy through solar PV with silicone. Normally when PV panels on a roof are broken or start to get old, the owners dump the panels along with the general waste. But what will happen in the future when every other roof has solar PV on it? We will need a serious recycling programme for PV panels, which will cost a lot of money as well as energy. This will lower the energy-efficiency of solar PV systems. In addition, such recycling will require particular technical processes if undertaken at a large scale. So there are still challenges to be solved before we can become optimistic about a renewable future.

"Under an agrowth strategy we may sometimes have growth, and at other times negative or (approximately) zero growth. We wouldn't care, as we would be indifferent about growth"

How do you see the role of renewable energy in the transition to a low carbon economy?
JVB. It is clear that, generally speaking, renewable energy is still not cheaper than fossil fuels, except in some locations where, for instance, solar inflow is very high. We need to make sure that the price characteristics of renewables improve, and it is therefore important to consider the net energy of, or energy return on, energy investment (EROI). This indicator captures how much energy can be obtained by investing one unit in an energy source. When oil was first explored over a century ago, its EROI was 100, while its current global average is around 30. Coal has an impressive approximate EROI of 100, which explains why it is so attractive economically. If we go to other sources, hydroelectricity is good but limited to certain locations, while when developed at a very large scale it can create considerable ecological impacts. Wind is mostly in the EROI range of 10 to 15 and solar of 5 to 10, although both can fall outside these ranges depending on the location. This shows that they still cannot compete very well with fossil fuels, which means that we need more fundamental research into solar and wind energy to increase their EROI values. This is in fact an argument for spending a relatively large amount on subsidies for innovation in comparison with on diffusion.

Environmental and climate externalities are also not taken into account in the prices of fossil fuels, which contributes to unfair competition with renewables. This immediately shows the importance of carbon pricing. In other words, we need a policy package with carbon pricing on the one hand, and subsidies for innovation research on the other.

You suggested that if the climate solution mainly consists of subsidies for renewables without any serious carbon pricing, then this will produce a green paradox. How does this work?

JVB. The possibility of a green paradox was first suggested almost ten years ago by the influential German economist Hans-Werner Sinn. Once subsidies for renewable energy allow prices to be competitive with fossil fuels, the owners of the reserves of coal, gas and oil will perceive that the end of the fossil fuel era is near, and fear that their reserves may soon become worthless. Before that happens, they will want to sell as much as possible and reap any potential benefits. But this goal will stimulate an increase in fossil fuel supplies, leading to lower prices which will stimulate demand for fossil fuels. As a result, emissions will go up, counter to the intention behind the renewable energy subsidies. This is known as the green paradox.

This scenario may be avoided by carbon pricing ensuring that fossil fuel prices do not fall too low. Another option would be to agree on a specific minimum global price for all fossil fuels. For instance there could be an international agreement to ensure that the price of oil would not fall below 100 dollars per barrel. If that happened, then the gap would immediately be compensated for by a carbon tax. Such a fixed bottom (or floor) price would create excellent conditions for renewable energy. Instead, we now (January 2016) have an oil price below 30 dollars per barrel, creating a serious barrier against reaching ambitious climate goals.

There is much speculation going on about the fact that Saudi Arabia is developing a strategy to compete with the fracking industry by lowering the price of oil. Saudi Arabia is the only producer that can still make a profit with the low prices as it has the lowest extraction costs worldwide. It is also powerful because it is the largest supplier. But an alternative explanation for low oil prices has been suggested, namely that the current low oil price is partly a reflection of a green paradox. The idea is that the huge emphasis placed on climate change over the last year, along with the negotiations leading to a climate agreement at COP21 in Paris, made oil producers more aware that the end of the oil era is near. The Saudi strategy might thus be motivated by the aim to safeguard their oil revenues for as long as possible. By quashing other producers, they can reduce supply structurally, and thus prolong the time during which they can create oil revenues for themselves. Of course, this is impossible to prove and merely a hypothesis.

Some politicians and societies are bolder than others. Denmark, for instance, has set very ambitious goals in reducing fossil fuel dependence.

JVB. This is laudable but should be taken with a grain of salt. Denmark still uses a lot of fossil fuels. But they have indeed been ambitious and invested in many renewable energy projects, particularly in the wind industry. But while Denmark and other countries like Norway may seem to perform well when you look at their CO2 emissions per output, these Nordic countries import many products from Asia which have been produced in a carbon-intensive way. So, from the perspective of consumption they are far from carbon free. This should make us a bit sceptical of Denmark serving as a perfect example for the rest of the world. But surely there is much to learn from their success in the area of wind energy, in terms of capturing a significant market share globally as well as installing many wind turbines within Denmark.

Technology is often mentioned as a key factor in the move towards sustainability. What is your view?

JVB. I am not particularly negative or positive about technology. Technology undoubtedly plays a role in finding a solution to the problem of climate change but we should not overestimate this role. Sound economic studies show that more than half of emission reductions to be made by 2050 must come from behavioural change, not new technologies. Many commentators on climate solutions seem ›

to overlook this. Innovation is important but the fact is that radical new technology doesn't appear overnight. Take solar energy which has been used for decades and still makes up only a few percent of total electricity production. This is disappointing. Moreover, solar is unlikely to grow very big in the next 10 or 20 years. Evidently, we should invest seriously in solar PV innovation because it really has a future, that is, if its efficiency or earlier mentioned net energy (EROI) can be considerably improved.

Energy transition and climate change are complex issues that are interconnected and need global cooperation. In recent years we have gone from a bipolar world to a multipolar world.

JVB. With the hegemony of the US we haven't solved these problems. In fact, the strongest resistance against taking action on climate change has come from the US Republican Party. It has many deniers of climate change within its ranks, something that you don't find so much in Europe. The Paris summit did not achieve a binding agreement because it could not count on support from the US (read: Republicans).

Another point is that while emissions per capita are still by far the highest in rich countries, emissions per unit of output are much higher in other countries. If you look at the most carbon-intensive production in the world you will find it in Ukraine, China and Russia. We have to be aware that they produce in a dirty way and then we, the rich, consume many of their products. So the opposition is not between rich and poor countries, it is more complex as countries are intricately interconnected. This means that for genuine solutions all countries must act in a coordinated way, otherwise we will undoubtedly experience a lot of carbon leakage from one country to another, which is not a real solution to climate change. Pledges such as those in the Paris agreement are not enough; we need coordinated policies for effective solutions. We will further require a systems perspective on climate policies and strategies because this is what a real sustainability assessment requires. Otherwise, we will come up with solutions that are not effective due to their indirect, systemic effects being overlooked. I guess this is my main concern. x

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Josep Maria Galí

RESEARCHER ON CONSUMER BEHAVIOUR

Current economic dynamics are based on the premiss of the existence of a perpetually unsatisfied buyer. However the emergence of a new type of consumer with critical awareness is changing the usual scenario and could lead to more moderate individual consumption patterns.

"Consumption is expected to solve all economic problems and happiness-related issues"

The role played by consumption in the economy seems unclear. We are encouraged to consume to "keep the machine running", and yet we must remember that irrational decisions on consumption (subprimes) were one of the factors to have triggered the economic crisis of 2008.

JMG. In industrial societies, consumption is probably one of the most important elements of economic dynamics. Consumption is expected to solve everything: growth, lack of jobs and even people's happiness. I have spent years studying this phenomenon: first, from an individual focus (in terms of the psychological processes that people go through as consumers), before moving towards an investigation of the social dimension. And it is at this level where the first problem to arise is sustainability.

I was lucky enough to come into contact with the Creafutur Foundation, becoming involved in a project they were promoting to examine the impact of the crisis on consumer habits. I suggested that they focus on consumption trends in society, and this approach allowed me to study these trends in Europe, Latin America, China, Japan and other countries. Along with one German and one English researcher, I also studied business strategies in relation to patterns of changing consumption in the market. The result of the work with the foundation led to a Report (http://www.creafutur.com/es/estudios/outlook2012), while the collaboration with the two researchers produced a book entitled *Marketing de Sostenibilidad*, in which traditional marketing is reconsidered from the point of view of sustainability. This work has had zero impact on the Spanish academic world because in Spain universities do not deal with this subject, whereas in other countries this new approach to marketing is normally integrated into studies.

What do you think of the idea of consumer sovereignty?

JMG. People often talk about this idea as though it were fact, but it's actually a fallacy. There are hundreds of strategies to manipulate people so they take out loans, use credit cards and consume much more than they need. The ambivalence associated with consumption (being a growth engine but also something that can foster a crisis via the wrong decisions) is based on this fallacy. We must identify that people in this field are not masters of their own decisions because there are very strong powers that lead them to make certain choices. For instance, in the case of the subprime crisis in the US, banks allied with companies to develop strategies for creating demand and encouraging debt and many people were trapped! One of the guidelines of sustainability marketing, which contradicts classic marketing, is that the customer is not king, but instead a person who is in a social context and subject to all the powers that force behaviour in a certain way. The fallacy of sovereignty allows these powers to do ›

many things: for example they make the consumer believe that they are a small finance expert so they can buy any financial product. Thus, many practices that are purely manipulative are legitimised.

What margin of influence does the so-called *critical consumer* have?

JMG. Citizens with social and ecological awareness who influence consumption patterns are a minority in all countries. Some of these countries have a tradition of criticism for different reasons (Scandinavia, the Netherlands, Brazil and Peru) and therefore they have more discerning consumers. However, sometimes it is difficult to move from thought to action, because there are several factors that stand between both, such as price. Yesterday I was talking to my daughter about the possibility of buying trousers that were made by people who receive fair wages and that were manufactured with low environmental impact. These trousers cost 100 euros, while virtually the same ones, without meeting these criteria, cost only 30 euros in a chain clothing store.

Do the authorities play any role in raising awareness on consumption?

JMG. Public authorities lag behind on this issue. The law is always late to catch up and is conditioned by groups with power.

What about companies?

JMG. Some companies are doing the right thing on this matter and are well ahead of citizens and public authorities. I remember once a professor at Business School ESADE told me that companies tend to be specialists on the future. They know, for example, that there will be a water crisis, or a population surplus, or a large mass of people who cannot consume. Some make decisions based on this data to protect their own interests and their own market, while others make money from it. Others don't, however. There are also areas with more possibilities than others. For example, in the clothing sector the dominant model is unsustainable but so far this sector has not managed to build a sustainable alternative.

"In the area of consumption, individuals do not take their own decisions because there are very strong powers that lead them to take certain options"

In building materials we see the opposite happening: companies are working with sustainability criteria and are doing well. Although companies are organisations, individual leadership is crucial.

You mentioned sustainability marketing earlier. Can you explain this term?

JMG. Yes, it means including social and environmental factors in a marketing strategy, and also throughout the value chain. It is a comprehensive business vision. It is about making a suggestion to the consumer that goes beyond what they would ask for, incorporating new values. An example would be selling cosmetics to women by saying that the product is not just good for the skin but also that it has been made by a women's cooperative in the Amazon, with natural products and using local knowledge. Traditional marketing only makes strict buying suggestions. Sustainability marketing takes into account the context in which the product has been made. In short, both people in a faraway place and the natural environment will benefit from the purchase. Sustainability Marketing is a bit risky because many things can happen, including that the purchase suggestion is not well understood by the consumer. The consumer may understand it but may not be willing to pay more. One option would be to incorporate the possible extra costs into the value chain so it has no effect on the final price. The consumer does not want a solution that involves more work or doing something extra. For example, if a carsharing scheme involves commuting to the nearest car park, which is 4 kilometres away, I will end up just taking my own car.

What are the differences between consumption and consumerism? What implications do these differences have on consumer attitudes?

JMG. Consumerism is not the same in all languages. When we say *consummerisme* in French it is not the same concept as consumerism in English. There is a slight nuance which is difficult to explain. In any case, what is clear is that awareness is growing in different societies of the negative effects of excessive consumption. This excess is what we call consumerism, although I do not use this term much. I do not use *responsible consumption* either. It is too imprecise, and leads me to ask "responsible for what?" Mobile phones use coltan and this material is a source of major conflicts in Africa, but does that mean I have to give up my phone? I don't think that the responsibility lies with the consumer because they are the ones with less power. That would be completely hypocritical. Citizens must demand that politicians adopt legislation so that externalities are included in accounting. In fact, the idea of a responsible consumer is something like the sovereign consumer, however in both cases the individual is attributed a power they don't possess.

What is a post-consumption economy?

JMG. This term refers to the idea of overcoming consumer society. Consumption remains a central element of economic activity but, in highly egalitarian and very rich countries, it is no longer a central element in people's lives. In these countries a rethinking of a deep philosophical kind has occurred that means that community values and solidarity have overcome unrestricted individualism. The consumer-king is the figure that represents this sort of individualism. The community values trend is not a neo-Marxism or socialist movement as it was known historically. It is a new collective awareness.

The economy continues to dominate public discourse, however.

JMG. French philosopher André Comte Sponville says that there are three levels in society. The first level is the economic and material life, the second level is the social and political organisation, and the third level comprises ethics and values. These levels have their own life but there is a defined hierarchy: if the economy is not controlled by the political level, things will not work well, and above politics must come ethics. Each level must control the level immediately below, but what cannot happen is that the top level controls the basic level or vice versa because then things will go wrong. For instance, if the economy were conditioned by ethics we would have to tell people how they should make decisions, but how would we do that? Interests are very different. Let's look at it the other way around, and consider if values were governed by economic forces that led to barbarism. As you can see, the logic of this hierarchy must prevail.

What is the relationship between consumption and happiness?

JMG. The relationship between levels of consumption and happiness has been studied from two perspectives: academic marketing and classical economics. What we know is that beyond a certain threshold of income, people don't usually say that they are more satisfied. This is called the Easterlin paradox. Clearly, there should be a minimum level of consumption and comfort which is essential to feeling good and probably 60% of humanity has not reached this level yet. There are also authors who have studied what happens when people's lives are oriented towards a high level of consumption. In such cases, they usually find these people have family or personal problems. ›

"Post-Consumerism refers to overcoming consumer society. Consumption remains a central element of economic activity, but it is no longer a central element for people"

Could you express reasonable limits of consumption in objective terms?

JMG. The question of what we really need – beyond the basics – cannot be answered scientifically but rather from a philosophical point of view. When I ask my students about what level they consider appropriate for their happiness, the answers are completely different because personal values condition everyone's answer. This is why trying to solve problems with the economy with ethics or philosophy is wrong. The most important issue right now is that we have a global sustainability problem but there is no global political action. Aviation is responsible for 3% of greenhouse gas emissions, for example, and yet has not been subjected to measures limiting these emissions. If we use these figures as the basis for controlling the economy and tell people that it is better not to travel, then air travel will only be accessible to the rich. Politics must intervene here and apply a small tax on emissions to each ticket.

In very egalitarian societies with certain levels of income and welfare, people do not need to express their life projects through consumption. When a North African immigrant working in Europe returns home, the first thing they show to their family and friends will probably be a new car. It is a legitimate way of saying "I have succeeded". When a young northern European returns home after a positive experience abroad, something immaterial will come up in the conversation to mark their success.

Although the history of humanity is shared, every civilisation lives their own evolutionary time.

JMG. Yes, and this means that more developed countries will enter a phase of moderate consumption in the near future, but Asia and other parts of the world will increase consumption, following the western patterns of the past. This will happen in the twenty-first century, and I don't know if the world will be able to cope with the pressure on resources. I don't think we can prevent this because mankind has never been able to work together on a problem of this type. The solution can only come from a sustainability crisis that will force the whole world to readjust. It's something that will probably happen 20 or 30 years from now. x

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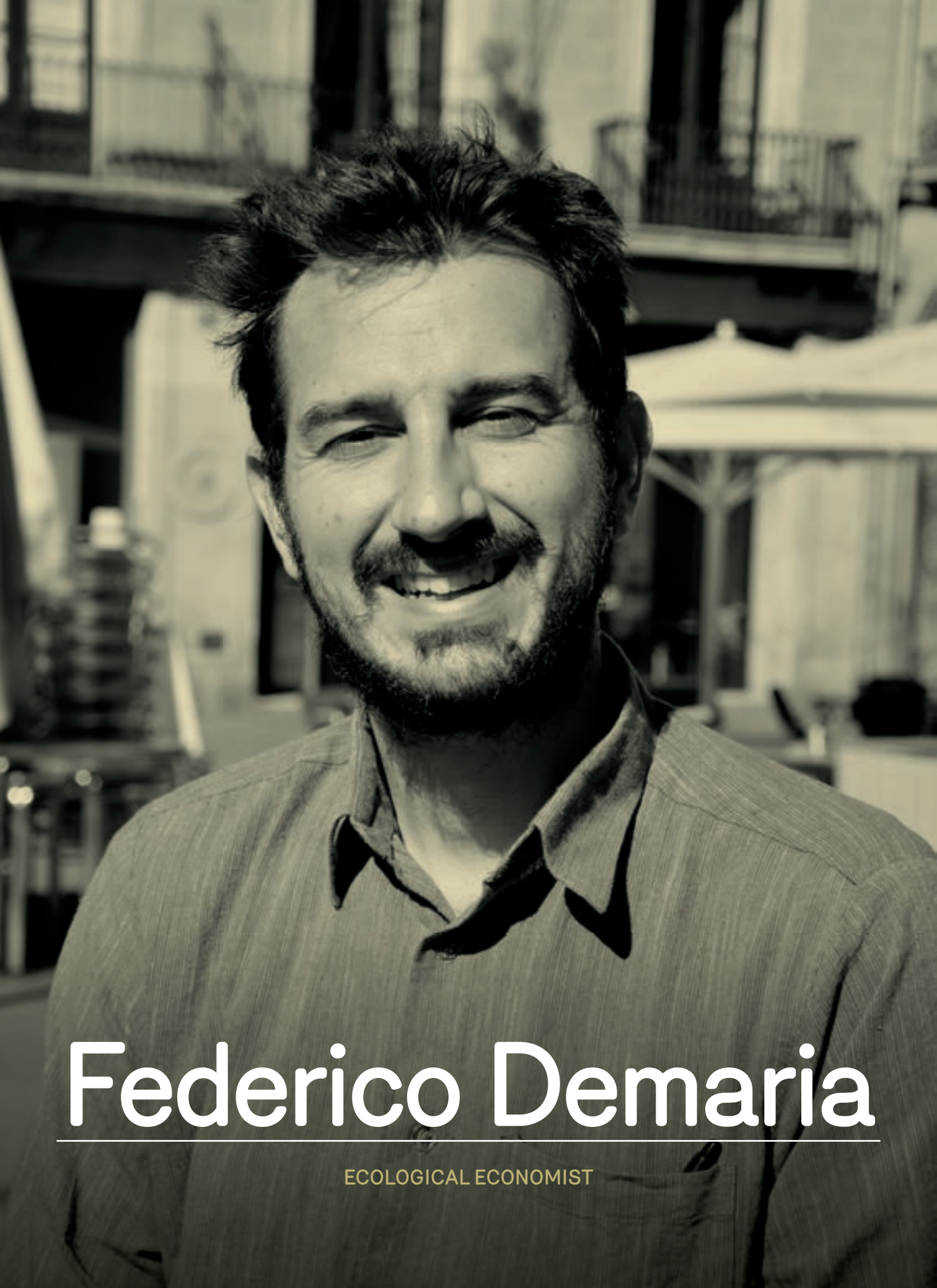

Federico Demaria

ECOLOGICAL ECONOMIST

Degrowth is a school of thought and a social movement that challenges the hegemony of growth and calls for a democratically led redistributive downscaling of production and consumption in industrialised countries as a means to achieve environmental sustainability, social justice and well-being.

"Degrowth is the hypothesis that we can live well with less"

What are the origins of the concept of degrowth? What is the basic thesis behind it and what are its intellectual sources?

FD. The term "décroissance" was first used by French intellectual André Gorz in 1972, when he raised a question that remains key to the current debate on degrowth today, and that is whether the survival of the capitalist system is compatible with the balance the planet requires, in which no growth – or even degrowth – in material production is a necessary condition. Degrowth primarily serves as a critique of an economy based on growth. It claims to *decolonise* public debate which is nowadays monopolised by the language of economics and defends the abolition of economic growth as a social objective. Degrowth also represents a favourable scenario in which companies would consume fewer resources and would be organised differently than today.

There are some main points to this framework. The first is the criticism of growth. Then there is the criticism of capitalism, which is a system that requires perpetual growth. Other important points are its criticism of GDP and commodification, which is the process of converting social products and services and socio-ecological relations into goods with a monetary value. Degrowth is, however, more than a critique. It is a constructive idea with its own imaginary, including the reproductive economy of care and the recovery of old and new commons such as eco-communities and cooperatives and concepts including basic incomes and income ceilings.

Is the meaning of degrowth unequivocal? Or is it subject to multiple readings and interpretations?

FD. Degrowth should not be taken literally. It allows us to defend the hypothesis that it is possible to live better with a simpler life by sharing. This may be achieved by a different type of society and economy that focuses on the redistribution of resources, the sustainability of life and the environment and a true democracy. Our proposal is not to reduce GDP – nothing would be worse than to paralyse growth in a society which depends on it – but to generate new questions and seek alternatives to our society which is based on a capitalist economic system.

Degrowth is usually associated with the idea that small can be beautiful. Ecological economists define degrowth as an equitable reduction of production and consumption, which decreases the flow of energy and raw materials. In the book *Degrowth: A Vocabulary for a New Era* (Routledge, 2015), however, the emphasis is not only on less, but on different. Degrowth implies a society with a lower metabolism, but more importantly, a society that has a metabolism with a different structure serving new functions. Degrowth does not aspire for less of the same thing. Its aim is not to make the elephant slim, but to turn it into a snail. In a degrowth society everything would be different: activities, energy uses, relationships, gender roles, time distribution of paid and unpaid work and our relations with the nonhuman world.

Could you describe the evolution of the concept of degrowth in recent years?

FD. As an activist movement, degrowth began in Lyon in the early 2000s as a result of protests for car-free cities, communal meals in the streets, food cooperatives and as a reaction against advertising. From there, *décroissance* began to spread outward from France and became a slogan for Italian activists who were pro-ecology and anti-globalisation. Since ›

2004, degrowth has gained an even wider audience in France through conferences and direct initiatives such as the magazine *Décroissance, le journal of joie de vivre*. The same year, researcher and activist François Schneider undertook a journey on the back of a donkey across France to spread ideas based on the concept, earning widespread media coverage. In 2007, Schneider founded the academic collective Recherche & Décroissance (Research & Degrowth) in France, with Fabrice Flipo and Denis Bayon, and sponsored a series of international conferences. The first one took place in Paris in 2008 and the second in Barcelona in 2010.

The English term degrowth was used "officially" for the first time at the Paris conference, marking the birth of an international research community on the subject. Since 2008, the English term has entered academic publications with more than one hundred published articles and at least eight special editions of magazines. Degrowth is taught at universities around the world, including in prestigious institutions such as SciencePo in Paris. Barcelona's Institut de Ciència i Tecnologia Ambientals (ICTA) joined the movement when Barcelona hosted the second conference. As the degrowth community expanded, ICTA contributed through its relationships with the academic community specialising in the green economy, as well as Latin American networks on political ecology and environmental justice. Following the success of the conferences in Paris and Barcelona, more conferences have been held in Montreal (2011), Venice (2012), Leipzig (2014) and Budapest (2016). New degrowth groups have also been created – and now are developing activities – in Flanders, Switzerland, Finland, Poland, Greece, Germany, Portugal, Norway, Denmark, Czech Republic, Mexico, Brazil, Puerto Rico, Canada, Bulgaria and Romania, for example.

"Degrowth, as an activists-movement, began in Lyon in the early 2000s as a result of protests for car free cities, communal meals in the streets, food cooperatives and against advertising"

How is the concept of sustainability viewed from the perspective of degrowth?

FD. In the first phase of the debate on degrowth in the 1970s, the emphasis was on the limits of resources. In the second phase which began in 2001, the driving force was criticism of the hegemonic idea of "sustainable development". For economic anthropologist Serge Latouche, sustainable development is an oxymoron. He has claimed that, *"A bas le développemente durable! Vive décroissance conviviale!"*.

Sustainability raises some questions: what exactly are we going to sustain? How? For whom? Many of these questions remain open. Even Pope Francis in the Encyclical *Laudato Si* – just like other religious leaders such as the Dalai Lama – has been unequivocal on the need to redefine progress. Equally unequivocal is the recent "Islamic Declaration on Global Climate Change" which states, "We recognise the corruption that humans have caused on the Earth due to our relentless pursuit of economic growth and consumption."

In the field of degrowth, the expression to "decolonise the imaginary" is widely used. What is the real meaning of this?

FD. As Serge Latouche explains in his chapter of our book *Degrowth: A Vocabulary for a New Era* (Routledge, 2015), the idea and the project behind decolonising the imaginary has two main sources: the philosophy of Cornelius Castoriadis and the anthropological criticism of imperialism. Together with ecological criticism, these two sources are the intellectual foundations for degrowth. In Castoriadis, the focus is on the imaginary, whereas among anthropologists, the focus is on decolonisation. If we analyse these two sources we can illustrate the exact meaning of the term. For all we know, Castoriadis never used the sentence "decolonise the imaginary" in this way. Author of *The Imaginary Institution of Society*, Castoriadis believes that social reality entails an implementation of "imaginary meanings", i.e. representations that mobilise feelings. If growth and development are beliefs, and therefore imaginary meanings such as progress and other founding categories of the economy, when we abolish them and transcend them this will involve *decolonising* our imagination This detoxification, however, is not entirely possible if a degrowth society has not been previously

established. First, we must break with consumer society and its system of "civic stupidity" that holds us in a circle. Condemning advertising, a vehicle of the current ideology, is the starting point for what Castoriadis referred to as the "consumerist and television onanism." The fact that the newspaper La Décroissance comes from the association "casseurs de pub" (ad-busters) is not a coincidence.

What are the limits of the green economy and of sustainable development?

FD. If you consider the international environmental policy for the past four decades, the limits to growth set out back in the 1970s have been erased. More recently, the final document for the Rio 2012 + 20 Summit entitled "The Future We Want" failed to identify the historical and structural roots of poverty, hunger, inequality and unsustainability. Nothing was said about the harmful effects resulting from the centralisation of state power, or from capitalist monopolies, colonialism, racism and the patriarchy. Moreover, the report failed to acknowledge that infinite economic growth is impossible in a finite world. It conceptualises natural capital as a "fundamental economic asset", opening up even more possibilities for the commodification of nature, via so-called green capitalism. The report does not reject rampant consumerism either. On the contrary, it places a great emphasis on market mechanisms, on technology and better management as a basis for the political, economic and social changes that the world demands. But this will not produce the expected results.

In contrast, there is a variety of movements for environmental and social justice based on old and new visions of the world, which suggest effective solutions that must be structural. Unlike sustainable development, which harbours the false belief that it can be universally applied, these alternative approaches cannot be reduced to a single model, because this set of notions on life is heterogeneous and plural.

We envision a pluriverse, as the Zapatatistas say "A World Where Many Worlds Fit". I'm now working on a new book, titled "Post-development dictionary" that will collect hundred of such alternatives to development.

What would the alternative to sustainable development be?

FD. Criticism is not enough. We need our own narratives. We must urgently do away with the concept of development and open the door to a multitude of ideas and worldviews, whether new or old. There are different proposals within this endeavour, with different names that come from indigenous peoples from various regions of South America, such as Good Living (Sumak kawsay or qamaña sum), a culture of human beings living in harmony with themselves, but also by means of communities with each other, and human beings and their communities with nature. There are the Ubuntu in South Africa, with their emphasis on human reciprocity: "I am because we are, and since we are, therefore I am ". Another example is the radical ecological democracy – or ecological Swaraj – in India, which focuses on autonomy and self-government and also on the possibility to live well with less and with equity throughout the world, without privileges for a few human groups.

These worldviews differ greatly from the current notion of the traditional concept of progress and development. These lifestyles I mentioned can have different elements, but they all express fundamental shared values such as solidarity, harmony, reciprocity, relationality, diversity, inclusiveness and unity with nature. We could mention the recovery of indigenous territories and ancestral forms of life in America; the Zapatista and Kurdish movements for self-government; the multiple and diverse forms of solidarity and popular economies, such as cooperatives of producers and consumers; transition towns and their approaches to building urban quality of life; community currencies as a way to move away from centralism; community management of land, water and forests; direct democracy movements in Latin America and South Asia; ecological agriculture; and decentralised renewable energy systems that have been implemented, among others.

What are the fundamental practices and institutions for beginning a transition towards degrowth?

FD. A transition towards degrowth does not amount to a permanent downward path, but a transition to convivial societies living in common with less. There are various ideas about practices and institutions that could facilitate such a transition, and the processes that can articulate them ›

and allow them to evolve. I am going to talk about three: basic economic practices; institutions of social benefits without growth; and monetary and credit institutions.

Basic economic practices include online communities (see digital commons), neo-rural communities, cooperatives, urban gardens, social currencies, time banks, barter markets and partnerships for child or health care. Due to the crisis and since mainstream institutions fail to meet people's basic needs, there has been a spontaneous proliferation of new practices and non-capitalist institutions in places such as Argentina, Greece and Catalonia.

Without growth, unemployment increases. In a transition to degrowth, new institutions handling social benefits will be required to decouple growth from wage labour, or to decouple welfare from wage labour: job security, basic income, reduced working hours and job sharing.

Money issued as debt creates a growth dynamic. Debts are returned with interest, and interest stimulates growth. An approach for a transition to degrowth requires the state to regain control of the money supply which is now controlled by private banks. Private banks create new money by issuing loans. While private banks can only issue money as debt through loans, the state could issue debt-free money to meet public needs. For example, the state could issue money to finance basic incomes or job security, or to subsidise cooperatives, care services, environmental conservation and renewable energy. Public money would improve public finances, since the state could claim the *seigniorage* (the difference between the nominal value of money and the cost of producing it) and because they no longer would have to borrow from private banks to finance public spending. Economies cannot continue to grow at the pace required to pay an accumulated debt from the past to maintain fictitious growth.

What are the possible effects of the practices and institutions you just mentioned on social and political organisation?

FD. There is no unanimous agreement in degrowth literature on policies and strategies by which certain alternative institutions, imbued with degrowth values, could eventually replace capitalism's existing institutions. There is a consensus in seeing a transition to degrowth as the result of multiple

"A transition to Degrowth does not amount to a permanent descent path; it is a transition to convivial societies living in common with less"

strategies and multiple actors; a movement of movements to change both daily practices and state institutions. Some authors such as D'Alisa classify strategies and actors into two groups: *civil* and uncivil. By uncivil are those who resist being "governmentalised". Organised disobedience belongs to the repertoire of such activists. This form of disobedience spans the occupation of abandoned buildings to protests against megaprojects such as power plants and also involves financial disobedience to banks.

Latouche, however, believes that transformation will come primarily from parliamentary politics and the actions of grassroots groups. He suggests that degrowth should be added to the agendas of leftwing parties, but he opposes the creation of a "degrowth party". Other authors place more hope in social movements such as the Spanish *indignados* in order to transform the parliamentary system into a more direct form of democracy, as represented by the assemblies in the squares. Others emphasise the transformative potential of non-capitalist economic grassroot practices: experiences in education, care, provision of food, life and production are considered policies, even if they don't take place in the traditional areas associated with politics.

One hypothesis is that systemic change towards degrowth will follow a similar path to previous systemic changes. Grassroot practices and monetary and benefit institutions may be the seeds of a new transformation that comes from within the system, in the latest crisis of capitalism, and also because the stage of growth and expansion is nearing its end.

Is it possible to have an economy in which the growth of the physical/material flow stops or decreases while value and wealth continue to be created from qualitative elements?

FD. It all depends on how we define the terms, starting with 'wealth and value'. If you understand

wealth and value as GDP, the answer is that this has not been possible so far. The idea that GDP may increase while energy and material flows decline (the decoupling hypothesis) has not been verified. Ecological economists have not been able to demonstrate that absolute dematerialisation will be impossible in the future, but all data and studies conducted so far confirm that the answer is negative. Surely we can continue to create wealth and value, but it may not increase to infinity, it will have to be related to real wealth, which essentially depends on the availability of land and the Sun.

How does a degrowth perspective consider a concept like cradle to cradle, where – without questioning the economic scheme – a radical reduction in environmental impacts is considered through innovation and technology?

FD. Growth is ecologically unsustainable. With continued global growth we will end up surpassing most of the limits of the planetary ecosystem. There is a strong and direct correlation between GDP and carbon emissions that alter the climate. In theory, the economy could be decarbonised thanks to the advancement of cleaner and more efficient technologies or through structural economic change in favour of services. However, with an annual global growth of 2 to 3%, the level of decarbonisation needed is almost impossible to achieve.

Global carbon intensity by 2050 should be between 20 and 130 times lower than the current one, when the improvement between 1980 and 2007 was only 23%. There isn't a single country that can boast of an absolute reduction in material consumption or carbon emissions while growing. When reduction is achieved this is because a country outsources polluting industrial activities to other countries in the developing world. Absolute reductions in energy and material use (dematerialisation) can hardly be achieved through technological progress: the more technologically advanced and efficient an economy becomes the more resources it consumes because they are cheaper (Jevons Paradox). Service economies also need materials. Services need a high level of energy (embedded energy). Finally, energy cannot be recycled and materials can only be recycled up to a point: further growth requires the extraction of new energy and materials. x

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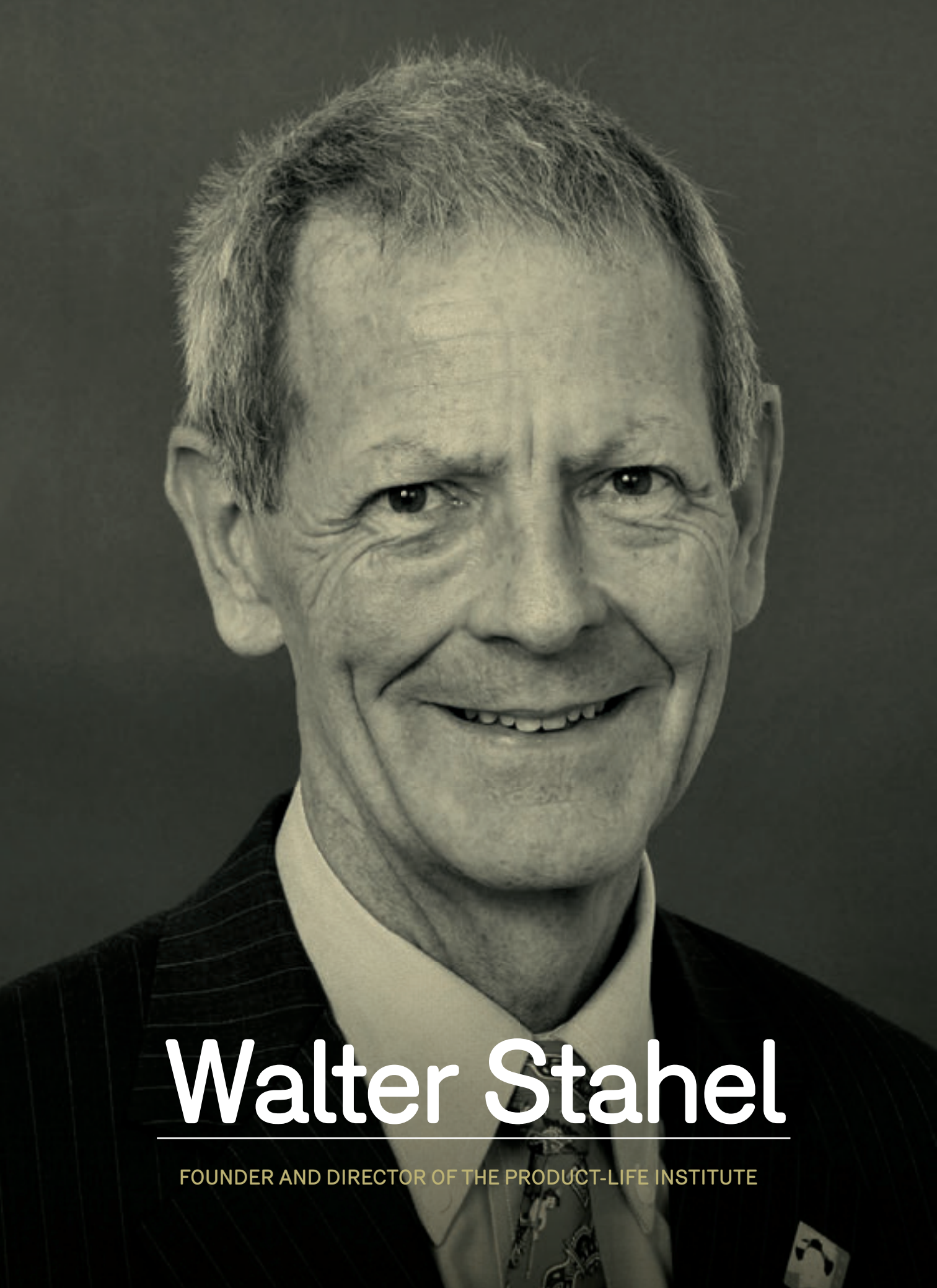
www.degrowth.org/federico-demaria



Walter Stahel

FOUNDER AND DIRECTOR OF THE PRODUCT-LIFE INSTITUTE

A circular economy is one which aims to keep products and materials at their highest utility and value at all times. It aims also to not producing waste or pollution. Material flows are of two types: biological nutrients which are designed to reenter the biosphere and technological nutrients which are designed to reenter the production system.

"Circular economy is part of a wider trend of intelligent decentralisation"

What is a circular economy and what are the main principles behind it?

WS. The main objective of a Circular Economy (CE) is to preserve existing values by managing the quality and quantity of existing stocks (capitals), such as natural, cultural, human, acquired and manufactured capital. Its business model is to "close the loops" by re-using goods and materials at the end of their service-life at their highest value.

In the centre of the CE is the use phase – traditionally called consumption – and strategies to optimise the use of goods and materials over longer periods of times. In comparison, the production phase and its optimisation up to the Point of Sale lie in the centre of the linear industrial economy.

To accomplish the CE objectives of value preservation and stock management of manufactured stock, 'consumers' have to become 'users' and substitute a new relationship of caring and stewardship with goods instead of the "make-take-dispose" attitude, shifting from treating goods like "chewing gum" to treating them as "teddy bears".

The same objective of value preservation and stock management can be applied to other resource stocks, such as food, water or energy. In my paper, I shall focus on manufactured capital, such as infrastructure, buildings, equipment and goods because this field offers the greatest opportunities for innovation.

The CE is complementary to the linear industrial economy of (mass) production based on value added and throughput management, which produces innovative solutions where there are technological quantum leaps (electric cars, music streaming and the Internet of Things). The linear industrial economy focused on production is an efficient strategy for overcoming scarcities of materials, food and shelter, but inefficient at coping with markets near saturation.

How does it relate to sustainable development in its environmental dimension?

WS. "The Potential for Substituting Manpower for Energy" was the title of my 1976 report to the European Commission, which first defined the concept and the structure of the Circular Economy. The CE has thus been a holistic concept from the start, linking the energy and the about dimension. The impact on the material dimension is best summarised in the axiom that doubling the service-life of manufactured goods halves resource inputs and end-of-life waste volumes (in MIPS terms, halving the material input necessary to produce one unit of service); the CE is therefore a prime strategy for decoupling resource consumption from economic wealth and dematerialising the economy.

The following graph originates from the 1976 report mentioned and clearly distinguishes two sectors of the CE of manufactured capital, separated by what I call the great profit divide:

- Product-life extension of goods and components through reuse, remarket, repair, remanufacture and technological upgrade strategies,
- recovering molecules for reuse by recycling materials. ›

With regard to the environment, the two sectors differ tremendously: product-life extension of goods preserves the large majority of the resources embodied in the goods, namely energy and GHG emissions, materials and their backpacks and water. In recycling waste (recovering molecules), most of these embodied resources are lost.

With regard to finance and competitiveness, the differences are also considerable:
At Junction 1, 'circular goods' enter into competition with newly-manufactured goods enjoying a considerable cost advantage. Remanufactured goods, have the same 'as-good-as-new' quality.

At Junction 2, 'circular materials' enter into competition with virgin materials, the latter often having both a quality (purity) and a cost advantage, because the prices of circular materials are determined by fixed costs of collection, separation and recycling, with little volatility. The price of virgin base materials, on the other hand, depends on highly volatile commodity prices, which, in times of abundant resource supplies – as is the case today – cannot be met by circular materials. See the economic difficulties associated with recycling plastic in Europe today.

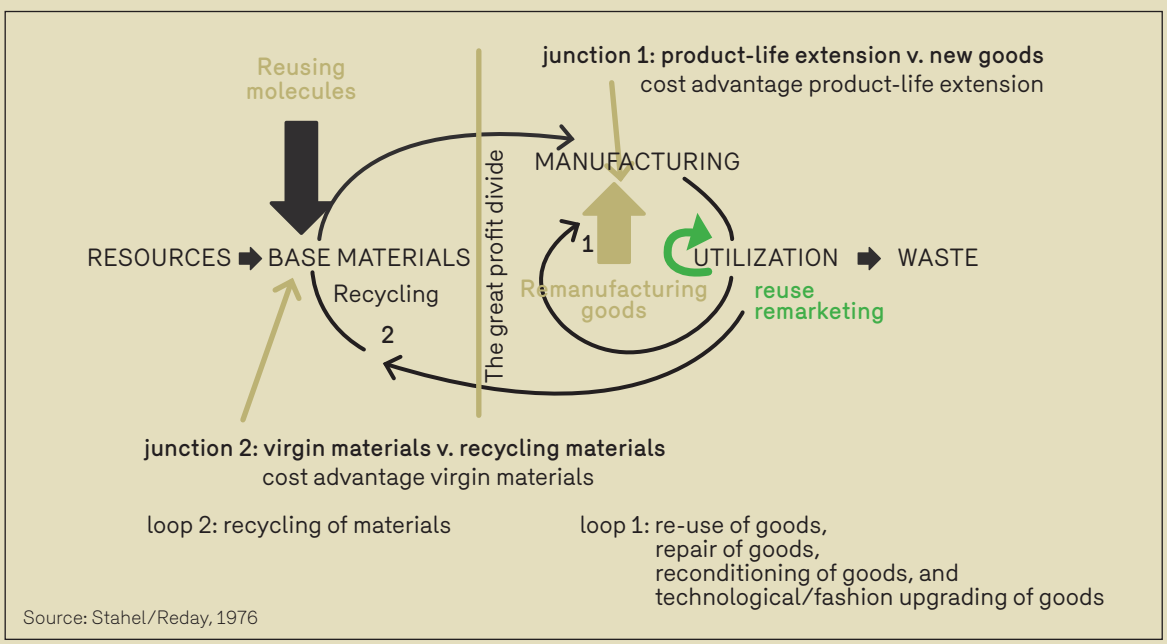
"Nation states promoting a sustainable development need to develop taxation systems which are simple to understand and foster a symbiosis between economic, ecologic and social wealth"

Why do we need this paradigm for our future? Is it mainly because of the risks to resources security in the twenty-first century? Are there other compelling reasons?

WS. The circular economy is not a paradigm for the future: it is a reality in developing countries (driven by poverty), in industrialised countries (driven by fleet managers, Business-to-Business (B2B) markets and a shift from selling goods to selling use, function) and in the market niches of cultural heritage (Cathedrals, museums and Amish. etc).

Saturated markets – where the number of new goods sold is similar to the number of used goods scrapped – are a sign that the stock of goods available is sufficient to cover the needs. The new

The two main business models of the circular economy



Source: Stahel/Reday, 1976

challenge then is to maintain and upgrade the quality and quantity of the stocks by developing and perfecting the tools and business models of the CE.

Resource security on the corporate and national levels becomes an issue that can best be achieved by economic actors switching from selling goods to selling performance, use and function (rent, lease, share), which implies retaining the ownership of goods and their embodied (energy, material, water) resources. This business model is at the core of the Performance Economy (PE), which integrates the opportunities of sufficiency and integrated system solutions with those of the CE.

The PE is the CE's most profitable business model. A retained ownership of goods greatly reduces transaction and compliance costs, but entails the internalisation of the costs of risk, liability and waste over the full service-life of goods. These costs constitute an economic incentive for developing loss and waste prevention strategies, which in turn reduce both the company's operating costs and its environmental footprint of pollution, waste volumes and emissions, creating a virtuous circle.

Let's talk about company profits and job creation. Can the circular economy influence these two vital issues in a positive way? How?

WS. On a microeconomic level, the circular economy is a regional economy: the smaller the loops (do not repair what is not broken; and do it locally), the more profitable they are. The CE is part of a wider trend of "intelligent decentralisation" and seems to go against the interests of global players selling 'hardware'. If, however, the revenues of these corporations shift from selling products to selling use, such as music and video streaming instead of CDs, or urban mobility instead of cars, or shift from outright sales to rent-lease-share business models, the CE turned PE can become a cash cow for economic actors.

A circular economy based on caring is labour-intensive and best done where the clients are in organic farming, forestry, health services, education, operation and maintenance (repairs) and selling goods as services all demand the development of profitable, locally-rooted business models.

On a macroeconomic level, a recent study on "the CE and its benefits for society" by the Club of Rome, which analysed seven EU countries, showed that a shift to the CE and PE will reduce national GHG emissions by up to 70 percent and increase national employment by up to 4 percent. *www.clubofrome.org/?p=8851*

On a purely profit basis, manufacturers with global supply chains and global publicity may lose their competitive edge if they do not adapt their business models to the new CE world for two reasons:

- "Returns on Investment" in re-manufacturing plants are a multiple of those in plants manufacturing the same goods.
- hidden business opportunities exist in the CE and even more in the PE; by changing the focus from "production" to "use" these opportunities become visible and can be exploited, especially by first movers.

What kind of taxation is needed in a circular economy?

WS. Nation states promoting sustainable development need to develop taxation systems which are simple to understand and foster a symbiosis between economic, ecological and social wealth. My proposal has three pillars:

- do not tax renewable resources, including human labour and work; but do tax the consumption of non-renewable resources, emissions and waste.
- do not levy VAT (value added tax) on the value preservation activities of the CE.
- give the same carbon credits for the prevention of GHG emissions – through value preservation in the CE – as for the reduction of GHG emissions in polluting processes. ›

Nation states should also stop subsidising the production and consumption of fossil fuels, which nowadays amounts to several trillion US$ per year globally.

The key benefit of not taxing work is that all labour-intensive activities in stock management, which involve caring, will become more competitive compared to capital-intensive manufacturing. Taxing non-renewable resource consumption will possibly entail a review of economy-of-scale thinking and may lead to re-dimensioned global manufacturing activities and reduced supply chains (less transport, less packaging).

Do you think that globalisation is a good framework to implement this new economic paradigm? Or it would be much better to develop it in local and regional economies?

WS. Globalisation was born from a superefficient linear manufacturing economy (based on flow optimisation), ignoring the qualitative and quantitative values of stocks (such as natural capital) destroyed in the process through transport, for example,, and neglecting the "diseconomy of risk" that comes with an "economy of scale": the black swans.

Manufacturers, which have shifted from selling goods to selling services, such as Philips selling light "pay per lux", Michelin selling tyre services "pay per mile" and Rolls-Royce selling "power by the hour" instead of gas turbines and jet engines, have developed entirely new profitable resource-saving business models combining centralised manufacturing with local services. The Internet and the Internet of Things have started to generalise this trend.

Globalisation will spread the CE message in the corporate world, while on the ground, intelligent decentralisation will promote 'pro-sumer' activities (Toeffler) such as urban farming and repair-cafés; sharing economies and sharing societies will blossom.

"The most successful new business models could well be those that manage to integrate sufficiency and systems solutions in order to achieve higher and sustainable profits."

So far we have been talking on a concept level, but please could you give us a few examples of the circular economy when applied to different industries? Could you also underline the main benefits of applying the circular economy in each case?

WS. May I suggest you read the 300 examples in my 2010 book *The Performance Economy*? The book treats the topics of producing performance, selling performance – the PE – and maintaining performance over time – the CE. And read the press! The shift to a functional service economy started years ago in the real economy (remember Xerox, which started selling customer satisfaction instead of photocopiers in 1990?), and is reported in newspapers (UBER, *autolib*, Disney's digital streaming).

The Internet provides free access to trillions of sources, including my book. Big data and the sharing society are opportunities which we can exploit to our advantage if we dispose of the appropriate filters. New opportunities stem from emerging local sharing concepts, from learning the language of marketing in the CE, such as an appropriate terminology for trading pre-owned goods (second-hand) and from exploiting the social, environmental and economic advantages of, for instance, repair-cafés.

CE is a regional economy and is therefore inspired by local culture and tradition. Approaches and business models which are successful in one region may be met with heavy resistance in other regions. (See the reaction to UBER in the U.S., Europe and Asia).

How important are new business models in the context we are discussing? Do we have to reinvent business in some way?

WS. Each business will have to reinvent itself in order to define opportunities which fit its own capabilities (culture, know-how and skills, manpower and innovation potential). As SMEs are the bulk of economic actors in the CE, the new business models will probably be developed in bottom-up clusters rather than in business schools.

The drivers of the new CE and PE business models will increasingly be issues of ownership, responsibility, costs and competitiveness. Environmental and social benefits will be a welcome result: legislation may fade as major driver.

The most successful new business models could well be those that manage to integrate sufficiency and systems solutions in order to achieve higher and sustainable profits.

Do we need great advances in technology and science to move forward in the new paradigm – such as in the development of new materials – or we can proceed using the current technology coupled with brilliant designs?

WS. The shift to the CE opens up new research and development opportunities in three areas: the era of 'R', the era of 'D' and innovative materials and components. The era of 'R': product use, the CE proper.

Technical and commercial innovation in the era of 'R' – responsibility for reusing, repairing, remanufacturing and reprogramming – will facilitate the reuse and service-life extension of parts and goods, such as remarketing used components for remanufacture and reuse in manufacturing; design for reuse and standardisation of parts can increase the efficiency of these approaches. Strategies and technologies for waste prevention in operations and maintenance can also contribute to the CE.

The era of 'D': from "end-of-life" to "as-pure-as-new" resources

Most of the material sciences and technologies need to turn end-of-service-life goods into as-pure-as-new resources do not exist today. The R&D results of the initial movers in this area can probably be patented and licenced to other economic actors: de-polymerising, de-alloying, de-laminating, de-vulcanising and de-constructing are some of the material and organisational challenges.

Innovative elements, materials and components

To improve the resource efficiency of production as well as products in use (technological upgrading of goods).

Individual owner-users of goods can become key players in the product use phase of the CE, a role which they have mostly ignored in the present consumer society, heavily influenced by fashion and the bigger-better-faster-safer publicity for new goods. Eco-Design will not reach most individuals. Corporate owner-users are guided by a functional relationship with goods and driven by the need to minimise costs. Design for the era of 'R' could have a substantial impact.

Economic actors for the PE have already begun exploiting many opportunities, such as systems solutions, modular design with standardised components, reuse of components and materials in closed liability and material loops, as well as sufficiency and such 'design for zero' strategies as spare-less repairs. ›

"As SMEs are the bulk of economic actors in the Circular Economy, the new business models will probably be developed in bottom-up clusters rather than business schools"

The cultural factor is always important. Consumerism and the "use and throw away" culture seems to dominate collective behaviour in richer countries and also in developing economies. Do we need a different mindset to embrace the circular economy?
WS. Present framework conditions reward consumers for consumption; fuel subsidies and periodic cash-for-clunkers schemes are just two examples of policies destroying stocks, pushing the linear industrial economy in order to create growth.

Governments will need to align their policies with the objectives of sustainability, developing strategies which combine environmental, social and economic quality of life, and of which the circular economy could become a central pivot. Policies based on incentives may be more efficient than command-and-control instruments in this shift.

Do you think that policy-makers can make commitments to progressively abandon the linear economy? Or are short-term focus and strategies – linked to the next election – a major drawback?
WS. Businesses and governments need to accept that the name of the game –competitiveness – is unchanged in the circular economy. Politicians can adapt framework conditions, such as taxation and support initiatives. But corporates are the key systems innovators. Witness *autolib* in Paris: an entrepreneur, largely unknown to the public, sells electric car mobility through an innovative system, based on non-emotional cars, without much publicity or branding and a long time horizon, with the support of the local government (free parking spaces on public ground). x

Walter R. Stahel received his diploma in architecture in 1971 from the Swiss Federal Institute of Technology in Zurich. In 1983 he founded The Product-Life Institute Geneva, the oldest established consultancy in Europe devoted to developing sustainable strategies and policies; with partner institutes in Tokyo and Vienna. Since 1984, Stahel has been active as a business consultant in most European countries, the USA and Asian countries in the fields of: developing strategies, policies and tools to foster sustainable development; researching utilization-focused technologies such as the re-use, repair, reprocessing and technological upgrading of components; risk management and the insurability of risks and their relevance for the shift from an industrial (or river) to a service (or lake) economy. Walter R. Stahel has been a consultant on the policies and strategies of a sustainable development to the European Commission in Brussels, participating in its 'Futures 2010' project. Since 1980, Stahel has authored books and numerous articles on policies, strategies and tools to foster an economic and societal development towards a more sustainable society.

www.wrforum.org/profile/dr-walter-stahel

Dirk Glaesser

DIRECTOR FOR SUSTAINABLE DEVELOPMENT OF TOURISM
AT THE WORLD TOURISM ORGANIZATION

Tourism is an industry with more than one billion consumers and a great environmental impact. But this big industry also provides examples of how to reverse this impact and transform it into positive effects for local economic development, cultural heritage and biodiversity preservation.

"Tourism can become an agent of change"

Tourism has an undeniable impact on the environment when we consider the large volume of people involved (over 1,000 million worldwide). Why is this universal phenomenon so popular?

DG. To understand tourism and its economic and environmental impacts, we need to understand the fundamental shift that the phenomenon has undergone. Tourism was born with the Industrial Revolution as a result of paid holidays. The initial aim was for workers to be able to relax for a short time and recharge their batteries, and a glance at laws to have historically promoted this time of rest makes this clear. Today tourism is very different, with its main goal individual self-realisation. Recreation is not only physical, but also mental. We place great importance on psychological well-being and thus tourism has evolved into a highly significant aspect of culture and society. In fact, today many people return to work physically tired after holidays, despite feeling relaxed and ready to face new challenges.

Traditionally we distinguished between work, leisure and vacation as separate blocks. The current reality is different. There are people who spend their vacation time working on something different to what they usually do, not necessarily with an economic objective. These deep-rooted social changes explain why more and more people are participating in national and international tourism and why the numbers of tourists are rising day by day.

Tourism is often analysed as a phenomenon with its own profile, but as you say, it is a more complex reality that is mixed with other activities. What are the implications of this for key aspects of sustainability such as resource consumption?

DG. The tourism sector is made up of small and medium companies in most parts of the world. It is a sector that generates economic activity in many fields. It may be stated therefore that it is a very diverse sector and of course it requires a wide range of material resources. But as I said before, individual well-being and self-realisation are also very important intangible items. In a business-as-usual scenario, the growth of a business usually involves a rise in the use of resources. But when it comes to tourism, the goal of decoupling resource consumption from an increase in demand may be considered due to the importance of these intangible items.

Moreover, since tourism is strongly linked to other activities, such as transport or trade, any progress made in this sector can also stimulate progress in other sectors and activities. This is why I believe that, more generally speaking, tourism can serve as an agent of change. If we look closely we will find that almost all tourism related activities have one thing in common, and that is people looking for something different than usual. In this sense, the ability to change and innovate is part of the activity's *raison d'être*. This opens the door to developing increasingly sustainable forms of consumption and production.

You are saying that tourism was once a simple phenomenon that has become more complex over time. There are many forms of tourism and many interrelationships with other activities. Is this a problem when analysing and studying tourism development and its effects?

DG. If we wanted to know what was really happening in this field, we would need practically real-time analysis tools producing data that shows the particular reality in a given destination. Until recently we focused on measuring reality *a posteriori*, in order ›

to check whether certain goals had been achieved, for example. Now institutions, especially on a local level, need more complex data to make better decisions. A detailed knowledge of the effects of tourism on a place is a good basis for appropriate sustainability policies. A clear example would be how knowing the capacity of a particular place would allow you to establish reasonable limitations.

In the 1990s, the World Tourism Organisation began drawing up sustainable development indicators for tourist destinations based on the three classic pillars: environment, economic and social. This led to the publishing of a manual in 2004, in which we suggested 23 thematic areas and corresponding indicators. For the past year we have been reviewing sustainability indicators to adapt to new UN Sustainable Development Goals for 2030. If we really want to make tourism a factor for change, then we must prioritise sound initiatives, and this prioritisation must be based on collected data. All this is very important considering the limitations of the financial resources available to agents that must intervene in any given place, i.e. the budgetary limits of the institutions that have the power to act. Sound data will also allow for greater efficiency in public spending.

The concept of sustainability must apply to real life and therefore have active policies. Sustainability is a process of constant progress and improvement: it is not a final destination. If we want to know whether we are on the right track, the only possibility is to use the indicators. I am convinced that the big data revolution will mark an enormous change.

What other features should the indicators include in order to provide a precise and detailed knowledge of reality?

DG. They must measure reality in a more accurate and immediate way. For environmental and socio-cultural aspects, you don't need very significant data to realise that an important change is taking place. There is what is known as an early warning. Let me give you an example. Imagine a tourist destination when a series of muggings occurs that are infrequent in the beginning but eventually increase until they reach a very significant number, and this is the point when we become aware of them. By this time, however, the spate of crimes may have already done irreversible damage to the destination, which may have seen its visitor numbers drop and left us unable to react. This is usually what happens. In this case, it would have been very helpful to have had an early warning by means of data that showed the increased frequency of muggings. We can get data from different sources such as social networks. I focused on theft in the example, but this pattern of data collection would be valid for environmental issues such as pollution. Other possible data sources are people's mobility flows from mobile phones, maintaining their privacy, of course. This ability to measure and analyse reality in almost real time requires a prompt response from tourism managers. Sound indicators and analyses could undoubtedly help us think of a more sustainable tourism model and also contribute to seeing tourism as a resilient phenomenon. Studying aggregate tourist data seems to suggest that tourism is a constant activity. There is always tourism in one place or another, but locally it can be a very volatile activity: if there is a problem it may quickly disappear from an area.

Alongside carrying capacity, the concept of slowing down has come to the forefront in recent years, and it is also related to sustainable tourism. What does this concept bring to the table in your opinion?

DG. It is well known that there is a type of tourism that aims to see a string of destinations in a short time. However new approaches try to put quality ahead of quantity. These approaches are much better for the economy because they enrich and enhance people's experience of a place with more detailed knowledge, which can lead, for example, to them becoming more interested in local culture and products, and not only in typical aspects such as landscape. This allows tourism to provide economic dynamism and coexists with a more respectful approach to the site by the visitor.

"The ability to change and innovate is part of the raison d'être of tourism. This opens the door to develop increasingly sustainable forms of consumption and production"

Let me add another one of these new concepts on the relationship between tourism and sustainability known as *levels of accepted change*. Nowadays, debate revolves around certain destinations. The following happens: the destinations become so successful that sometimes people feel that the place does not work for them anymore but only serves the needs of tourism. This is a crucial discussion that residents have to have and can be summarised in the following way: what level of change are they willing to accept? Obviously there is no single answer to this question; it will depend on many variables. It is a discussion on sustainability because the idea of establishing certain limitations plays an important role. This concept shows that sustainable tourism necessarily requires public participation. You cannot design plans behind local communities' backs. Another important issue revealed when we start with this approach is that sustainable development in one place does not necessarily equal sustainable development elsewhere. A region where water is abundant does not have the same challenges as a dry area. For this reason, it is very important to talk about sustainability on a local level. Sustainable tourism must be discussed in the local context.

You referred to the inhabitants of a place as active agents in making more sustainable solutions, but there is also a responsibility that lies with tourists. Do you share this view?
DG. Yes, absolutely. Tourists must make a difference and take responsibility. The challenge of our work is to make the impacts of tourism activities transparent and thereby provide data to improve tourists' awareness. When we consider a particular mode of transport and its ecological footprint, then this immediately produces figures that can be useful for increasing our responsibility. Certainly, this is still a vision for the future and not a reality, but it is the direction in which we must work. And while moving in this direction, we must continue to manage tourism *in the context*. The idea could be summarised by saying that it is not about planning tourism in Madrid but planning Madrid for people who live there and for those who visit the city.

Can you give me an example of a tool that serves to increase awareness and individual responsibility?
DG. Architecture can have a strong influence although at first glance it does not seem so. Innovation in materials and energy efficiency in buildings help reduce energy consumption which is high in places where there is a concentration of hotels. This is good for tourists seeking more "sustainable" hotels, so to speak, rewarding their choice of hotels which are committed to saving energy and resources. However, what is happening today is exactly the opposite: consumption is rewarded.

The World Tourism Organisation has developed a programme for sustainability in the sector. Can you discuss some of the programme's highlights?
DG. The two main areas are oriented, on the one hand, to measuring the impact of tourism and, on the other, to gauging the acceleration of change. The first, as already mentioned, is addressed by our work on the formulation of the best indicators. The second refers to the strategy of decoupling growth from resource consumption. To do this, we are working on a programme with four major areas: integration of sustainable patterns of consumption and production (SPC) in policies affecting tourism; collaboration between stakeholders to increase tourism performance in SCP; accelerating the implementation of guidelines, tools and solutions to improve, prevent and mitigate the impacts of tourism; and improving investment and financing for sustainable tourism.

Although an international organisation mainly works with concepts and guidelines, we also go to the ground on many occasions, such as in order to validate if a given area is successfully focusing on the issue of preserving biodiversity in relation to tourism. This also allows us to identify best practices that can be transferred to other scales.

You also have a network of observatories. What is their mission?
DG. The UNWTO observatories are very important tools for us for promoting the sustainable and resilient development of tourism. Their mission is to collect data on a constant basis, through satisfaction surveys among locals and tourists, among other methods. ›

Biodiversity is key aspect for the planet's environmental balance, however, in recent years, we have begun witnessing its loss. Can tourism help reverse this negative trend?

DG. Biodiversity is normally lost when it is not considered to be of value. In this sense tourism can promote this aspect by increasing biodiversity's worth in local communities. This is not an objective for benefitting tourism but is aimed at allowing the local context to enjoy such biodiversity. On the other hand there are regions in the world that currently do not receive visitors and are off tourist paths which could become new destinations and generate local wealth. All this must be done with extreme care to avoid an excess of tourists that would be counterproductive for biodiversity. The only suitable instrument is planning based on an analysis of impacts. It is certainly a complex but a necessary goal. It is easier to achieve when tourism is well integrated into the institutional framework, for example, within ministries engaged in environmental and land management.

One topic that must be addressed when it comes to tourism is aviation. As we know, aviation is entirely based on fossil fuels, it is a major emitter of greenhouse gases and also falls outside the limits set by major international agreements on climate change. What is your view?

DG. First, you have to accept reality. The reality is that there is a growing trend of international tourism with people travelling further and further away. Indeed, this entails an increase of flights offered at lower prices and at the same time it is indisputable that aviation generates greenhouse gas emissions and is outside the agreement on climate change.

However, international tourism is the tip of the iceberg and not the whole iceberg: for every long distance international trip there is always much more domestic travel. The bulk of world tourism is between neighbouring countries. We do not know how long it will take for aviation to become viable without fossil fuels, but it doesn't seem likely in the near future. While we await the development of more sustainable aviation, we can begin to design innovative modes of transport and land transport is clearly one of them.

"There is a type of tourism that aims to see many destinations in a short time. But it is better to put quality ahead of quantity. This approach is much better for tourists because it enriches and enhances their experience"

The smart move is therefore to reduce emissions of these other modes of transport whenever possible. This will allow us to partly offset the impacts of aviation.

Another important issue is to promote reflection on the meaning of travelling long distances for staying very short periods at the destination. Many trips to the other side of the globe are made just for two or three days. Each of us should analyse the value of such long-distance travel when the stay there is so brief. Here the concept of *slowing down* makes sense. But the phenomenon is complex and must be considered as such. If we consider it from the perspective of economic development, which is a dimension of sustainability, we realise the limited options for some island countries, for example, and then we see that we cannot jeopardise their development. There are countries that do not need much tourism because their economic possibilities are greater. For others, however, the possibilities of choice are drastically reduced due to geographical factors, for example. In any decision that is made, we must bear in mind that mobility has always been crucial for development generating knowledge and wealth. Sustainability also means achieving a balance between different possibilities. x

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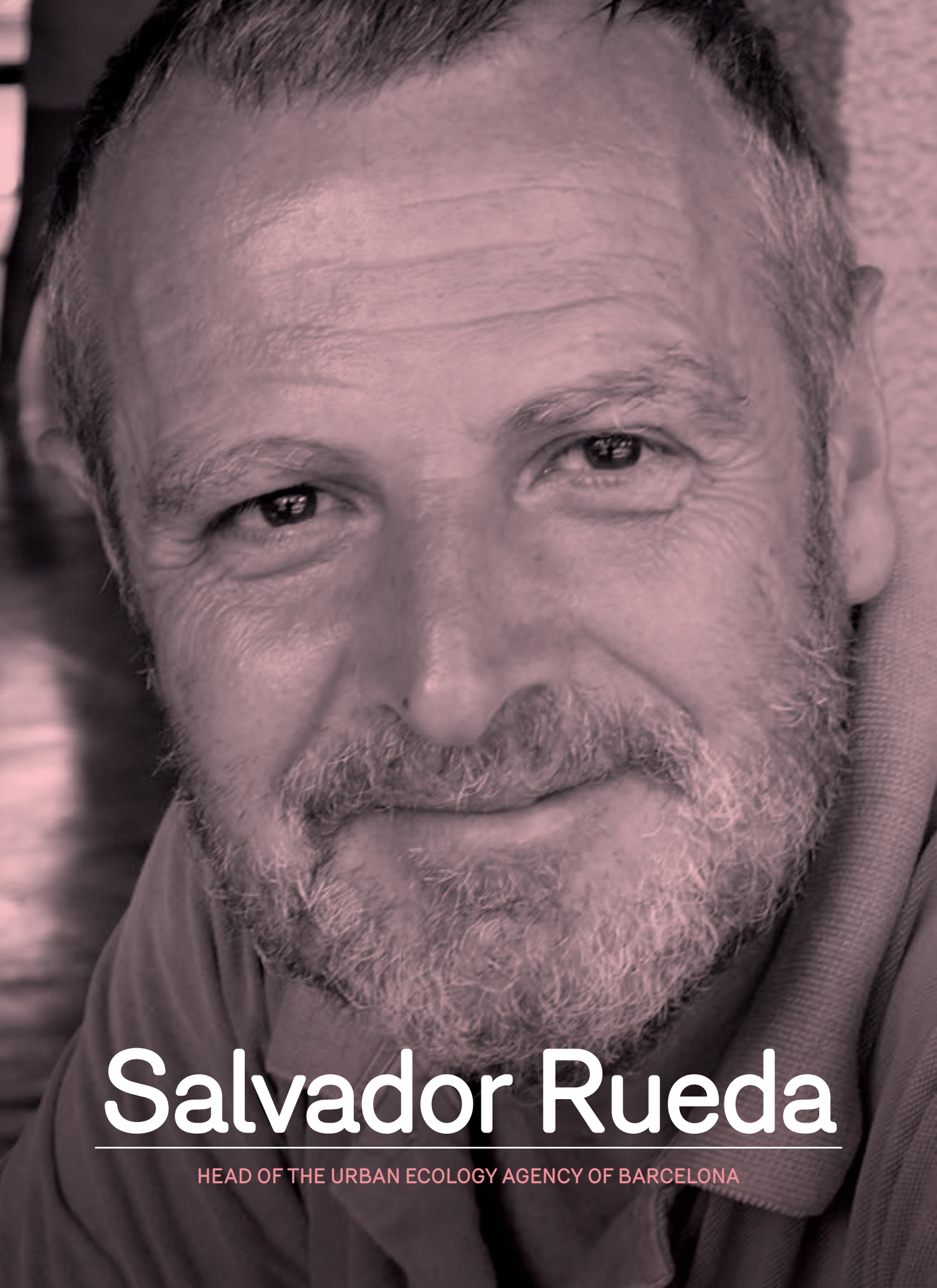
www.gstcouncil.org/en/about/people-at-gstc/gstc-board-of-directors/772-dirk-glaesser.html

Over half of the world's population lives in cities and urban regions, and projections suggest this figure will continue to rise until at least 2050. Sustainable cities are those which work to provide a healthy and resilient environment for their populations, with such a challenge involving architects, urban planners, policy makers and also civil society.

Building better cities

Salvador Rueda | Zulma Bolívar | Anupama Kundoo
Antonio Lucio | Frauke Fischer | Carlo Ratti



Salvador Rueda

HEAD OF THE URBAN ECOLOGY AGENCY OF BARCELONA

Urban sprawl creates serious urban dysfunctions, whether in terms of complexity (where built up space is mono-functional), efficiency (where resource consumption is at an unprecedented high) and stability and social cohesion (where there is less diversity and income segregation). The key to urban sustainability are compact and diverse cities. This is a model that minimises land use, energy and material resources, while contributing to the preservation of natural and agricultural systems.

"Cities force us to rethink almost everything"

The more complex a civilisation is, the more important the urban phenomenon becomes. Why is this?

SR. The essence of a city is defined by two key elements: the existence of public space and the presence of a certain amount of legal entities (urban organisations) that interact with each other in any given area. The two elements are complementary. Public space exists to the extent that all urban functions may be developed in it (transport, pedestrian areas, leisure, economic activities, etc.). If these urban functions cannot be performed in an area then what we have is simply urban space, which is not public space, and therefore does not constitute a city. Even if there are buildings and streets in an area, if only cars use it, then the essence of the city has been lost. The diversity of legal entities represents a high degree of organisation that feeds socio-economic activity. I work at this office but I went out to eat at a nearby restaurant. My goal and the restaurant's goal may be different, but our interests are linked. When this kind of connection spreads on a large scale and involves many different actors, it generates processes of economic growth, as well as creativity, solidarity and social exchange. This richness makes the city the most complex mechanism (with a high degree of organisation) that humankind has ever created. The possibilities inherent to cities are endless.

The concept of urban planning that typifies modernity and is characterised by Le Corbusier and the Chicago School has generated interventions that are rejected nowadays. An example would be the zoning of urban areas according to urban functions. Why do you think that this attempt to "rationalise" urban space seems to have failed?

SR. The model is invalid because it has produced sprawling cities in which urban functions that were previously combined and mixed in the same space have been separated, such as places for living and others for working. The spaces must be connected in some way, however, and in the twentieth century, this has mostly been achieved by means of the mass use of private vehicles and their associated infrastructure. The model has also been largely accompanied by the widespread use of the family home building type. Instruments such as mortgages and credit have provided mass access to housing and automobiles, with all of this creating an infernal machine that has contributed to the occupation of large areas of land without restraint, like a metastasis. In Spain, we have a clear example of this process: in the years before the economic crisis, building in Spain equalled that in Germany, France and Italy combined. Over a period of 30 years, Spain has come to occupy two and half times more territory than it had occupied in the previous 2,000 years. The impact on the consumption of material resources, water and energy has been enormous, with this way of making cities unsustainable. ›

There is also an important cultural issue in this process, as high income residents leave city centres to live in the suburbs of these sprawling cities. This is a new phenomenon, as, historically, those with the greatest fortunes in a country used to live in the inner city. Now the trend to move out to the suburbs is beginning to be reversed, not only in Spain, but also in the United States, where this model is completely dominant and has strongly shaped the structure of large urban centres.

Which urban model should be promoted in order to foster sustainability?
SR. We should promote the model of Mediterranean cities that are compact rather than sprawling, complex in their organisation, and in which a great diversity and mixture of uses may be found. These kinds of cities have healthy levels of metabolic efficiency and can be improved with the use of renewable energy, making them almost self-sufficient. No less important is social cohesion: cities are for the people. I am convinced that one of the key indicators in any city is the level of conviviality.

A common analogy in your vision of urban planning is to describe cities as ecosystems. What is the similarity between an artificial system such as a city and a natural system?
SR. Sometimes it seems hard to understand that a city is an ecosystem, but it's actually quite simple. A system is nothing more than a set of physical and chemical elements that interrelate with each other in different ways. The incorporation of living organisms into a system serves as an ecosystem. If you were to study a city and see how it works, then you would realise that it meets all of the requirements of an ecosystem. An ecosystem features various interrelationships, as does a city, but what is just as important if not more important are the constraints among the elements. Let me give you a little analogy: a conference is a small ecosystem with physical elements, a room temperature, and people who have gathered to listen to others speak. How can I know that I am in the conference ecosystem and not in a different one? I know because of the constraints I find. I won't find the people attending the conference eating, dancing or crying, (as all potential behaviours are restricted in this context). They will instead listen to the speaker and ask questions at the end of the speech. Cities also have their constraints such as traffic regulations including hundreds of rules that allow us to drive in a somewhat safe and predictable manner. Constraints also allow us to identify a particular city by the rules governing the use of urban space and other aspects.

Why is ecosystemic urban planning more suited to meeting the challenges of contemporary cities than nineteenth or twentieth-century urban planning?
SR. It addresses two major challenges: sustainability in its three dimensions and the fact that we have entered this new age of information and knowledge. Ecosystemic urban planning proposes a system of indicators (restrictors) to define a particular city model. These indicators allow us to analyse a large number of parameters. Morphology, structure and urban functions are included in this analysis which has many applications in urban management and design. These indicators tell us which elements serve to heighten the complexity of urban organisation over time. Complexity is very important and comprises two lines: the number and diversity of legal entities operating in the city, on the one hand, and urban biodiversity, on the other. Then there are the metabolic vectors of the city that are linked to the water cycle, the flow of materials and the use of energy, with maximum efficiency and maximum self-sufficiency the goal for this area. In the case of social cohesion, the goal is to create an urban space that promotes conviviality and creativity.

I guess that this approach does not require the destruction of the urban fabric or the visual memory. Can you intervene in a city without radically changing its shape?
SR. Yes, you can. Le Corbusier made plans to radically change Paris or Barcelona in a series of outrageous proposals that did not respect the landscape of the cities. Nowadays, technology allows us to rehabilitate our wonderful cities without destroying the historical fabric so appreciated by their inhabitants.

"Ecosystemic urban planning proposes a system of indicators to define a particular city model. These indicators allow us to analyse a large number of parameters"

In the past, building activity was different. It featured more layers of information, with richer and more complex results. In our time we have chosen to simplify the forms of modern buildings. We have created regular and very minimalist visual landscapes where straight lines generally dominate. Technology allows us to completely redo old buildings and equip them with the latest features, retaining the façade and therefore maintaining the visual presence on the street.

Synthetically speaking, how would you describe one key instrument of ecosystemic urban planning?
SR. What we do is to develop theories and basic concepts that are later introduced into planning. In the city of Barcelona, one example of a key instrument would be the superblocks developed by uniting different blocks with the aim of reducing the area used by the private car and of increasing the area for pedestrian use. Inside superblocks, people and certain types of vehicles (resident vehicles, bicycles and service vehicles) have priority, with through traffic circulating in the streets outside the superblock. Thus a hierarchy between traffic crossing the city at higher speed and pedestrians and certain vehicles circulating more slowly (local mobility) is established. With this urban design, the area dedicated to pedestrians reaches 70% and the remaining 30% is for through traffic. Normally this ratio is the other way round. This is not only a numerical or quantitative question but a quality issue. The area inside the superblock greatly improves the public space and new areas for walking, playing or simply spending time are generated. This substantially affects quality of life and the pedestrian becomes a citizen who can fully exercise their rights in the public space. We must not forget that 'politics' comes from 'polis', which means 'city' in Greek.

Why is the idea of public space so important?
SR. Public space is what makes a city. It also makes us citizens. It is the space shared by all the city's inhabitants. Historically, cities stem from the idea of a common place where people can meet.

How does the planning of a city take into account both its location and the impact on the environment?
SR. In recent years we have found ourselves in a situation where nature has shown its limits, as is the case with climate change, and this means that we have had to rethink everything. To begin with, we must rethink the way we have *produced* cities so far because it is a formula with a significant environmental impact. Change can only come when the metabolic vectors are as self-sufficient as possible. This means that the sources that provide us with materials, water and energy are local and renewable. Public urban interventions should therefore aim for this goal. It is true that all cities have their own peculiarities; therefore they should take advantage of them. I'll give you an example. In Basque coastal city San Sebastian, the power produced by the sea may be developed into wave energy. We therefore launched a project for this kind of energy in the city. Other cities might have more wind or sun or biomass and these sources should be used accordingly. In any case, all cities have places where some aspects of self-sufficiency can be developed, as is the case with roofs that can accommodate devices for generating energy and vegetable gardens.

How do you view a city like Detroit that is experiencing a sharp decline? Do you think that a case like this can be reversed?
SR. In any system, dysfunctions appear when there is a major change in any key variable. In Detroit, this change has been the decline of the automotive industry in a city where there was little complexity, lack of diversity, and for this reason a serious imbalance has been generated. The balance in an organism works the same way. For example, if the amount of sugar in the blood rises (and the regulatory system becomes impaired), the eyes, ›

heart, arteries and many other elements become altered because the body is a system. What should be done in this case? Should we reconstruct the city from scratch? Perhaps it is an option. But the decision should be determined by the capacity for resilience. A city like Detroit, which sprawls for miles, would completely collapse in an energy crisis affecting car mobility: the population could not get to work or access services. Distances are not made for walking and public transport is not viable under the circumstances. For this reason, ecosystemic urban planning is not only useful for improving the quality of life in a city that already works, but to ensure the future of any city. Obviously when we talk about the Mediterranean city as a model, this does not mean that this kind of urban planning cannot be universally applied. But it is true that in some American cities, such as Detroit or Phoenix, it would be very difficult. One of the virtues of ecosystemic urban planning is that it increases cities' resilience. Resilience is communities' and ecosystems' ability to be disturbed without being altered in their structure and functions so they can return to their initial state.

Cities can also become *self-contained* entities for material flows. Don't you think this risks altering their historical roles as centres for exchanging goods with other places?

SR. I suggested to the city of Bogotá that building should only use materials derived from demolition. It is just an example and I understand that the economy has yet to have been dematerialised, but I think this should be the overall goal: to reduce the material impact of economic activity. In the case of Bogotá, if this suggestion was implemented resource consumption would slow, but not economic activity, because waste managers would have a lot of work on their hands. This is all about services having more weight in the economy. It is the same in the automobile industry. Today the main goal is to sell many car units but cars in the future will be shared and business will be in services related to this reality. The economy is moving towards some dematerialisation but it will not be absolute and goods exchange with the world will not disappear.

What role should cars play in cities?

SR. The main idea is that journeys from one point to another in cities may be made efficiently in the shortest time possible, especially in the case of forced mobility. Each mode of transport has its optimal distances based on a reasonable time. For travelling by foot, it has been estimated at just over one kilometre; for conventional bikes it is 4-5km and for electric bikes, 7-8km; for public transport it varies greatly, depending on whether we are talking about the underground or the bus. In theory, cars are great for all distances, but because of the difficulty of finding a parking place and of traffic times, it becomes unpredictable and then clearly the potential decreases. The problem with cars is not just the fuel they need but the space they occupy. A car needs 25 square metres for parking. This includes of course the area to execute the manoeuvres necessary for getting the car parked. In the systems constituted by cities, maximum efficiency must be achieved in the use of space, since space is a scarce resource. Therefore electric cars help reduce emissions but do not solve the problem of space.

Cities are in countries and countries belong to an international context. Don't you think that urban centres are limited in their decision-making precisely because they are conditioned by higher policy frameworks?

SR. There is a key element that is usually forgotten about: the amount of the state budget that goes to cities. In Spain it is around 15%, but in Denmark it is around 60%. If there was a change in budget structure in favour of local authorities and cities, the level of services and quality of life would be totally different. The capacity for employment policies, for example, would be much higher. Local sovereignty, understood as the capacity for political decisions, should go hand in hand with ecosystemic urban planning. If cities could have a large share of the national budget, they could design a policy of incentives to implement changes towards cleaner and more efficient energy, or closing the water cycle and ultimately improving all elements that define a more sustainable city. In short, political organisation and budgeting are decisive elements of new urban planning. x

Salvador Rueda is head of the Urban Ecology Agency of Barcelona. He has a degree in Biological Sciences and Psychology, and also in Environmental Engineering and Energy Management. Salvador Rueda is an expert on various aspects of the urban environment from a holistic perspective. He has been coordinator of renewal and revitalization of the Old City district of Barcelona, has drafted the Catalonia Water Plan and the Waste Management Programme for the Metropolitan Area of Barcelona. Previously, he was also leader of the Catalan Government's Urban Environment Area and a member of the European Union's Expert Group on Urban Environment from 1994 to 2000. He has led the Urban Ecology Agency of Barcelona since its founding in 2000 and has worked on several strategic projects aimed at reorienting cities towards a more sustainable model. He is also the author of several books and scientific, technical and specialized outreach articles on urban environment.

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Zulma Bolivar

HEAD OF THE METROPOLITAN INSTITUTE OF URBANISM OF CARACAS

Cities of the developing world share many problems with the cities of the developed world, but they face additional challenges that sometimes hinder urban management. These challenges include the poor functioning of institutions, poor governance, and lack of infrastructure and services

"We must achieve basic development before sustainable development"

When talking about sustainable cities from the perspective of Europe or the United States, we tend to consider highly developed cities as a universal pattern. But this view is not valid for other parts of the world such as Latin America, for example.

ZB. That's correct, and I think there is a touch of Eurocentrism in this view. There is also a tendency to generalise concepts and design indicators with points of reference based on cities from Western Europe or North America. However, a couple of decades ago, experts began to question whether the "ideal development" of these cities really was sustainable, and to what extent their model and management should be imitated by other cities. Latin American cities, along with many cities in Asia and Africa, have developed in contexts that are totally opposed to those in the Western world. History, geography, climate and particularly the policies imposed by their rulers locate them in a world which is unequal, unjust and exclusive.

In developed countries order, justice, planning and a respect for rules are taken for granted. It is an undisputed fact that each individual is a citizen and that the State has an obligation to provide education and health or basic services such as water and electricity, as well as to organise public transport. Duties and rights are equal for everyone; there are employment opportunities and freedom of movement. There is legal certainty, social and economic security, and the population has sufficient purchasing power to live decently and compete in the economy.

By contrast, in most cities in the third, fourth and fifth world, these conditions are mere aspirations and targets in government plans that are never actually met. Undernourished and unhealthy populations scrape by in cramped housing, amid supply shortages and a lack of public services. The situation in Venezuela is no different from many parts of Latin America. Despite its high rate of urbanisation (80% of its territory), 45% of the population live in informal settlements without running water, electricity, rubbish collection or adequate public transport. More than half of the population spend five to six hours travelling from home to work and vice versa. A quarter of the population live in extreme poverty as their daily wage is less than a dollar, and around 40% of children fail to complete secondary school.

A city grappling with these conditions is unlikely to be able to prioritise the meeting of the Millennium Development Goals or reduce CO2 emissions.

What would be the five main challenges faced by Latin American cities nowadays? Can you also talk a bit about Caracas in particular?

ZB. The first challenge is to train sufficient human capital to act efficiently and encourage participation and inclusion of all actors that make up city life. The second is to strengthen local governments' administrative structures by developing means of efficient and sustainable management, on the basis that each city is unique and therefore has its own needs and opportunities, requiring its own plan with well-defined priorities that is flexible enough to adapt to changes. The third challenge is to reduce poverty ›

by creating new sources of employment. This implies the promotion of smart cities that generate numerous business opportunities and the possibility of public-private partnerships in a network involving all stakeholders. The fourth challenge is to improve the infrastructure of services and facilities, including housing as a right and the quality of the public space as the city's main structural element. And last but not least, public institutions must be restored, with respect for justice and democracy paving the way for good governance.

Caracas is now one of the worst cities to invest and do business in, one of the most unsafe cities in the world with the highest murder rates, the worst speed internet connection and the highest number of days to register a business. We also have the lowest average wage in Latin America and half of our population live in informal settlements in unhealthy and risky conditions. We also have triple-digit inflation considered to be the highest in Latin America.

What is the meaning of sustainable development in the context just described? Is this concept understood as a distant or vague idea? Or can it be seen as a transformative idea that may inspire solutions?

ZB. I think that when we characterise the word "development" with the adjective "sustainable", it presumes that there is some kind of "development" in our cities which is not entirely true. We must first develop some basic aspects, and it is only then that we can make them more efficient and increase their quality, going on to talk about sustainability. Sustainable development is achieved through the employment of a comprehensive and interdisciplinary perspective in the processes of urban planning and management, integrating the environmental dimension into the city's urban planning, finances and governance.

A sustainable city is one that provides the best possible quality of life for its inhabitants, minimising impacts on the environment and preserving natural assets for future generations. To achieve this, local governments must have fiscal and administrative capacities and foster active participation among their communities. Latin American cities have a long way to go as they must overcome the education, health and housing "social debt" and ensure that institutions, human rights and the law are respected. Only then can they engage citizens, legitimise authorities and work towards sustainable development. Without governance, sustainability is impossible.

What is the most significant obstacle to good governance?

ZB. I think it is poor education. Without intelligent and ethical citizens, intelligent and capable officials will never be elected, preventing the development of sustainable cities. Poor education also results in significant social inequality and social exclusion and promotes a perverse demagogic game whereby those who gain power manipulate the masses without the slightest concern for the common good.

Ignorance also goes hand in hand with inefficiency. Disaster occurs when the power is in the hands of the ignorant. Venezuela is the most vivid and recent example of this. It is an immensely rich country with the largest oil reserves in Latin America and has valuable soils with minerals and precious stones, a great potential for agriculture and livestock with year-round clement weather, a strategic location and a predominantly young population of employment age, however poor public policies have turned Venezuela into the worst country in the world for investment.

Latin America must invest in education, leaving behind the fear generated by radical regimes and increasing hope for participatory regimes. Countries should base their development on their human capital, sound institutions, respect and democracy.

Institutions require the adoption of a certain attitude. What should the attitudes of those who govern and those who are governed be?

ZB. Good government is the sum of a set of institutions that serve the state organised through a participatory, accountable and transparent system, with civil servants who have a sound knowledge of their duty and are monitored by a regulatory framework underpinned by the law. This framework must be equitable, fair and accessible to all.

"I think the factor that hinders good governance is lack of education. Without intelligent and ethical citizens, we will never elect intelligent and capable politicians, and without that sustainable cities cannot be developed"

Institutions must be judged according to the degree of democratisation inherent to political processes, respect for human rights, the effectiveness of public administration and the monitoring of corruption.

Engaged citizens should participate with a sound conscience and professionalism, demanding their rights are met but also fulfilling their responsibilities. Such an attitude must be based on respect, equal treatment and transparency in accountability.

The obstacles to forming good governments are related to a lack of citizenship, political leadership, political culture and public ethics. In Venezuela, for example, it would appear that all of these impediments have served to destroy the country and hinder any attempt at progress. The central government has tried to weaken local governments and their structures have been asphyxiated politically and financially. This kind of action goes against the global trend in favour of local governments. Personally, I believe and I stand up for the autonomy of local governments, for freedom of information, for free encounters between supply and demand and for the respect of private property. I promote strategic alliances for building a shared vision of the city and the country that we want. I believe in meritocracy, professionalism, human capital formation and strengthening NGOs and local authorities as a basis for good urban management.

As President of the Metropolitan Planning Institute of Caracas, how important do you believe urban planning to be as a tool for change?

ZB. In Venezuela and it seems that in most of Latin America, the urban legal framework defines municipalities as autonomous bodies with a legal personality and sufficient powers and responsibilities to assume a central role in the developing of the strategy for the city. But in reality, autonomy is something relative, since municipalities depend on political, administrative and financial support from the central government. I think that the only way to achieve physical and social transformation in our cities is with support from organised civil society.

What role should urban planners play?

ZB. Urban planners should not only draw up plans: urban interventions must be managed in order to discover problems and opportunities for intervention, defining how the public administration should act, the importance of other sectors of society and how to integrate these different aspects within a common strategy.

Responsibility for planning entails an institutional commitment that must be clear, going beyond private interests or the current government's interests. Planning involves multidisciplinary teamwork prioritising equality.

There are two levels of urban planning: the day-to-day problem solving and the strategic vision of the city. In a big city, the second level is essential in order to promote joint action to confront the difficulties associated with urban agglomerations. This is a strategic task of great importance and requires adequate institutions distinct from municipal institutions. This is why the Metropolitan Planning Institute of Caracas – a public body assigned to the Metropolitan Mayor of Caracas – is devoted to developing the Strategic Metropolitan Caracas 2020 Plan, a planning tool for achieving an accessible, dynamic, productive, safe, integrated, governable and environmentally sustainable city.

Urban planning is not easy. Very often the efforts made in this field are lost. Caracas is an example of an extremely difficult case, which brings together political fragmentation and political radicalisation, as well as the dismantling of metropolitan institutions. It is an urban area where many national, regional, metropolitan and local authorities converge in an alleged two-level government the central government is yet to recognise. Urban planning as a public function does not make sense in a country where institutions are not respected. We have implemented strategic planning as a methodology joining efforts and involving public and private ›

sectors, guilds, academia and the whole of civil society to carry out the programme of actions required to transform Caracas into a city for life. Planning should be an uninterrupted methodology implemented by the State in order to try to make public investment more efficient for the benefit of the community. Planning should be a technical, participatory and financial matter.

Can you give examples from Latin America that may be seen as a benchmark for good practices in urban management?

ZB. I will refer to three experiences in objective and scope that have marked a milestone in the transformation of cities on the level of management models:

The CEPAL project for Latin America cities envisages local urban management as exercised by particular institutions, where the local government is formed by competent and motivated authorities whose efforts are aimed at generating administrations and management that are appropriate and tailored to the characteristics and requirements for the city's development. Although this assumption may seem idealistic for Venezuela and many countries in Latin America and the Caribbean, it could be defined as the goal we should aim to achieve. The project suggests developing efficient management by means of four basic strategies: improving mechanisms for increasing urban productivity from an efficiency perspective; negotiating and allocating resources to the public system, prioritising investment, informing and guiding the private sector, identifying needs and encouraging community participation; promoting and strengthening decentralisation; and focusing efforts on improving management processes that extend the frameworks of local institutions.

Although on another scale, the Initiative for Emerging and Sustainable Cities (ICES) driven by the Inter-American Development Bank must be mentioned. This initiative is developing detailed studies on how a high rate of urbanisation generates social and economic impacts, with severe consequences for the environment. These studies emphasise the need to achieve growth patterns that improve the conditions of the present generation without compromising the future of the generation to come. In this new vision of sustainable urban development, the city is characterised as a holistic system in which social, economic, environmental and institutional aspects are fully harmonised across subsystems that are interrelated and interdependent. ICES has managed to successfully implement its methodology in 50 Latin American cities.

"There are two levels of urban development: day-to-day problem solving and work on a strategic vision of the city. In a metropolis this second level becomes essential"

Finally, I would like to mention Danish architect and urban designer Jan Gehl's vision of restoring the human scale, as this has been the greatest and most positive influence to the urban structure and citizens' quality of life in recent years and one in which public space is considered as a structural axis for the city. Gehl is an expert at creating "cities for the people", developing a theory about what makes a desirable and liveable city. He believes that social sciences and psychology should be taught at architecture schools and has developed 12 principles for determining whether a public space is good or bad, based on the observation of everyday people and the simplicity of the place, the fostering of visual contact between citizens or the existence of proper infrastructure to avoid unpleasant sensorial experiences.

Apart from these three experiences, I can also give you some examples of cities that have implemented large and successful urban projects on the public space: the system of Library Parks and Rio Park in Medellin under implementation in Colombia; the pedestrian and bike route along the Mapocho River and the Parque Bicentenario in Santiago de Chile; Puerto Madero in Buenos Aires; the seaside boulevard in Rio de Janeiro, Brazil; and the Costanera in Panama City.

A very characteristic and common phenomenon throughout Latin America is the great rural exodus that, while depopulating the countryside, also puts more pressure on urban systems. Wouldn't territorial balance be a more sustainable means of avoiding this double negative effect? Do you think it would be possible?

There shouldn't be a rural-urban exodus if the nation has a public policy to achieve a balance between the sectors. Town and country are complementary; they are inseparable. But in order to have good living conditions in both, some minimum requirements must be met. There must be sufficient incentives not to leave the countryside; rural areas must have all basic services, good transport systems and roads, as well as commercial, educational, recreational and health facilities.

In addition, there must also be a system for valuing the land where the distribution of burdens and benefits that urban planning brings could be made in an equitable way. The design of such a system is entirely possible. It requires a detailed knowledge of the territory, its opportunities and constraints, a national long-term plan with specific targets, development guidelines for the creation of a system of cities that support and complement each other, and, above all, equal housing conditions and jobs for the entire population.

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Anupama Kundoo

ARCHITECT

Buildings are large consumers of energy and material resources. In addition to its environmental impact they have an important social impact. The good architecture of the future will have to be better integrated into its environment and also be beneficial from a socio-economic point of view.

"The only way forward is through knowledge"

Buildings consume a lot of energy and cause a great impact on their environment. This has not always been the case, however: traditional architecture before the industrial era was intuitively in tune with sustainability. What can the wisdom of traditional architecture bring to future architecture?
AK. Traditional architecture is not something that belonged to a particular fixed time in history, but was also itself a slow evolution of knowledge and skills gathered through building upon the knowledge and discoveries of human society's engagement with materials and spaces needed for various activities, as well as to provide climatic comfort through available resources. In this sense, we are at a particular moment in this evolution and the standards of design efficiency and intelligence have already been set at a high level where materials and skills have achieved a lot with very little. Future architecture will be richer if it continues to be aware of what has already been achieved rather than imagining that the present or future begins on a clean slate. New research developments and the latest technologies should ideally be applied to take past achievements to greater heights, rather than merely to serve the whimsical and frivolous expressions that we allow ourselves in our times, where our reality is about growing environmental, social and economic concerns. This need not curb creative expression, but should instead provoke more imaginative solutions and scenarios.

You come from India, but you have worked in many countries. The twentieth century was dominated by International Style. Do you think it would be interesting to go back to local cultures and contexts to achieve a positive renewal?
AK. I would not formulate it as a 'going back' to anything, but rather as a widening of the perspective and a vision of the present (and future) as a continuity of the past. We obviously need to look forward without forgetting to be aware of the past, and of the consequences of our past choices that we can see better today. The future could be even more promising than the past if technological advances are used to achieve more with fewer resources. Today the world has a much higher population than in the twentieth century and the heyday of the International Style, and the per capita resource consumption among the privileged is much higher too. On the other hand, today we also aspire for a more equal society and the resources will not suffice if distributed fairly for all. So past standards are not likely to suffice, and greater innovative leaps are the need of the hour, to have a future idea of development that is not at the cost of major environmental destruction.

How important are materials in promoting better architecture from an environmental point of view, and also from the standpoint of human health and welfare?
AK. The importance of the choice of building materials cannot be overstated. Natural materials such as stone or wood do not require huge quantities of energy consumption in order to transform them into standardised, manufactured materials that can be ordered from factories. Furthermore, locally- ›

sourced natural materials significantly reduce transportation energy and may keep the material depletion in some kind of balance compared to the environmental impact that industrial quarries have on the territory, where materials are produced in bulk and transported to distant destinations. There are also growing health concerns in the case of several manufactured materials that exude harmful compounds and impact health. Then there is the pollution aspect. The choice when opting for manufactured materials must be made judiciously in the knowledge of these facts and in cases where natural materials cannot fulfil the spatial needs, but unfortunately the trend for selecting materials for contemporary buildings is usually an unconscious act. This could be due to habitual practice, ignorance or personal convenience for those who decide, rather than for the actual betterment of those who inhabit the buildings and spend all their life in them.

The social dimension of architecture is another fundamental aspect. Population grows faster than the possibilities of offering dwellings in good conditions for everybody. What needs to change in architecture so that it can meet the needs of all people to a decent standard?
AK. Affordable solutions are the key. Research, innovations and experiments are required to open up options of delivering environmentally sound, but also socio-economically beneficial approaches to building that are inclusive and allow people's participation in the construction if that can make housing more accessible to all. Innovations are urgently required for building technologies to become significantly more affordable than current ways of building, when talking about the future, many think of flashy design and focus on the appearance of buildings. But maybe the key to more sustainable architecture lies in the construction process (which often goes unnoticed)?

There is no reason why deeper values of healthy building practice would result in anything less aesthetically appealing. Flashy designs can be seductive and novel when they first appear, but

"Innovations are urgently required for building technologies to become significantly more affordable than current ways of building"

fashions and styles are always a temporary phase that pass by quickly and have a very momentarily gratifying wow factor. Then there is the timeless beauty that is eternal. I see no contradiction between benign materials and technologies being used for achieving good and contemporary architecture. It is a myth to think that architecture that is informed by unsustainable trends is necessarily a nostalgic return to the past. It is rather one which continues to envision a better future that is aware of the follies of the past and present, with long-term gains in mind rather than short-term impulsive reactions.

After a short time of crisis and hesitation (especially after 9/11), high-rise buildings have grown exponentially in the last decade worldwide. What is your opinion of this phenomenon? Does it offer something positive to sustainability or not?
AK. There is a growing concern around urban sprawl, gated communities and the rapid depletion of agricultural lands and forests. High-rise buildings do keep the footprint compact, but then they require high-tech services and high-tech construction. Low-rise – depending on what one calls high-rise, whether skyscrapers or buildings with more than 8 storeys – compact urbanism can in many cases also prove to be more efficient. So it is a question of balance, and cannot be generalised as a standard formula for development. You have to address this question in a site-specific way, taking into account the total developmental impact such as mobility, etc.

The presence of architecture in the media has been linked in recent years to spectacle and a kind of star system. Should humility and simplicity be vindicated as a pathway to more sustainable architecture?
AK. With more knowledge, society will naturally idolise the right kind of developments. You have to be careful with stereotyping human qualities and traits such as arrogance or humility and simplicity, in order not to create a kind of new religion out of sustainable

practices. Architecture is in any case a very complex profession requiring the capacity to synthesise complex information and knowledge and yet be visionary. The path to simplicity could be a complex one, and the solutions to our complex times cannot be too simple if they end up being naïve. For simple straightforward outcomes when going against the general tide, the architect's role could be even more complex than contemporary practice where going with the trends could be easier and 'simpler' for the architect but could have grave and 'complex' consequences for the collective, if all the implications are truly analysed.

Should architects think more about buildings' end of life in order to lower the impact of deconstruction on the environment? What solutions are available for this problem? And how can current practices be improved?

AK. The only way forward is through knowledge. Taking advantage of the knowledge and collective wisdom from across the world and across history, current practice could be improved if time were devoted for reflection and understanding of the emerging global picture, through past and current research in related fields.

Do you think that open innovation is good for future architecture? Can citizens really participate in buildings' design? Or can they just suggest some ideas that architects will then materialise with their expertise?

AK. Affordable solutions are the key. Research, innovations and experiments are required to open up options of delivering environmentally sound, but also socio-economically beneficial approaches to building that are inclusive and allow people's participation in the construction if that can make housing more accessible to all. If solutions are not affordable to the bulk of the population, we will continue to perpetuate the growing trend of urban poverty where there is a big mismatch between salaries and rent, where people with full-time jobs are not able to afford housing. There is a saying that the strength of the chain lies in its weakest link. If we want to increase the strength of the chain, then we have to work on strengthening the weakest points, or else that's where the system will fail, regardless of other areas that are already strong that we continue to strengthen further.

How do you see trends such as the Internet of things and Smart Cities in relation to architecture? Could they have a decisive impact on the way we conceive buildings or will they just be added technology? Do you think that in the years to come we will see buildings generating more energy than they spend? Is it feasible on a large scale? When will we see this paradigm shift?

AK. In many parts of the world, we still have huge unacceptable social disparity and stark differences in quality of life and access to basic services. Technological advances have their advantages but one cannot expect these to solve everything. There are other areas of necessary progress that we are neglecting, and alongside the technological rat race, these areas of necessary development must be taken along. Unless we achieve a relatively equal society with equal access to electricity, health, sanitation and education, then digital technologies will continue to empower the already privileged. Along with smart cities and intelligent buildings, we should also be concerned with smart and intelligent society, not that our objects and gadgets are smarter than us By this I mean that education is defined in a way that includes intelligence and not just access to information, where we can as a society at least discriminate between what is essential and what is superfluous, which today is not necessarily the case. Progress would be made if our education could achieve a society where we know at least as much as our ancestors did, which is not necessarily the case. Today people know how to use a lot of gadgets ›

"I would hope that the architecture of the 2050s would be more efficient, in the sense that it would take advantage of the technological advances as well as past achievements in order to deliver much more quality of life with fewer resources"

but may not be able to resolve problems and improve our lives directly. For example, today's architecture students do not know as much about climatically appropriate design, building physics, structural design or even basic geometry for that matter. This doesn't convince me that we are getting any smarter or intelligent, but rather gives the impression that only our gadgets know how to regulate our buildings and we ourselves are passive, and have no idea about first principles any more, and only rely on devices that we passively learnt how to operate. Technological advances are great, but becoming passive and failing to think for ourselves is a dangerous trend of our times. Nothing good can possibly come out of this trend.

Finally, I'd like to ask you to imagine the architecture of the 2050s: what will the most important features and ideas shaping buildings in the mid-twenty-first century be?

AK. If I were to be optimistic, I would hope that the architecture of the 2050s would be more efficient, in the sense that it would take advantage of technological advances as well as past achievements in order to deliver greater quality of life at the cost of significantly fewer resources. I would hope that the growing stark contrast in urban form between slum developments and skyscrapers would be a thing of the past and that development would mean taking everyone along, and not at the cost of the environmental depletion that we have gotten used to. x

Anupama Kundoo is a global architect, advocating a 'whole world' approach to housing practices. Born in Pune, India, and currently based in Brisbane, Kundoo began work as an architect in 1990 with a strong focus on reducing the environmental impact of building technologies. Rather than focus on grand architectural forms, Kundoo has immersed herself in the brick-by-brick detail of how structures are built, proposing architectural solutions that provide socio-economic benefits to the local area through a holistic and contextual approach to sustainability. Kundoo has built extensively in India and has had the experience of working, researching and teaching in a variety of cultural contexts across the world: TU Berlin, AA School of Architecture London, Parsons New School of Design New York, University of Queensland Brisbane, IUAV Venice and ETSAB Barcelona. She is currently Professor at UCJC Madrid where she is Chair of 'Affordable Habitat'. In 2013, Kundoo received an honourable mention in the ArcVision International Prize for Women in Architecture for 'her dedication when approaching the problem of affordability of construction and sustainability in all aspects'.

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Antonio Lucio

TRANSPORTATION MANAGEMENT EXPERT

Transport is one of the most difficult urban challenges to resolve due to widespread prominence of private vehicles and the difficulty of finding viable alternatives to them. Sustainability of public transport should be based on reducing environmental impact with clean technologies but also on the ability of a community to fund such transportation. Social dialogue is the key instrument for advancing in this field.

"Human needs are the true purpose"

In recent years there has been a trend to use the term *mobility* rather than *transport*. Why is that?
AL. I guess that the use of the term mobility expresses a significantly new vision of public policies that address the movement of people and things. This new vision goes beyond supply and demand policies and all the policies that focus on the requirements of vehicles and that are supposed to be based on rational decisions and planning "from above". The new vision of "mobility" focuses on demand management policies that are primarily focused on social and human needs for which transport is a purely instrumental aspect. These policies are responsive to non-motorised mobility and to the needs expressed by social forces "from below". The term mobility seems to respond to an impulse to humanise and to apply a collective intelligence in the understanding and managing of the reality of travel.

Why is transport (or mobility) so often said to be a key element of sustainability? Do you dare define policies for sustainable mobility?
AL. Mobility (or transport, or whatever you want to call it) has a quantitative and qualitative importance for the transition to a sustainable society and economy. The reality of current urban mobility patterns is disturbing. The problem has been created by urban expansion that is low density and spread out and dependent on the private car which is not connected to public transport. It is the symbiosis between this kind of urban development and current urban mobility patterns that is providing us with so many problems. To a large extent, the challenge of local sustainability (and also global sustainability) depends on this core of interactions, therefore we need to arrive at an intelligent social consensus about the city model. In developed countries, in which the urban hardware is almost complete, the challenge is to get it to work in a very different way from now. This evolution opens up fascinating prospects for government and business, as well as for social and technological innovation.

As for the second question, sustainable mobility policies are those serving the economic, social and environmental impacts resulting from the reality of transport in a balanced way. These policies need a minimum level of consistency, requiring measures such as cost-benefit assessments of investments and subsequent operations, an honest integration of mobility variables in environmental impact assessments of projects and evaluations of social costs, etc.

Sustainable mobility envisages a strengthening of humanism and democracy. The human factor must take centre stage in all reflection, planning and management. Values and decisions to be taken must therefore be legitimised by means of sufficient social consensus stemming from mature dialogue.

Aspects such as pollution or the excessive occupation of public space by vehicles are real problems for any city. What are the most advanced solutions to these two problems?
AL. I do not think "solutions" exist. What we need are intelligent dialogue processes in every city, even in every neighbourhood, agreeing on possible solutions adapted to each specific case. The ultimate ›

responsibility to make decisions does however lie with the competent authorities. And although some of these decisions may prove unpopular, dialogue should always be useful.

There are two types of measures of a general and strategic nature that are of utmost importance: diagnoses of urban mobility and urban mobility plans. I would like to stress the importance of diagnoses, specifically in the characterisation of mobility patterns. The recent economic crisis has threatened several vital studies performed on a recurring basis (such as household mobility surveys). With a forward-looking vision, some studies are aimed at achieving similar results at a lower cost, as is the case of the analysis of certain sources of "big data".

On the other hand, we must not do away with many empirical sources that are also vital for knowing what actually happens in our streets in terms of mobility, such as regulated car park services; the characterisation of the vehicle fleet; the characterisation of professional mobility activities (especially merchandise distribution); or the actual magnitude of the demand for pedestrian mobility.

Mobility Plans allow for long-term thinking beyond short electoral cycles. In the coming decades, addressing pollution and the occupation of public space will develop the need for an "art of government". Emerging countries have increasingly begun to surprise developed ones with their talented solutions, which will prove decisive in knowing how to integrate technologies and their potential. It will also be vital to manage political consensuses. Air quality management, with enforceable standards in relation to the characteristics of the vehicle fleet of each city (which will not change sufficiently over the next twenty years), will lead to certain limitations on private vehicles in terms of road surface, meaning lower road capacities and fewer car parks than today. This substantial recovery of public space will provide room for bus lanes and bike paths.

Some cities have developed initiatives to limit the use of private vehicles in certain areas, usually the city centre, establishing different types of urban tolls. Is not there a danger that these initiatives will end up penalising those with the lowest incomes and generate "mobility poverty"?

AL. It makes perfect sense to discuss this risk you point out and to raise the concept of "mobility poverty." Such a perspective must be taken into account, but we do not have to rule out tolls or other deterrents for private cars in urban centres (such as parking metres). Social concerns have to be incorporated into such measures. This should be done with transparency, knowing what is collected, the service costs and the benefits, if any. These benefits can be allocated to alternatives to private vehicles. This is what happens in London. This element is essential to partly legitimising the measure that has been taken. You also have to monitor and publicise the measure's deterrent effect. Of course implementing an urban toll requires an honest and courageous public debate. Scandinavian capitals have held referendums on the subject in the first decade of this century. All variables involved must be on the table in the designing of equitable models. Here technology offers a real opportunity to factor in exceptions and price graduations. It should be noted at this point that the true social cost is congestion, or in other words, the valuable time lost by captive public transport users. City centres are usually well connected by mass transport with the outskirts, but the various peripheral areas are not well connected with each other. I am thinking of some residential areas and business parks, for instance. Here the supply of public transport is poor, and this is where everyday situations of inequality occur.

Most public transport systems are held together by the state contribution. Is it worth considering their profitability or should this issue take a background role due to the social benefits that public transport generates?

AL. Citizens should be familiar with how much it costs to maintain public transport. We should all know the costs involved with running our bus, metro, tram and suburban rail networks, including public bicycle schemes. It seems important to introduce a *sentimental* aspect to this reflection on the economy.

"Economic maintenance of public transport should be a truly familiar matter to citizens. We should all know the cost of our bus, metro, tram, and suburban train networks, including public bicycles"

I am referring to a *personal* identification with the city's public transport, which could help us become more aware of funding issues. In the Western world, government subsidies usually cover 50% of the costs and users the other 50%.

Let's talk about technology: Smart Cities, Big Data, the Internet of Things... Could a sensorised urban space be the ultimate tool for sustainable mobility?
AL. I think that we would be deceiving ourselves if we referred to all of these devices or technological services as "the ultimate tool" for sustainable mobility. I understand this question is asked because the idea has been floating around recently, but we must be clearheaded on the subject. Obviously technological innovation offers extraordinary instrumental possibilities to improving mobility. Several key companies are involved in these new services, providing detailed images of future developments in the field. The media like them; they find the images very attractive. It is clear that big business is around. However, we must maintain a critical perspective on the public spending associated with the application of these technologies in different policies. This means that these policies must have clear objectives and specific measures. Only then it will make sense to invest proportionately in Information Technology (IT). The real challenge is to know how to define these policies, their objectives, measures and priorities in a consensual and realist manner. If strategies cannot be agreed upon, the presence of IT may be viewed with mistrust.

There are however obvious benefits from the use of IT, such as all the data which may be made available for better governance though the evaluation of public policies and mobility measures. IT could also be beneficial for providing services with flexible and open strategies, and for new collaborative business models.

Could you talk more specifically about the use of Big Data in mobility?
With proper management of data analysis and supplemented by other data sources, Big Data can provide highly valuable knowledge which until now was only available at a considerable economic cost. Such is the case of the analysis of phone calls compared to household mobility surveys. However, we have to be responsible because there is relevant data that is not going to come from big data, especially for areas of high priority, such as the characterisation of pedestrian mobility. But it is true that in the context of public spending cuts, big data becomes very important. The introduction of smart parking metres in Madrid is a very interesting case in which many representative samples that were taken manually are now automated, making them a mine of information. Anyway, we still need to observe reality to understand what's going on, such as physically witnessing parking infractions in the street.

What contribution can driverless vehicles make to sustainable mobility?
The idea of driverless vehicles is an exciting technological challenge. But I am not sure whether this challenge responds to real social needs in terms of mobility. And this makes me think about an important issue that must be considered: the dissonance between technological innovation agendas and public policy agendas. There is a certain risk that a permanent yearning for technological progress becomes a goal in itself and not in reference to needs that must be included in the agenda on public policies. I have personally participated in meetings between technological innovation experts and mobility experts from the same administration and it was the first time they had seen each other. Although this sounds surprising, it is all too common. ›

One way to stimulate scientists is make them feel part of an effort to make real progress. But there is a real danger of generating despair because of the difficulties in implementing an advance in a satisfactory manner. A good example is the difficulty of implementing electric vehicles that has to do with flawed public policies. Without the minimum political will, it is difficult for technological advances to be implemented.

Transport is certainly a complex system with many variables. It also has a huge potential to generate problems if good decisions are not taken. Transport has historically been a field only for technicians. To what extent could citizens contribute to mobility decisions? Is it possible to talk about democratisation in this field?

AL. Yes, democratisation is possible in decision-making on urban mobility, and not only possible, it is essential if we want to act in a rational manner when approaching desirable solutions. Urban mobility tests the capacities of collective intelligence. Mobility cannot be managed only by a wise few who can develop their creativity to offer a solution to everyone's needs. This top-down approach has been the general pattern for urban planning and mobility during the twentieth century. Especially after World War II, a kind of authoritarianism became widespread based on the alleged scientific evidence for decisions. The influence of urban dogmas of "modern architecture" in connection with mathematical models predicting traffic demand produced a determining dehumanisation of mobility planning and public space. This mode of operation has been normal in democratic societies for decades. There is now a realisation of the failure of those solutions and the need for smarter decision-making processes has been recognised. In our day and age we are constantly witnessing the reversal of decades of dehumanised measures: roundabout overpasses are being torn down and footpaths are being widened, among other measures

How would this participation materialise?

AL. The need for deliberative processes is clear. In theory, this can slow processes down, but in the end the result is worth it. Some philosophers, such as Daniel Innerarity, have spoken of a "democracy of knowledge". Mobility is a great example: the value of practical experience provided by multiple actors

"I recognize that the idea of driverless vehicles is an exciting technological challenge. But for me it is unclear whether that challenge responds to social needs concerning mobility"

is essential. If we consider bicycle lane networks in our cities, everyday users will identify the best solutions for intersections, or the best options for routes overcoming barriers provided by major infrastructures. It would be much more difficult, if not impossible, for this work to be done by the administration or consultancy companies working for it. The same applies to school routes, pedestrian routes in general or merchandise distribution networks. Moreover, not considering the knowledge that comes from below involves a risk that decisions taken from above will not be understood or even misunderstood so that they generate rejection which can lead to failure. That was the case with the London congestion charge and its extension west of the city that was finally rejected. The extension was undoubtedly necessary, but it was discredited for not including the population directly affected. x

Antonio Lucio has been a member of the Body of Lawyers of the Madrid Assembly since 1991, assigned to the Environment Committee. In 2001 he went on to hold positions related to management innovation processes in environment and sustainability, including managing director of promotion and environmental discipline, director of environment of the Madrid 2012 Olympic Project and director of the Mobility Foundation of Madrid (2006-2011). Antonio Lucio has been also vice president of the Green Building Council in Spain. Currently he is a member of the board of World Wildlife Fund in Spain, professor at the EOI-Madrid, and director of the online magazine Ecosostenible.

www.esmartcity.es/empresas/fundacion-movilidad

Frauke Fischer

ELECTROMOBILITY EXPERT

Although the electric car still shows some limitations, the most advanced cities are developing plans to integrate it in transport systems. Charging points increase and local governments offer electric vehicle drivers some advantages. The ultimate goal is not only the presence of electric cars in the streets but also a shift in culture and mentality regarding urban mobility.

"Changes in behaviour have never been achieved overnight"

According to statistics, the transport sector is the largest and the fastest growing source of CO2 emissions. The fact that aviation and shipping do not have a clear alternative to the use of fossil fuels transfers a great deal of responsibility to ground transportation, particularly cars, trucks and buses. However, there is an alternative for these vehicles: electric power. The question is why, after two decades of tackling climate change, has this alternative not become mainstream? And why does road transportation still rely mainly on fossil fuels?

FF. That is a true fact. Even though the first electric vehicles appeared on the roads around the middle of the nineteenth century, they did not go into series production. The massive development and improvement of combustion engine vehicles in combination with the high cost, the comparably low top speed and the short battery range led to electric cars' niche existence.

Nowadays, state-of-the-art electric vehicles do however offer a significant opportunity for a variety of uses. With an average range of 150km/battery load, they are the optimal choice for vehicles used in urban environments, where the average operating range of a car per day is usually below 50km. Just to name a few, these could be commercially operated car fleets, public transportation and heavy duty freight, as well as last mile logistics and private use. Nonetheless, potential end customers often still suffer from range anxiety and a rather problem-oriented ("what-happens-if?") way of thinking.

Field tests and experiments in different countries and various environments have shown that in the end – besides price and availability – it is well-functioning systems that lead to success and an increasing number of electric vehicles on the roads. Such systems include an available and suitable (publicly accessible) charging infrastructure, as well as services tailored to the electric car user such as repair shops, fast charging, alternative vehicles for long-distance drives and extended fleet management tools and the like.

With the lessons learned on climate change and environmental pollution behind us in 2016, we are (once more) at a point in time where battery electric vehicle technologies are ready for market uptake, offering a real and sustainable alternative to fossil fuel driven vehicles.

Electric vehicles (EV) come with issues on cost, range and charging speed. Can you explain more about the difficulties connected to these issues and how they can be overcome?

FF. As EVs are still a niche product for most producers today, the purchase price for an electric vehicle is still significantly higher than for a similar combustion engine vehicle. Only small discounts are granted as availability is still limited. Therefore, at first glance, EVs seem to be an expensive alternative, offering less for more money. ›

This is, however, proven wrong the minute you follow an extensive TCO (total cost of ownership) approach. Taking into consideration aspects such as the very low maintenance cost and reduced energy cost compared to fossil fuels, electric vehicles become a low-budget and attractive alternative. Such individual and overall TCO calculations should therefore become part of every sales process and purchase decision for EVs.

Another financial aspect is the unclear salvage value of a used electric vehicle. As close to zero second-hand EVs have been put on sale, a retail market is yet to be established. However, fleet operators as well as private car owners often consider value retention an important aspect when identifying the pros and cons of a new vehicle. This issue will become more transparent as an increasing number of second-generation EVs are put onto the market.

The above mentioned TCO and price-value-constraints are fired by the range anxiety of potential customers who are afraid that they cannot use an electric car without having to change established mobility and behavior patterns. They envision themselves getting stuck on a deserted road with an empty battery without being able to (quickly) recharge nearby. To disprove such anxieties and arguments, some things need to be understood and explained: today's EV generation offers a driving range of about 150km, and considering the average operation range of a passenger car in an urban environment is less than 50km per day, running out of energy is not very likely during a day's use.

There are diverse sentiments and expert opinions in the sectors on whether or not public charging is necessary at all. Some people believe that overnight charging (at a slow speed) is the only necessary infrastructure needed. However, there is proof from markets in different areas and countries worldwide that the development and provision of a comprehensive, area-spreading charging infrastructure network is essential for significant and rising e-car use in a region, including urban areas as well as well chosen fast-charging spots on mayor highways.

"With an average range of 150 km / battery load they are the optimal choice for vehicles used in urban environments, where the average operating range of a car per day is usually below 50 km"

Regions wanting to enforce the use of electric vehicles should thus always follow a common concept for building up on charging infrastructure to ensure that sufficient charging spots, offering different charging modes (speed, type of plug etc.) are available for EV users with common access and payment methods.

There is also some criticism about the ecological impact of batteries. Could this be a major drawback for the EV?

FF. Not really. On the one hand, there are various approaches to second life concepts, using batteries as stationary storage units in smart energy grids. A large economic potential lies in the storage capacity of outdated batteries once we reach a point where significant numbers of batteries will become available for the second-life battery and energy market. Such second-life energy concepts will ensure sustainable usage of the batteries even when they are no longer needed or are unsuitable for driving.

Moreover, in the long run, new battery concepts (post-lithium-ion-batteries) are expected to offer better and higher energy density using less noble earth under improved manufacturing processes.

You are a project manager at eMO, the Berlin Agency for Electromobility, and focus on promoting EV from a very cross-cutting approach involving expertise from business, science, politics and public administration. Why have you chosen this kind of approach? How does it work in practice? Could you give us some examples?

FF. The Berlin Agency for Electromobility eMO is the central point of contact for electromobility in the German capital region. As such, eMO links and coordinates the players, acquires new partners for regional, national and international projects and promotes activities. All of eMO's activities push electromobility as a system, including and considering much more than just the electric car itself.

The root of today's electromobile activity landscape in Berlin is the "international showcase for electromobility Berlin-Brandenburg". Berlin-Brandenburg is one out of four regions in Germany that was chosen in April 2012 to take part in the Electromobility Showcase initiative targeted to test and promote electric mobility at the interface of energy systems, vehicles and traffic systems. In this regard, the objective of Germany's capital region is to turn Berlin-Brandenburg into an internationally-recognized model for all matters of electromobility.

In Berlin, we put a strong emphasis on giving everybody a chance to see and experience electric mobility first-hand in approximately 30 core projects and an equal number of associated projects with a focus on "driving, charging, storage, and integration." Over 100 project partners from the worlds of politics, business, and science helped establish a great base for future development.

By today there are about 100 active projects running in the capital region. No matter if the project focus is on e-logistics, smart city quarters, vehicle and component development, individual and public passenger transport, or energy and charging infrastructure, they all share a common mindset: it is only if you envisage and drive electromobility "as a whole" that you will create an e-environment that is attractive to everybody´s mobility needs in the long run. Therefore eMO's projects have a comprehensive "from well to wheel" reach that always considers renewable energy sources, people´s mobility needs, innovative vehicle concepts and city concerns with the objective of strengthening local businesses and creating new and innovative activities and jobs.

To put it in a nutshell, you could conclude that eMO's work is targeted at promoting electromobility as an essential part of a smart city's (e)mobility landscape, also including future trends such as digitization, intermodal passenger transport, urban logistic concepts and assisted and automated driving.

Do you think that the promotion of the EV could be more successful on the local (municipal) level that on the national level? If so, why?

FF. Examples from various countries have shown that the promotion of EVs can give a notable boost to the market, resulting in higher sales figures and a notable share of EVs in traffic figures. Now, as we have entered the phase of "market uptake", incentives can have a significant effect on market development and market penetration.

The monetary promotion of EVs should not however be carried out as a stand-alone action in order to reach long-term and enduring results. It will only be if the development of a publicly accessible, easy-to-use charging infrastructure is driven in parallel that constraints such as the omnipresent "range anxiety" will be overcome.

If the use of renewable energy sources for recharging batteries is also addressed, the electric vehicle market will profit from a monetary promotion and develop from niche to mass market in the near future. ›

This process of spreading electromobility is naturally taking place in different parts of the world. What is your opinion of this universal movement? Do you think that this global process is accelerating and we will see real changes in the next decade? Or things will keep going at a slow pace like in recent years?
FF. It is my strong belief that electromobility is at a tipping point, ready to take up speed and notable market shares.

Unfortunately there has been some public disappointment and harsh criticism in regards to the rather small increase in EV numbers on the road. However, we must keep in mind the progress we have made and where we have come from: until 2014/2015 the market was mainly an "early adopter" market. There were few vehicles from series-productions available, often offered at a comparably high cost level. In this phase of "market preparation", total availability of cars and infrastructure hindered serious market penetration.

In 2015/2016, however, we entered the stage of growing and notable market development, marked by improved and competitive TCO figures, market segmentation, larger and more attractive product portfolios and attractiveness for the general public. The next three years will be essential for the uptake of the market on the way to becoming a global mass-market.

The EV is more than a means of transportation: it can also be part of an energy network in the context of Smart Grids development. Could you explain more about this role? What benefits will be offered to citizens?
FF. The role of a singular electric vehicle in terms of smart energy grids is rather small. However, if there is a significant number of electric vehicles on the road as part of a mobility and energy system, the potential of the vehicle´s battery storage capacity as part of a mass-storage becomes quite attractive in a smart grid contexts (similar to "the wisdom of crowds"). In the future, EVs will be able to participate become a notable and active element in energy networks and support the load and power management.

So called vehicle-to-grid (V2G) functions describe a system in which EVs communicate with the electric grid and either return electricity from the car´s battery (peak demand periods), throttle their recharging rate or even take up extra energy from the grid in times of peak production. Vehicle-to-grid is classified based on the power flow direction – unidirectional V2G and bidirectional V2G – of which only few bidirectional models are available on the market today.

The benefit to citizens is the chance to become an active part of the energy market. They will be able to offer and sell electricity to the grid and at the same time control and decide when (at what time and what price) they wish to recharge their vehicle.

The other benefit is on a public level, as EVs can make energy grids more reliable and stable and can help promote the integration of (more) renewable and flexible energy sources into the grid as the vehicles help balance loads for example by charging at night when demand is low and sending power back to the grid when demand is high. Peak load leveling in return provides utilities with new ways to provide regulation services (keeping voltage and frequency stable) and provide spinning reserves (to meet sudden demands for power).

Do you see EV implementation in cities as an opportunity to change not only mobility, but also cities' morphology and functions by increasing pedestrianized areas, moving from the concept of private cars to carsharing, changing merchandise distribution patterns? Could the EV be a key player in the shift towards more sustainable cities?
FF. Turning the city into a more livable – meaning quieter, cleaner, and better – place to live is a clear target of our work. On the one hand, we are witnessing a worldwide trend for re-urbanization, while on the other hand, people are becoming increasingly concerned about the quality of life that they find in urban areas. This includes environmental constraints as well as the way people want to live and interact with their neighbors. In this regard, smart-(e)mobility development plans and concepts will

"If the use of renewable energy sources for recharging the batteries is addressed as well, the electric vehicle market will profit from a monetary promotion and develop from niche to mass market in the near future"

become an increasingly important argument and advantage of location for future smart cities.

In general, we see that people who are open to using an electric vehicle tend to also be open to new ways of living together in a city. Therefore issues such as co-creation, co-usage and sharing very often go together hand-in-hand with electromobiliy.

In Berlin, we already have a number of innovative and interesting activities going on linking smart-city-quarters and electromobility. Projects range from e-carsharing and the restructuring of public space (once there are less individually-owned vehicles parked and blocking the road), intermodal passenger transport linking individual transport and (existing) public transportation services, all the way to new concepts of last-mile-logistics and local distribution patterns.

When talking about the EV, most people think about the plug-in vehicle, but there is also the fuel cell hydrogen vehicle. How do you see the future of both types? Will one prevail over the other?

FF. It would be foolish to favour one technology over the other. In the end, it is much more likely that we will see a "peaceful" co-existence of both concepts as they both have their strengths and advantages in different areas: pure battery electric cars are a perfect solution for fulfilling mobility needs in urban areas. Cars used in cities hardly ever travel more than approximately 50km per day. Today´s state-of-the-art battery and vehicle technologies can already meet and fulfil such urban mobility needs without any range-anxiety.

However there will always be the need for longer distance travel in personal passenger transport, as well as for logistic and freight transportation.

Even though we see an emerging fast-charging infrastructure at highways and mayor motorways across Europe, it will not always be (economically) viable to realize various re-charging processes along the road. This is where fuel cell hydrogen vehicles will provide the technology to meet economic and ecological demands at the same time.

At eMO we therefore address, support, and drive both technologies in parallel, believing that together they will form a balanced e-mobility landscape.

An important question that cannot be neglected in any process is how people react to it. Mindset is very important for acceptance or refusal. Today many people still see EV as a novelty, but not as the standard in mobility. How do you change this mindset?

FF. Changing people's mindset has been and always will be a longer process. Essential changes in behavior have never been achieved overnight.

It is therefore essential to bring electromobility into people's everyday life. If people see EVs on the road every day and at the same time get the opportunity to experience EV driving themselves, they will realize that EVs are no longer reserved for early adopters, technical nerds or the upper class.

Electric carsharing has proven to be able to have a significant impact on this mind-changing process as people can experience electromobility in their everyday life, without taking on any economic, comfort or status related risk. Therefore a large pure battery electric carsharing fleet was established in Berlin under the international showcase in 2012. Today we also see mixed carsharing fleets from big OEMs running in the city where EVs are very popular.

The Berlin agency for Eletromobility eMO is the central point of contact mainly on a B2B level. In parallel we intend to set up and develop more and more places for everybody to get in touch with ›

electomobiliy. This may take the form of central stations for passenger transport where we link "traditional" passenger transportation with e-Busses and e-Bikes, powered by renewable energy sources. It may be a center for e-mobility where businesses and private users can find answers. It may be the city quarter (in Berlin called "Kiez") where we drive e-carsharing in combination with other smart mobility solutions. It may be an electric garbage truck, noiselessly emptying trash containers.

In any case, the bottom line is that people need to experience (look, feel, drive) electric vehicles in their everyday life. They need to see and believe that "it works" without having to give up on the personal quality of mobility in life.

In the end, the goal should probably be to let everybody know about the "joy and fun involved with driving an electric vehicle"

And, finally, from your experience in eMO, do you think that electromobility could stimulate local economic growth?

FF. Driving economic growth by supporting local businesses, attracting new companies to the area and thereby creating new jobs is a central point of action for eMO. In this regard, the region's many local advantages and opportunities are systematically put to use in order to promote economic development while ensuring a higher quality of life and improving environmental protection.

Germany´s capital region has managed to become a veritable open-air laboratory for smart e-mobility, where practical applications are tested and adapted for industrial-scale rollout. Concepts and products with "proof of system" in Berlin have a high potential to be applied internationally and become an "export hit".

Today we see Berlin as a highly attractive location for established players as well as for innovative (e) mobility start-ups from all over the world. In close cooperation with Berlin's universities and academia, they form the breeding ground for economic growth and wealth as well as ecological balance in the region. x

Frauke Fischer joined the Berlin Agency for Electromobility in 2013 where she is responsible for intermodal passenger transport and the development of electromobility topics for the smart city of Berlin. She studied business economics in Germany, France and Ecuador before she started her career in the field of renewable energies with a focus on photovoltaics (solar energy) and the development of energy efficient building solutions. Over the years she has worked on different projects as an international project manager in Spain, the US and Germany.

www.emo-berlin.de/de/ueber-uns/team/

Carlo Ratti

ARCHITECT, ENGINEER AND EDUCATOR

A smart city uses information and communication technologies (ICT) to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to improve contact between citizens and government. Sectors that have been developing smart city technology include government services, transport and traffic management, energy, health care, water, innovative urban agriculture and waste management.

"Our cities are becoming computers on open air"

How would you summarize the work of the MIT Senseable City Lab?

CR. Senseable City Lab started around 10 years ago. At the time, new technologies were promising exciting transformations in communication, transportation, and fabrication. We tried to imagine how these developments could impact urban studies and how the interaction between the digital and physical world would affect the way we understand, design and ultimately live in cities. In other terms, we decided to explore how ubiquitous computing – i.e. the increasing deployment of sensors and hand-held electronics – is opening up a new approach to the study of the built environment.

Does sustainability drive the lab, whether directly or indirectly?

CR. Our core is focusing on the quality of life in cities starting from concrete urban problems such as energy, traffic, waste, and water management. Sustainability is a key driver, but in a certain sense it's an indirect one, inasmuch as it comes from citizen issues.

You have said that "digital technologies are becoming networked and atomized, hence changing the interaction between humans and the built environment". Can you explain this phenomenon in more detail? What are the main consequences for the built environment and for humans?

CR. The idea is easily explained. What is happening at an urban scale today is similar to what happened two decades ago in Formula One auto racing. Up to that point, success on the circuit was primarily credited to a car's mechanics and the driver's capabilities. But then telemetry technology blossomed. The car was transformed into a computer that was monitored in real time by thousands of sensors, becoming "intelligent" and better able to respond to the conditions of the race. In a similar way, over the past decade digital technologies have begun to blanket our cities, forming the backbone of a large, intelligent infrastructure. Broadband fiber-optic and wireless telecommunications grids are supporting mobile phones, smartphones and tablets that are increasingly affordable. At the same time, open databases – especially from the government – that people can read and add to are revealing all kinds of information, and public kiosks and displays are helping literate and illiterate people access it. Add to this foundation a relentlessly growing network of sensors and digital- control technologies, all tied together by cheap, powerful computers, and our cities are quickly becoming like "computers in open air."

Overall, I believe that the transformations brought along by technology are positive. The French anthropologist Leroi-Gourhan in his essay *Le geste e la parole* underlines how it is possible to draw a curve of human civilization simply looking at the way tools are used across history. From the Neolithic to the twentieth century, from the first utensils made of rocks to the development of digital technologies, ›

from stone axes that extended the capabilities of the hand to "outsourcing" to computers our mental processes, progress has always been profoundly marked by the gradual subcontracting of our functions. The development of new technologies always had the same goal, that is, to increase our chances and possibilities. The possibility to act, the possibility to create.

What are the advantages of the real-time city coming from Big Data? How can such an enormous amount of data be processed to the benefit of the city? Will we be able to develop more efficient urban centers with this technology?

CR. First of all, just a comment on the amount of information we produce today, which is staggering. If the amount of data produced from the dawn of civilization up until 2003 can be estimated in five exabytes, according to Google's former CEO Eric Schmidt, "today that same amount is created every two days" (a prediction which is itself a few years old!). The possibilities are invaluable and we have begun to explore them. The information we can collect from the city around us can help us understand, design and manage it. It is nothing new than what planners and urban designers have always done. Elysee Reclus, over 100 years ago, wrote that before "planning"we need to start "surveying". Today it's the same, but we have an unprecedented ability to survey our cities through Big Data.

You have been working on some interesting projects such as the Copenhagen Wheel. What is this project about? And more generally: do you think mobility is one of the areas that will experience more changes as a result of sensors introduction?

CR. Mobility – and the air pollution that results from it – is a crucial issue in our cities. According to the World Health Organization, up to 7 million premature deaths annually are linked to air pollution. The Copenhagen Wheel started as an experiment into human powered mobility and air quality sensing.

It quickly and easily transforms any bicycle into a smart electric hybrid simply by replacing the back wheel. The Copenhagen Wheel also allows you to collect data about your cycling activity (riding habits, calories burned) and about your surroundings (air quality, etc.). You and the community can use the data to change your cycling patterns, for instance avoiding polluted areas. And the city can use the data to build new cycling paths and other cycling infrastructure. It's all about feedback loops: how data can inform urban change.

In your book Open Source Architecture you claim that Open Access Networks can make democratic architecture become a reality. Normally we are used to top-down architecture (from Star Architects!) Do you see a paradigm shift in the near future with bottom-up proposals shaping cities?

CR. In the book, we highlight the possibility, reviewing some of the transformations that they have already produced in other fields. I am not sure if we will see the death of the star architect, but for sure we will be able to have new forms of engagement.

Do you think there is enough collective intelligence to enhance management on complex issues such as energy or waste through networks? Shouldn't we talk about smart citizens rather than smart cities?

CR. Absolutely, people can be the intelligent agents of change.

Here is a little anecdote from our Trash Track project. We focused on how pervasive technologies can expose the challenges of waste management. Using thousands of small, location-aware tags, we followed different types of trash through the city's waste management system, revealing the final journey of our everyday objects.

An important lesson we learned is how data can enact behavioral change. It can provide citizens with information that ultimately empowers them to take more informed decisions or even have a role in changing the city around them, which results in a more livable urban condition for all. People involved in the project were able to follow their trash traces. At the end of the project, one person told us: "I used to drink water in plastic bottles and throw them away and finally forget about them. Now I cannot do that anymore. I know that those bottles go to a landfill just a few miles from home, and because of this, I stopped drinking water in plastic bottles..."

"According to the World Health Organization, up to 7 million premature deaths annually are linked to air pollution"

Do you envisage this urban data revolution creating new professions or altering deeply existing ones? Which professions could be more affected and how?

CR. We are now living in a hybrid space between the digital and the physical world. This space offers a lot of possibilities for architects and designers. Architecture has always been concerned with designing interfaces between people and their environment. When we lived in the grotto, this environment was made of atoms; today is a hybrid space made of bits and atoms. The definition of architecture has not changed, but architects have to face a new reality.

Also, architects probably have to be more "future-facing" and engage in what we call Futurecraft. As Herbert Simon wrote:
"The natural sciences are concerned with how things are... Design, on the other hand, is concerned with how things ought to be, with devising artifacts to attain goals... Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Herbert Simon, The Science of Design, 1988).

I believe that designers must challenge what exists today, introduce new and alternative possibilities, and ultimately pave the way towards a desirable future. This is not dissimilar to the conceptual framework of 'speculative design' proposed by Anthony Dunne and Fiona Raby at the Royal College of Art, as it is a process that neither attempts to solve problems nor predict the future. Rather, they understand design as a "catalyst for collectively redefining our relationship to reality," speculating on how things could be. Even earlier, Buckminster Fuller's Comprehensive Anticipatory Design Science (CADS) was a systematic approach to design, "to solve problems by introducing into the environment new artifacts, the availability of which will induce their spontaneous employment by humans and thus, coincidentally, cause humans to abandon their previous problem-producing behaviors and devices." He believed that design could pull society into a brighter future (or, to put it in a slightly haughtier way, "I just invent, then wait until man comes around to needing what I've invented").

However, the designer must peddle abstract ideas. Crucially, the work must be made tangible, not necessarily creating fully functional products and systems, but demonstrable concepts that promote interaction and debate. The goal of design is to generate alternatives and open up new possibilities. The momentum of the crowd can project ideas into the future and spark development; as a result, our work is meaningless unless it ignites imaginations. At the urban scale, this implicates any and every citizen.

Living in space and creating space can go hand in hand. A system does not need to be fully developed, deployed, and succeed/fail. If it is tested, we can collectively adjudicate its desirability before wasting resources, ultimately accelerating the future. Broadly speaking, this frames design as evolutionary, where beneficial changes will steer development in a positive way. In fact, biological species do essentially the same thing, on an extraordinarily long timeline. Random mutations are introduced from one organism to the next, and if the mutation is successful, that organism will be more likely to reproduce. The best changes are incorporated into the species, and, over time, it evolves.

In a seminal 1863 text, Darwin Among the Machines, Samuel Butler proposed this basic analogy, replacing 'organisms' with 'artifacts' and allowing for the synthetic kingdom to be classified into genera and species, an evolutionary tree of objects. Continuing the analogy, the designer becomes what, in biology, is referred to as a 'mutagen': an agent that produces mutations. Specific design artifacts improve function or enable a new process, and on a broad scale, collectively drive change and development in the synthetic world. This, we call "Futurecraft." ›

Old cities have grown in what might be referred to as a historically unplanned 'organic' fashion. Will cities of the near future return to this path? Will urban planning fall out of fashion with collective intelligence taking the lead?

CR. Since the emergence of cities over 7,000 years ago, planning has always been in between bottom up and top down. Roman engineers would start a new city by tracing two axes – the Cardo and the Decumano – and then let people build in between them.

However, something went wrong in modernist times. Think about cities such as Costa and Niemeyer's Brasilia or Corbusier's Chandigarh. Brasilia is a beautiful city when you look at it from the air, shaped as spread airplane wings. However, it is a city that does not take into account its citizens' needs. If you are a pedestrian, it's almost impossible to walk around in the city center (everything is designed for cars) or enjoy its surrounding lake. I would say that Brasilia shows the shortcomings of Modernist urban planning, with its lack of sensitivity to people. Something similar happens in other cities built around the same time. Take for instance Chandigarh, India, another capital that was built after World War II, and that is so conceptually staggering and yet so staggeringly uninhabitable!

Luckily, today people's voices and actions can be better heard, hopefully before similar mistakes are made again.

For many planners and authorities, city traffic is a big problem to solve. Others, more radically, want cars out of town and dream of endless pedestrian boulevards. What role do cars play in cities and how could they be more useful to citizens?

CR. Cars can be part of the mobility solution. However, today's cars are idle 95% of the time, so they are an ideal candidate for the sharing economy. It has been estimated that every shared car can remove ~10-30 privately owned cars from the street. Also, the impact of carsharing will grow exponentially with the advent of self-driving. Self-driving vehicles promise to have a dramatic impact on urban life because they will blur the distinction between private and public modes of transportation. "Your" car could give you a lift to work in the morning and then, rather than sitting idle in a parking lot, give a lift to someone else in your family, or, for that matter, to anyone else in your neighborhood, social-media community, or city.

A recent paper by the Massachusetts Institute of Technology's SMART Future Mobility team shows that the mobility demand of a city like Singapore – potentially host to the world's first publicly-accessible fleet of self-driving cars – could be met with 30% of its existing vehicles. Furthermore, other researchers in the same group suggest that this number could be cut by another 40% if passengers traveling similar routes at the same time were willing to share a vehicle – an estimate supported by an analysis of New York City Taxis shareability networks. This implies a city in which everyone can travel on demand with just one fifth of the number of cars in use today.

Such reductions in car numbers would dramatically lower the cost of our mobility infrastructure and the embodied energy associated with building and maintaining it. Fewer cars may also mean shorter travel times, less congestion, and a smaller environmental impact.

How can poorer countries benefit from the advantages of this technology we are talking about? Is it really something within reach of their economic capacities?

CR. Every technology needs to start somewhere. In the beginning, it will be used only by a minority. If some of the technologies we are talking about are not yet accessible, it is encouraging to see that for many others – such as mobile phones – the divide is rapidly disappearing all across the planet, and we detect more and more encouraging signs of leapfrogging, where those who were behind jump over those who are ahead...

Aren't you afraid that sensors technology could be used in an undemocratic way by some governments against its citizens? Is that possible?

CR. We all need to be very vigilant, as the past shows that every new technology can be misappropriated. x

Carlo F. Ratti An architect and engineer by training, Ratti practices in Italy and teaches at the Massachusetts Institute of Technology, where he directs the Senseable City Lab. He graduated from the Politecnico di Torino and the École Nationale des Ponts et Chaussées in Paris, and later earned his MPhil and PhD at the University of Cambridge in the UK. Ratti has co-authored over 200 publications and holds several patents. His work has been exhibited worldwide at venues such as the Venice Biennale, the Design Museum of Barcelona, the Science Museum in London, GAFTA in San Francisco and The Museum of Modern Art in New York. His Digital Water Pavilion at the 2008 World Expo was hailed by Time Magazine as one of the Best Inventions of the Year. Ratti was a presenter at TED 2011 and is a serving member of the World Economic Forum Global Agenda Council for Urban Management. He is a regular contributor to the architecture magazine Domus and the Italian newspaper Il Sole 24 Ore. He has also written as an op-ed contributor for BBC, La Stampa, Scientific American and The New York Times.

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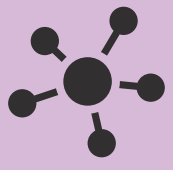
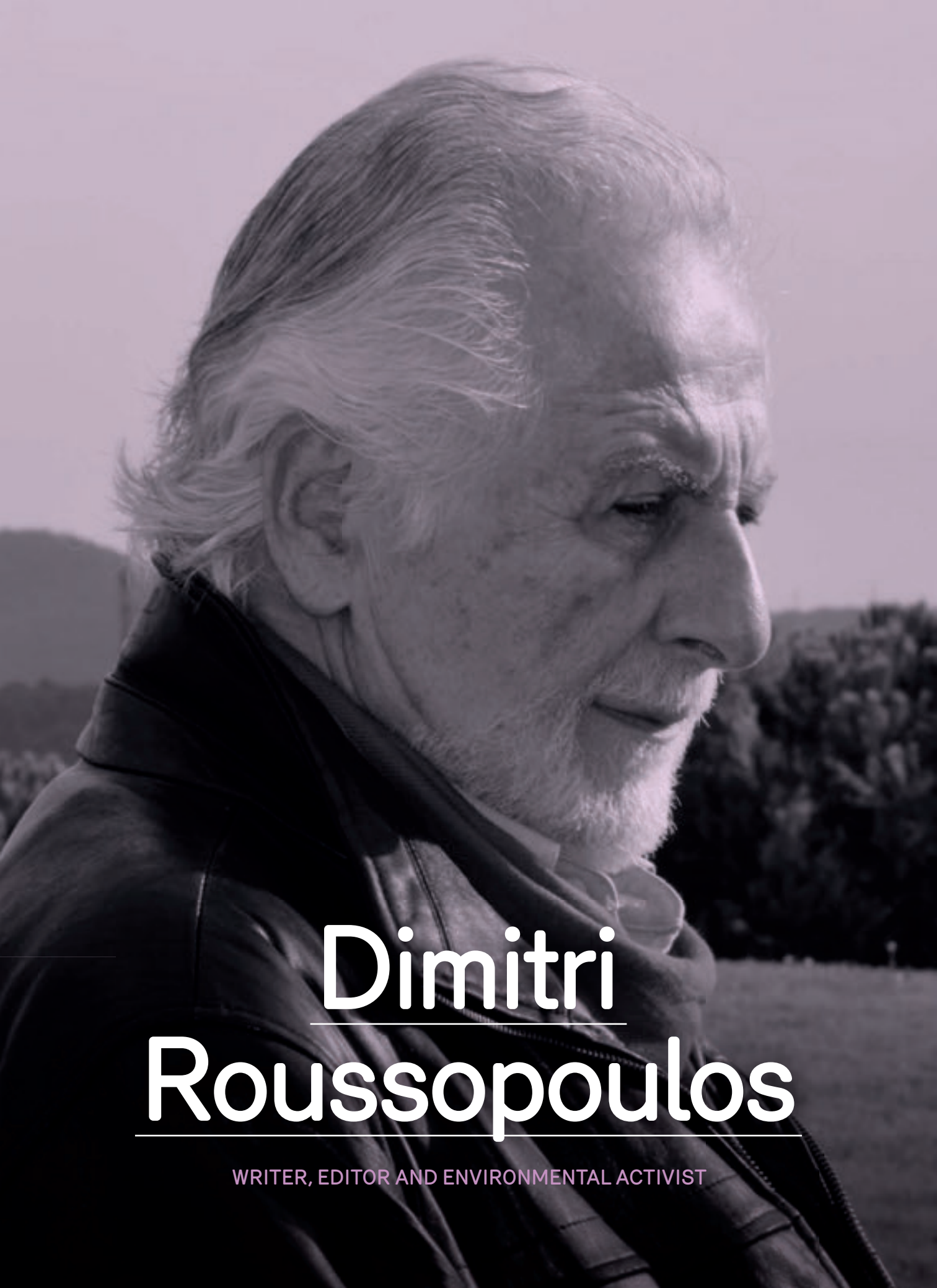
Local activists often do not trust the authorities, while governments and world institutions tend to minimise the importance of the messages generated by social unrest. The truth is that local, national and international spheres must all contribute equally to the fostering of debate and action driving change toward sustainability.



Initiatives for change

Dimitri Roussopoulos | Domingo Jiménez Beltrán
Marylin Mehlman



Dimitri Roussopoulos

WRITER, EDITOR AND ENVIRONMENTAL ACTIVIST

Citizens mobilizations have expanded in recent decades the concept of democracy by establishing new mechanisms of participation in public affairs. These mobilizations have managed to set the political agenda and have been able to transform simple protests in organized movements that operate strategically to achieve their social change goals.

"The enviromental crisis is not a problem with nature; it's a problem with our society"

We have witnessed the failures of so-called 'high politics' (international summits with their pompous and empty declarations) to address the major environmental challenges facing humanity. In this context, local communities appear to serve as a space for social, environmental and political hope. Why does this hope stem from small-scale decisions taken in local communities?

DR. I can begin answering this by saying that I have just spent two weeks in Paris at the COP21 events and that event is another example of how the process of trying to negotiate an international agreement between 195 countries produces results that are less than desirable. The 35-page document which constitutes the treaty, which is yet to be ratified and is terribly feeble and will not come into effect until 2020 anyway, is an example of the deadlock between national governments in terms of assuming serious responsibility towards climate change.

Parallel to the COP21 conference of nation states was the World Council of United Cities and Local Governments also held in Paris, which is the biggest global federation of cities and municipalities. Over a thousand mayors came from all over the planet, which shows that they took the challenge seriously enough. Though they didn't bind themselves by means of some highfalutin agreement, they agreed to many inter-urban policies and are able to go on and implement them, bypassing the inertia of national governments who are very much at the table of corporations. So there is a new reality that has entered onto the world stage. With this in mind, civil society can have real leverage to push their city governments and local city councillors and keep them accountable; this is a much more effective strategy of lobbying rather than going off to the national capital bowing and scraping and hoping for the best. For such a city-wide movement to be maximally effective, it has to be rooted in a whole variety of neighbourhoods rather than a few organisations' spokespeople.

Direct participation in public affairs dates far back in history, especially in ancient Greek cities, and is still alive today such as in modern Switzerland. Nevertheless, this model based on people directly deciding on important issues seems to be the exception not the rule. Do you see elements in today's societies that could catalyse a transformation in the near future and make advances in participatory democracy?

DR. In the last number of years, we have seen a real upsurge in the number of urban struggles in hundreds of cities. I am referring, for example, to the Occupy Movement, from Wall St to Syntagma Square to Tahrir Square, Tokyo, Hong Kong and Sydney. This represents an urban focus as a point of resistance and revolt, which reflects how people are aware of where power is focused and that they are prepared to take direct action by occupying public space. However, this movement was not influential enough, partly because, in many of these cities, it wasn't rooted in urban struggles, an exception being many Spanish cities such as Madrid and Barcelona, where ›

we have seen the election of radical left-wing mayors and municipal administrations.

Second, there can be no substitute, as the ancient Greeks taught us and as Murray Bookchin refers, for *pedaia*, which is the political education of citizens. We do not emerge from our mother's womb as citizens, we have to become them, and this moral and intellectual development requires a higher level of social and political education: people must know how the power structure works, its weaknesses and how to intervene effectively to demand fundamental changes.

Given you mention Switzerland, such a case shows that a democratic urban society requires certain democratic tools. This includes the general assembly of citizens who gather several times a year in scores of hundreds to decide on large policy directions for their canton, town or city. There is also the powerful tool of referenda, where collecting a certain number of names can force a referendum which is legally binding on the national government, rather than merely consultative. In Montreal, we pushed the city to adopt a Charter of Rights and Responsibilities, a UNESCO-recognised document. Among other things, it gives us the 'citizen's right to initiative', with which we can initiate public consultations at the borough or the metropolitan level, though they are only consultative. In Montreal, in the 2000s, we also held five citizen summits, bringing together citizens and organisations from across Montreal to discuss issues and make recommendations that we insisted upon to the City Hall.

So between all these factors are the ingredients to ignite a new thirst for democracy, for municipal democracy and even direct democracy. In January this year, there will be a whole conference in Utrecht in the Netherlands on stateless democracy. Amongst the many international movements represented, will be a particular focus on the anti-authoritarian society of Kurdish-majority north-eastern Syria, a region called Rojava. There, people are experimenting in forms of direct democracy based on street and neighbourhood assemblies, impressive gender equality and a remarkable respect for ethnic and linguistic diversity.

People's participation in public affairs is not a good thing per se, but rather if there is knowledge, critical awareness and, dare I say, common sense. Given our current situation ("our" meaning western societies) where alienation seems to be hegemonic, how can we articulate a 'quality' democracy over a 'quantity' democracy? What ethical values should prevail in order to build real citizenship?

DR. I would like to return to part of my answer to question two. People improve via two fundamental things: rational thought and experience. The first can occur through activities such as study groups, reading circles and documentary screenings. The second occurs through doing things in our community, by attending citizen assemblies, by discussion with other citizens, by marching in demonstrations and by organising resistance. Any attempt to create a democratic movement has to incorporate these two elements and that is how all the major political and social movements have developed.

Why is the city a favourable place for social change?

DR. As of 2007, most of the world's population were living in urban areas. Of all the cities, there are around 65 which effectively control the global economy; in these places, 400 of the world's major corporations have their headquarters and their elite staff. And so what we have to do is to take over these cities and turn them on their head. However, we cannot only make democratic and ecological cities, we also need to confederate them across the planet in order to collectively and co-operatively solve problems together on an international scale.

"In the last years, we've seen a real upsurge in the number of urban struggles. This represents a point of resistance and revolt which reflects how people are aware of where power is focused and that they are prepared to take direct action"

We do, however, then also have to wonder: what is a city? Murray Bookchin, in Urbanization without Cities, famously criticises modern capitalist urbanisation as the blind and anonymous massification of urban areas, something he distinguishes from a specific meaning of 'the city' as a living organism of cultural cosmopolitanism and vibrant communities of citizens that participate in their collective destiny. In doing this, he asserts that what we usually describe as 'cities' is a shadow of what they could be like, for which we need to create communities on a human scale.

What is your opinion about the Transition Town Movement? Do you see it as a possibility for a more sustainable economy and society?

DR. I don't think very highly of this movement. They are well intentioned, they are liberals, they are not anti-capitalists necessarily (some of them are and some are not). They don't question enough of the current social, political, economic and cultural power structure and they are not radical enough. They are not engaged quietly in a subversive way to turn the system on its head. They are engaged in changes, some of which are useful and important, but it is not clear what they want to transition towards. Do they want to transform to radically democratic and radically ecological cities? I don't think so. They want to transform parts of things rather than turning the system on its head. They don't talk about 'system change' as I understand it, which is radically transforming the power structure.

Among your many books, there is one called *The Public Place: Citizen Participation in the Neighbourhood and the City*. The book was written in 1999, a time when the Internet was developing but had yet to achieve the scope and power it has nowadays. To what extent can the digital era contribute to building a public place for communities? Is it really useful or can it be a drawback?

DR. The new technology is like a double-edged sword: it cuts both ways. It has created as much damage as it has helped us. It has distracted the new generation with the illusion of having many superficial relations, of which Facebook is the ultimate expression. It is a source of worry for me as it has not created assemblies nor ongoing convergences for movement building. It has helped us organise very effectively and the Battle of Seattle is an example of this; however, what makes this confrontation so famous, namely the blocking of world leaders from entering the WTC building (resulting in the cancellation of the conference), occurred not on an online forum but on the streets with flesh and blood people, communicating face to face and holding onto each other for dear life and in forming affinity groups face-to-face in preparation.

If we want to talk about being beyond the fragments, about building a living community, about a living democracy, there is absolutely no substitute for people interacting on a personal level, for seeing smiling or frowning faces, and for hearing people agreeing, disagreeing and raising their voices.

Technology should supplement rather than substitute that. There was (and maybe still is) a school of thought that imagined that democracy, even direct democracy, could be mediated totally through the internet. That has not worked and I don't think it ever will.

This is not to mention how heavily commercialised the Internet is as a place of marketing and consumption; nor how the Internet is so heavily monitored and even censored by the secret police of governments across the world, almost rendering the age-old practice of espionage through infiltration obsolete. ›

In recent decades, the idea of community has gone beyond any given physical place (and now I am not referring to digital communities) and has become related to specific ideas such as pacifism, feminism, GBLT rights and ecologic activism. Do you think that this partition should be transcended in order to develop a more comprehensive approach to social challenges, which are by definition complex and not segmented?

DR. This question is of tremendous concern to people like me, and that is how to bring fragmented constituencies together. It is a huge, huge, huge task. But I think that it happens from time to time and the imperative is to build on it.

The World Social Forum has, since the beginning of the alter-globalisation movement, been converging social movements to spark fundamental conversations about how our struggles are parallel and how we all envision a better world. As the 'Movement of movements', it has been doing this on not only a global level, but on continental, national, regional and local levels. Here in Canada, we organised the first such national forum in 2013 and it was the first time that Canada's English, French and indigenous left were brought together under the same roof.

In Paris during COP21, we also saw thousands of social movement activists converge from across Europe and beyond to participate in the demonstrations, workshops, fairs and discussions in opposition to the official negotiation process. At a weekend-long Village of Alternatives, Montreuil's streets were blocked off and crowded with kiosks from different French and European civil society organisations raising questions about economic strikes, alternative agriculture, feminism, organic wines and strategic planning of future direct actions. The climate justice movement is seeing important bridges being built across different movements in a way that is transcending identity politics.

"If we want to talk about being beyond the fragments, about building a living community, about a living democracy, there is absolutely no substitute for people interacting on a personal level"

However, the question is how far will we go and will we try to fundamentally transform society or will the power structures deceive, seduce or exhaust us first? In the 1960s, there were the anti-nuclear weapons movements, the Civil Rights movement and the anti-Vietnam War movement: three movements that had a lot of overlap and seemed like they were seriously challenging power structures. However, the first was halted with the Test Ban Treaty and the ban of atmospheric testing of nuclear weapons; the Civil Rights Movement lost its steam with the passing of the Civil Rights Bill by LBJ; and the anti-Vietnam War movement dissipated with the withdrawal of US troops from Vietnam. My question is what will the power structure throw at the climate justice movement to slow or halt it by deceiving it into thinking it has won? They tried to hype the Paris Accord as a 'historic agreement', though many of us in civil society were quick to point out its grave inadequacies and to organise resistance to it.

You have made a significant contribution to political activism and have participated in many struggles over the last 50 years. What is the future of activism in the twenty-first century? Is it possible that social movements might abandon the strategy of using mass protests and go for specific actions like the creation of alternative structures in different areas (such as energy, schooling, cooperatives and food production) thus facilitating the emergence of another society within society as a fait accompli?

DR. The environmental crisis is not going to go away. It is terribly serious and as more and more people experience catastrophes or freak weather, mass protest action will only continue in the form of

complaints, demonstrations, petitions etc. However, what I suggest is that this is not enough. In the face of mass protest action, the power structure is going to say that "We are going to do this and we are going to do that." And they will do a little bit of this and that. But we have to change the power structure of our society. We have to set ourselves an agenda to create a new society in the stomach of the old. We have to focus on eliminating our domination and exploitation of nature and each other. As social ecologists insist, the problem of the environmental crisis is not a problem with nature; it is a problem with our society.

In terms of whether we should try to change the system directly or create alternative structures, I have always believed, and this is a principle of the New Left, that we have to do both. We have to focus on what has to change in the existing society in terms of power structures. But we also have to explore the creation of new, parallel structures, even if they are limited by the existing power structures. For example, the Milton Park Community, a Montreal co-operative housing project and community land trust and the biggest in North America, is a living miracle but it has not been able to expand.

You founded the first municipal green party in North America known as Ecology Montreal. Could you please summarise this party's history and give us your insight on the future of green parties and ecologism?

DR. We were really breaking new ground: we had a very good programme and we were the only municipal Montreal party with gender equality. We had 11 men and 10 women as candidates. Despite all this promise, we were badly defeated in the 1990 elections (though we did better in the 1994 elections) because we didn't have proportional representation but still the antiquated first-past-the-post system.

There is a case to be made for radical green municipal parties, and I emphasise municipal as opposed to national or regional parties. At any level other than the municipality, we lose a lot of democratic sensibility, human interaction and accountability. The power structure can co-opt us without us even being aware of it. In Ecology Montreal, we had nothing to do with the national or regional Greens.

Is there a future for green parties? I don't think so, at least not for national and regional green parties. This is because such Greens seem to be infected by what the Old Left called 'parliamentary cretinism'. Being elected to parliament, cosying up in alliances with this or that party and trying to make merely piecemeal reforms. There are very few green parties that talk about changing the system root and branch, even if they may have it on paper in their policy documents. That doesn't mean that they haven't played an important role. For example, the Hamburg Greens together with a coalition on the Left prevented ambitions to bring the Olympics to Hamburg.

Green parties started with so much promise. The German Green Party, for example, had a principle of rotation where Green members of Parliament could not stay for more than one mandate but were obliged to begin training a replacement during their first and only term. But that was abandoned as soon as their first members were elected to parliament. Or the principle of the salaries, whereby they were required to give a large percentage of their salaries (40-50%) to a fund that supported local childcare. Thus they were not allowed to accumulate the comforts of the political profession. Despite these important safeguards, the process of moral corruption slowly ate these away; their ideas became skewed and abandoned. The political system has such powers of corruption, of which we saw the same thing here in Montreal with the Montreal Citizen's Movement (MCM). For a radical green municipal party to be ›

effective and authentic, it certainly depends on how internally democratic they are as political organisations and how rooted they are in communities and neighbourhoods. These things will keep such parties on the straight and narrow.

You founded the Transnational Institute of Social Ecology (TRISE) in 2012 in Athens, which is a network of intellectuals/activists working in various cities across Europe. What is the purpose of this network? What has been the outcome of its work so far?
DR. For TRISE, the term 'intellectuals/activists' is important because we absolutely insist on the interrelation between the two. This is as opposed to the role of useless academics full of knowledge but with nothing to bring society.

TRISE is a European institute dedicated to developing a new politics in different cities. We created it for people interested in the legacy of Murray Bookchin and social ecology and to develop it further, because history of course moves on, so these ideas need to be expanded and enriched. We have established a network of about fifty people from Istanbul to London and the objective is to develop a new politics in various cities and to root it in political and social activism.

To date, we have had three major annual conferences, the last being in the city of Patras. And in the fall of 2017, we will have our next in Thessaloniki around the city's Direct Democracy Festival. Registration for the TRISE conference is free and is open to everyone.

It is growing very slowly because we do not have the financial means to do otherwise. Everyone is a volunteer and contributes on the side of their teaching job or taxi driving – on top of their other activism – and it is only through this volunteerism that we function. As such, everyone who is involved is very committed and it is an inspiring group of people with solid values and radical visions. x

Dimitri Roussopoulos, writer, editor and environmental activist, has participated in peace initiatives, environmental projects and cooperative movements since the end of the 1950s. In 1989, Roussopoulos founded the first municipal green party in North America Ecology Montreal, which was very much inspired by social ecology. In 1995 he also founded the Montreal Urban Ecology Center. He has headed the working group on Municipal Democracy in Montreal, been involved in the World Social Forums, and worked to set up an extra-parliamentary opposition in Canada. Among his many books is *Political Ecology: Beyond Environmentalism*.

http://trise.org/tag/dimitri-roussopoulos/

Domingo Jiménez Beltrán

INDUSTRIAL ENGINEER AND EXPERT ON ENVIRONMENTAL POLICIES

Sustainability has entered the policies of states and supranational bodies such as the European Union. However there is a significant gap between declarations and actual implementation of policies, although some countries are more committed than others.

"The future will be sustainable or there will be no future"

You were General Director of Environmental Policy at the former Ministry of Public Works, Transport and Environment from 1991 to 1994 and Director of the Observatory of Sustainability in Spain. You also led the EU European Environment Agency in Copenhagen from 1994 to 2002. Based on the knowledge obtained from these valuable experiences, what would be the limitations of the government's commitment to sustainability? And what would be behind these limitations?

DJB. There is a widespread agreement that sustainability is essential to the future: the future will be sustainable or there will be no future at all. The challenge, as Gandhi predicted, is that "some people will have to change so that all people can live better" and those who will have to change (us included) are reluctant to do so because of the unsustainable existing interests that are threatened by the paradigm of sustainability.

The limitations are clear but how to overcome them is not. The main limiting factor for governments and public authorities is simply determined by the political short-termism of short electoral mandates. Governments must make the most of these mandates before the next election and this does not lead to medium and long-term strategies. These strategies, when they exist, are also not respected in the short term. This is most evident in less mature democracies, which are less advanced than the ones we might call "prospective democracies", in which society and the political class – and even the economic class – are committed to the future as a way to shape the present.

In the EU, in fact, there is a north-south gradient in terms of medium and long-term integrated operational planning: it decreases as we move southward. This is something that the European Commission has sought to address by demanding the presentation of such plans as a requirement for access to EU aid. This solution is not straightforward because a stronger vision and commitment to the future corresponds to greater democratic maturity and to the institutional and governance capacities of each country, so it can be said without any hesitation that "there is no sustainability without better governance". The absence of future plans can be explained by the lack of perspective in some countries but also by the existence of ungoverned countries. Spain is a flagrant case of this because it doesn't even have energy planning for the medium term, never mind the long term. This political short-termism is reinforced and even driven by speculation and the short-term economic interests of large companies, groups and lobbies. Short-termism and misrule are therefore the major constraints for sustainability.

Are these insurmountable constraints? What factors do you believe could help establish public policies that are consistent with the principles of sustainable development?

DJB. Of course they are surmountable, by means of political leadership, purpose, vision and a drive towards an economy that should be effective (supplying the goods and services required), efficient (with less use of resources) and above all, sufficient (reducing the sumptuary), offering predictability to economic and business sectors (medium and long term), and no margin of discretion (with a regulatory ›

framework, taxation and market rules to avoid "free riders"), promoting innovation and offering advantages to companies that rely on sustainability. Finally, the market should work towards sustainability and not the other way around, as is currently happening in Spain.

All this should be accompanied by an independent monitoring of the situation and trends in sustainability via indicators and the assessment of compliance with targets for the continuous review of policies, ensuring transparency, accountability, information and public participation. These are key instruments of democratisation and governance. With the closing of the Observatory of Sustainability in 2012 which first discredited the unsustainable model for Spanish development and forecast the crisis in 2005, Spain has once again shown its commitment to maintaining the model that led us to the crisis.

The role of an independent body is played on an EU level by the European Environment Agency and the European Commission, and it has enabled further progress on an EU level in terms of the strategic (Strategy and Sustainable Development Principles, EU 2020 Strategy, Roadmaps 2050) and operational (Horizons 2020, 2030 in Energy and Climate Change) framework for sustainability. More advanced member states such as Germany, France and Denmark have transferred this progress to a state level, once again unlike Spain, which is an example of what not to do in this area.

There are certainly some factors that could help develop public policies in favour of sustainability within the EU and its member states. The most obvious would be for sustainability to remain a priority on an EU level and for its implementation and importance to be strengthened by enhancing the capabilities and responsibilities of the European Commissioners – to have been thinned out in the current Commission – and of the European Commission Services in which the Secretary General plays an important role not exercised by the previous General Secretary. The European Environment Agency should be transformed into a true Agency for Sustainability, expanding the role just like in the fields of Transport, Agriculture and Energy. Another factor would be for the EU process to be replicated on the level of the member states, following the example of countries such as Denmark, Germany and Holland.

The challenge posed by climate change offers an opportunity to make this shift towards sustainability. Climate change means the economy must be decarbonised, which requires de-energising and dematerialisation.

The interesting thing is that climate change has given us a good reason to do something that should be done even if climate change didn't exist, which is changing the production and consumption model for sustainable progress. It has also given us a dimension and horizon for change. If the EU wants to fulfil its commitment of not contributing to an increase in global temperatures by more than 2°C, then the economy should be almost completely decarbonised, up to 95% by 2050. This commitment has served to establish roadmaps for 2050 for a low carbon economy, for energy and for an efficient use of resources, which have also been replicated in the legislation for some member states.

"The main limiting factor for governments and public authorities is determined by the political shortsight-edness resulting from short electoral mandates"

Although we are speaking on a general basis, how do you think that different cultures and national identities influence the issue? A country like Denmark has set more ambitious targets for renewables than other countries.

DJB. Good question. In countries like Denmark, democracy is a fundamental part of the culture and this is a sign of a mature democracy that allows for not only national pacts in force beyond legislative mandates but a continuity in key policies such as social, education, energy, housing, transport, planning and housing policies, with broad support, participation and public control.

In somewhere like Denmark, they have been able to agree on and implement strategies and plans in the medium and long term in order to build future scenarios and a desirable future for society and for the economy that further enhance public R&D. This has also involved the scientific establishment and transferred into practice the best definition of sustainable development, which is "one that is based on knowledge and not on ignorance", with the latter defining unsustainability.

Why did the serious economic crisis that began in 2007 and that we have yet to come out of contribute to "postponing" the strengthening of environmental policies in countries like Spain?

Efforts targeted at the environment have never been ambitious or transcendent in Spain, and are unconvincing due to the lack of conviction. Environmental policies have come in second place for a long time (except perhaps in 2004-2008 under socialist minister Cristina Narbona) and haven't been considered a fundamental part of a forward-looking approach, never mind the essence of such an approach. In fact the Spanish crisis was exacerbated in terms of the overall European crisis by the unsustainable Spanish development model based on the building sector, consumption and the inefficient use of land, water, energy and resources, and by the marginalisation of environmental policies considered to be a burden on development.

Of course the economic crisis has further promoted this marginalisation. During the 2011-2015 legislative term, significant backtracking was made in the environmental field particularly in terms of conservation and specifically in terms of natural and territorial assets. This resulted in statements by public offices identifying employment and air pollution as mutually exclusive or other statements about the need to lower the environmental bar in order not to curb economic development.

As I said before, the problem is that the economic model being implemented to overcome the crisis is the same one that led to it. In the years before the crisis, there was a false sense of a buoyant economy due to misleading increases in employment figures and GDP. Just as with cholesterol, a strong increase in GDP results from growth in sustainable sectors, and an unhealthy increase in GDP is based on non-renewable resources and the destruction of the natural and social capital.

Do you think that debt levels in many countries and the scarcity of public money may become a major setback (or excuse) for weakening environmental policies? This has been the case with both health and education.

DJB. Of course, although there is hope because many states are realising something that the United Nations has been repeating for some time, and that is that "there is no crisis of resources, but rather of a mismanagement of resources" or in other words, misrule and poor governance. This is evidenced by the poor socioeconomic status of countries with large mineral and energy resources, such as Venezuela, and the opposite situation in countries with few natural resources, such as Denmark and the Netherlands.

This leads us to consider a new future where the effective and efficient management of a country's own resources, including its finances, becomes a key issue. It is also important to have a new taxation system taxing activities which do not promote ›

sustainability, such as the unnecessary consumption of energy and raw materials, the use of non-renewable resources, waste generation, pollutants and greenhouse gas emissions. On the other hand, this new taxation system should also encourage desirable, quality jobs, renewable energy and energy efficiency, so that the market will eventually promote sustainability.

In the energy field, we can see that continuing with the current model based on fossil fuels is not only burdensome for the climate and the environment in general, but also for the economy and even for the security of the country, because of the great external dependence and vulnerability. By contrast, the possibility to advance towards an energy transition based on efficiency and renewable energy sources, usually local, and consequently to aspire to a form of "connected energy self-sufficiency", could serve as an agent of change towards economic sustainability in general, not just in the energy field.

As for the current excessive debt that we have seen cannot be tackled by austerity policies on areas as vital to progress as education and health, as well as the environment, a possible solution lies in instead removing exorbitant and unjustified debt to start again with more sustainable financial and tax schemes. It is therefore essential to conduct real audits of countries' debts across all levels of their administrations. Regardless of whether you call this 'new' or 'green', some kind of taxation is needed to reduce debt to sustainable levels.

If you had a limited budget with reduced funds for environmental policies, what would you prioritise?

DJB. I would prioritise a truly independent assessment of the situation in order to urgently address critical situations that are endangering people's health and that must be dealt with immediately. Second, I would target the driving forces or economic sectors that are the source of environmental degradation. The general improvement of the environment will not come from environmental policies on quality of air and water, nature conservation and waste management, but above all from the shifts towards sustainability that these policies have brought about in key areas such as planning and urban development, energy, transport, agriculture and infrastructures.

"Many states are realizing something that the United Nations has long been repeating: "there is no crisis of resources but mismanagement of resources" This is to say misrule or bad governance"

A single priority placed on a sustainable energy policy based on renewable sources, for example, would not entail additional costs especially if environmental costs were internalised, but would help to mitigate climate change and would drastically reduce air pollution (it would almost disappear) which has a high cost for society. This applies to unsustainable agricultural policies, one of the main agents of degradation of water resources, as well as to land-use and planning policies which are responsible for the degradation of nature and of the landscape. All these policies could be examined in order to promote sustainability, with environmental and economic benefits.

Environmental policies focused on prevention at zero cost do not progress simply because of the existing economic interests linked to the political establishment. Preventive policies have a very high cost for the establishment because the benefits for large speculators would be reduced benefits. Corruption always goes hand in hand with unsustainable patterns and speculative bubbles. The Spanish Observatory of Sustainability warned against the housing bubble as early as 2005.

A classic phenomenon in environmental policies is the implementation gap. Is this gap smaller or wider than is commonly believed? Could you comment on the specific case of European directives and national law?

The gap between existing legislation and its implementation is subject to the same north-south gradient that I mentioned at the beginning for integrated medium and long-term planning. I think the gap is wider than usually believed, and even more so in the south of the European Union, and particularly in Spain. In this country, the idea that we harm ourselves and not just others when we degrade a common asset as important as the environment has not resonated with people. Limitations are cultural and related to democratic maturity.

As for the so-called *acquis communautaire* – directives, regulations and decisions that shape EU environmental legislation – it may be categorically stated that this is one of the EU's achievements and remains one of the most comprehensive and advanced in the world. Denmark, the United Kingdom, Germany and Holland are among the most compliant and couldn't have done better, environmentally speaking, outside the EU. In the case of less compliant countries, such as Spain, I can also say that the situation could be much worse if we weren't members of the EU. x

Domingo Jiménez Beltrán studied Industrial Engineering at the Polytechnic University of Madrid. He has extensive experience and knowledge in many fields, especially in environmental protection, natural resource management and sustainable development, both in private companies and Public Administration. Jiménez Beltrán has also worked for the Spanish Administration and for the Permanent Representation of Spain in the European Union. Subsequently he assumed responsibility in the European Commission, as head of the division Health, Safety and Quality. In 1991, he returned to Spain to perform the duties of Director General of Environmental Policy within the Ministry of Public Works, Transport and Environment. In 1994, he became the first Executive Director of the European Environment Agency, based in Copenhagen. In 2002, he became the head of the Directorate General for Health and Consumer Protection. Since 2003, he has performed different tasks such as Engineering Consultant in Sustainable Development and consultant to the Economic Office of the President of the Spanish Government. From 2004 to 2005, he was president of the Spanish Observatory of Sustainability.

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Marylin Mehlman

GENERAL SECRETARY OF GLOBAL ACTION PLAN INTERNATIONAL

The international community has not yet made substantial breakthroughs in sustainable development. With all their limitations, the United Nations and other organizations have laid the foundations for a partial and slow progress that is taking place in many fields.

"Universal common good is a concept that has been very slowly gaining ground"

You have been awarded the Rachel Carson Prize 2011–2012 for your long-term efforts to involve individuals, companies and NGOs in sustainable actions. In your experience, what are the main obstacles hindering individuals and organizations' greater commitment to sustainable development?

MM. Fear, I think, is a major obstacle. A child and I were once talking about fear. "What do you think people are afraid of?" I asked. He promptly replied: "People are afraid of facts. Because if something is a 'fact', they don't think they can do anything about it."

To quote a much older gentleman, "Change happens when there is a reasonable balance between dissatisfaction and hope." But where do we look to find such a balance today? The very word 'dissatisfaction' implies a possibility for action. Fear mongering is big business today, trying – and often succeeding – to convince us that we have no choices, that there is only 'one way'.

To what extent are such obstacles removable?

MM. In one sense it's very easy. In any human situation, there is always some choice. By supporting people so that they can explore the choices open to them, however small, we can open up a window for change, letting in a breeze of dissatisfaction and letting out some of the fear. Thus hope is born, and a positive spiral can begin.

The difficult part is that it seems that mass media, large-scale business and political elites are – with some honourable exceptions – conspiring (though doubtless unconsciously) to slam shut all such windows.

Many global conferences often end in disappointment, with sovereign states always putting their national interests before global interests. How useful would it be to create a brand new concept of the universal common good in order to overcome national interest?

MM. There you go, you see: peddling a 'fact'. Neither sovereign states (politicians) nor business people nor individuals are invariably egoistic. It has something to do with the level of fear and a lot to do with greed, which is also an expression of fear. Poor people (and nations) are often more generous than the rich. What is striking, but not surprising, about the failure of climate conferences is the intransigence of the richest countries.

'The universal common good': yes indeed, it's a concept that has been very slowly gaining ground since the Covenant of the League of Nations in 1919 (which was strongly promoted by Henri La Fontaine, one of the founders of the UIA and Nobel Peace prize winner). The Declaration of Human Rights was another milestone. And the latest, the United Nations' Sustainable Development Goals (SDGs), takes the concept to a new level.

The interesting question is what will tip the balance and what will transform the concept into real change. ›

How could such a concept transcend – not only ideological – but civilization barriers which have started to seem stronger than ever? (China, for instance, demands the right to keep its own way of development even if it is clearly unsustainable.)
MM. The Sustainable Development Goals are particularly interesting because they avoid the trap of defining 'development' as something needed by the poor countries, to be paid for by the rich. With the SDGs – as with the Human Rights – we all have something to hope for and something to be dissatisfied with. If they can escape excessive bureaucratization, perhaps they can indeed trigger real change.

What role does Global Action Plan International play in progressing toward sustainable development? How does this organization work in order to meet its targets?
MM. We were founded in 1989, and early defined our role as being to 'empower people to live and work increasingly sustainably'. So we have a narrow focus, and have indeed become a global leader in the practice of sustainable behavior change. We also treat every project as action research, so we are constantly learning.

The work on the ground is done by our member organizations and partners, with support from us. It's a painstaking business, empowering people. Slow, but an essential component of 'creating a reasonable balance between dissatisfaction and hope'. Several million people have taken part in our programs. And we know from research that each participant engages more people, with one study suggesting 7-8.

The programs take many forms; for example, employee engagement (e.g. Netherlands, UK, Belgium, Spain...), adult education (almost all of our 25+ member organizations), youth empowerment, school lessons for sustainable development (Ukraine, UK, Ireland, India, Vietnam...). Working with them, we have garnered a priceless treasure of knowledge about behavior change, empowerment, cultural adaptation, and community development. And last but not least, we have also gleaned knowledge on how we learn, and how we can learn more quickly from experience.

GAP International has been granted consultative status with the United Nations Economic and Social Council, ECOSOC. How important is this status for implementing your views?
MM. In one sense, not at all. There is little direct relevance either to our members' day-to-day work or to our action research. But in another sense it's hugely important. Partly it gives us insight into the ideas emerging within the UN community; partly it enables us to make our voice heard.

More importantly: maintaining our status is an expression of our support. Nothing human is perfect. But we believe in the idea of a universal common good, and the United Nations is so far the best option we humans have created for progressing in that direction.

The transition towards more sustainable societies has started in different places and is moving at different paces. Do you think it will have become widespread enough and moved quickly enough before a serious world crisis breaks out? (By crisis I don't mean in the strictly financial or economic sense, but a truly systemic crisis linked to resources depletion.)
MM. I wish I had a crystal ball! The only realistic answer is that no one knows. It may already be 'too late' to salvage what we think of as human civilization. Or it may not. In the meantime, we switch to low-energy light-bulbs and buy organic food.

This highlights a dilemma of sustainable development. In many languages there's an expression meaning that 'the best' can become an enemy of 'the good': by striving only for the best, we may disastrously ignore all the small opportunities for improvement. Which, taken together, could make the essential difference.

"The Sustainable Development Goals are particularly interesting because they avoid the trap of defining 'development' as something needed by the poor countries, to be paid for by the rich"

We sometimes speak of 'strong' and 'weak' sustainability. They are hardly precise terms, but my personal interpretation is that weak sustainability is about those small steps that make things less bad; whereas strong sustainability is about the steps – big or small – that actually restore damage already done. In other words, we need transitions and we need transformations: completely new ways of looking at the world, of combining changes that will develop momentum of their own.

You may have heard of the 'ecological footprint', which in essence measures how bad things are and indeed how much worse they are getting, in many areas. One of our member organizations, in India, has developed the concept of an 'ecological handprint': a measure of what each of us does to contribute to solutions.

The challenge for all of us working with sustainable development is to make the most of even the weakest steps, without losing sight of the strong vision. An example of this is praising businesses for taking 'weak sustainability' steps due to their actual contribution, while simultaneously reminding them of the need and opportunity to find 'strong' solutions. Or, as in our example from Ukraine, encouraging school children to take action each within their own sphere of influence, and thus to experience their own power as they weigh dissatisfaction and hope.

So, is it too late? I don't know. But I do know that if I choose to be an optimist and believe there is still time, then I will continue to make a contribution. If we all choose to be pessimists, and do nothing, then it certainly will soon be too late.

You have been Vice-President of the Union of International Associations, a research institute and documentation center, since 2005. One of its great virtues is that it covers many different topics and collects information of great value in many fields. How is this great organization helping to raise awareness on sustainable development issues (especially in decision-makers)?

MM. The UIA was founded as a contribution to world peace, ironically at the start of one of the most war-torn half-centuries in human history. My own opinion is that the present-day equivalent of a focus on world peace is a focus on sustainable development. We have indeed come a long way on the path away from war, despite the fear mongering headlines. The new refugee streams are engendered at least as much by climate change as by hostilities.

The UIA founders saw civil society's potential to contribute to a positive future for humankind. International civil society, as chronicled by the UIA, has grown explosively and is in many instances indeed making a significant contribution: think of Amnesty, Red Cross/Crescent, Save the Children, to name some of the best known. Such big organizations have little need of support from the UIA. For smaller organizations, especially in countries where civil society is regarded with suspicion by authorities, attention from the UIA can be very important. The simple act of publishing, world-wide, the existence and activities of a small CSO can help them to survive and work. ›

"In many languages there's an expression meaning that 'the best' can become an enemy of 'the good': by striving only for the best, we may ignore all the small opportunities for improvement"

Beyond that, my own belief is that the UIA could do even more to support international organizations focused on different aspects of sustainable development, including, of course, the original emphasis on peace-building. Few human activities are as unsustainable as war.

Will the change that allows us to treat sustainability in the right way come from a revolution of the mind (i.e. in thoughts and values) or will it come from a techno-scientific revolution (such as in the case of cold fusion in the field of energy)? New techno-optimism for change is emerging from many digital world users, as you know.

If we so choose, the accelerating technical developments can give every human on Earth a comfortable quality of life in return for a modest contribution of working hours. Or we can choose to use those same technical developments to intensify human poverty and misery, and destroy our life support systems. What will we choose? My belief is that it depends on an opening of the minds and hearts of many, many people.

Marilyn Mehlmann is General Secretary of Global Action Plan (GAP) International, a network of NGOs that teach individuals, businesses and organizations a sustainable lifestyle and sustainable manners of operating. Global Action Plan International aims at empowering people to live and work in a more sustainable way. She is a partner and senior consultant with the Fenix Group (Sweden), focusing on sustainability, leadership and social change processes. She is also a founding and board member of the Swedish Community of Learners. Her experience combines backgrounds in psychosynthesis, enspiriting, and empowerment to create new fora for personal and professional development, including a coaching 'master class' currently offered in four countries. Since 2005, Mehlmann has also been Vice-President of the Union of International Associations. She received the Rachel Carson Prize 2011-2012 for her long term efforts to involve individuals, companies and NGOs in acting sustainably.

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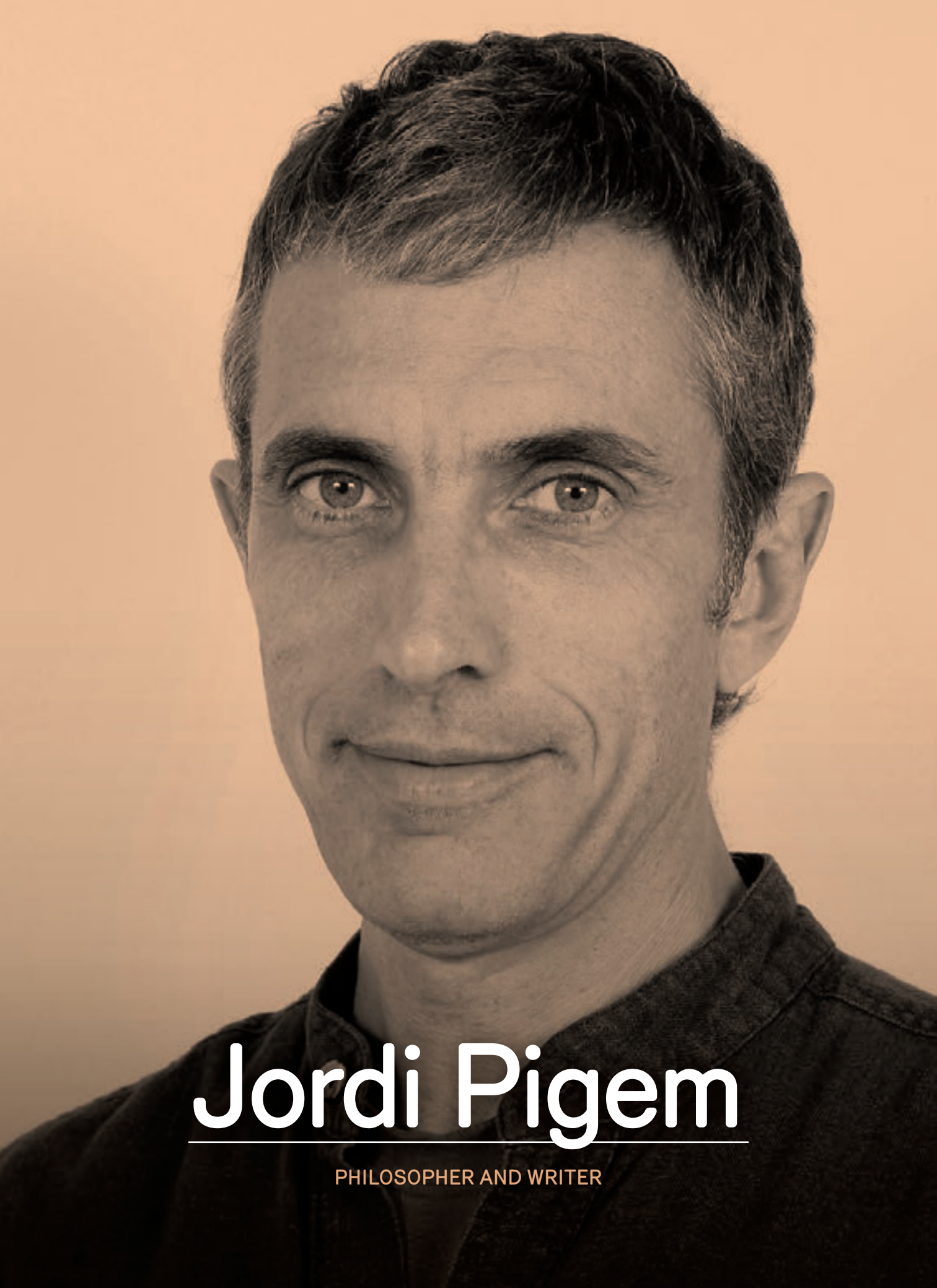
Values are the principles that determine our vision of the world and make sense of our actions. Some thinkers have stressed the existence of values that may be highly useful in the promotion of a more sustainable world. These values are not new, but have been shared by various cultures for centuries.

Values for a sustainable world

Jordi Pigem | Jorge Riechmann



Jordi Pigem

PHILOSOPHER AND WRITER

The Western vision of the world has prevailed in History. Since ancient times this vision justifies the large-scale exploitation of the resources of nature by humanity. This approach focuses on analysis and calculation and leads to continuous imbalances and crisis in the socioeconomic system.

"We have power over nature, but not the maturity to use it wisely"

Do you see the 2007 economic crisis as the manifestation of a systemic phenomenon?

JP. Financial and real estate speculation are usually identified as the causes of the economic crisis that began a few years ago, but beneath these factors lies a deeper issue: the clash of the industrial system with the planet's limits. The Club of Rome warned us about this in 1972 and yet we have avoided confronting it head on. It has since been shown that unlimited expansion will not be viable on a planet of finite resources, although I prefer to use the word 'materials' rather than 'resources'. When we use the term 'resources', it seems like we are talking about materials that are at our disposal for us to exploit as much as we want, and that is exactly where the mistake lies.

The current crisis, unlike that of 1929, is not only economic but part of a broader crisis that has to do with the values and the meaning of our existence in the world. Another difference with 1929 is that at that time the world was less globalised. Once the crisis passed, future prospects were based on following the same path, because the idea of limiting the use of so-called resources didn't exist. This is no longer possible.

What is our civilisation's worldview?

JP. A peculiarity of Western culture – both religious and secular – is that it clearly separates the human being from the natural world. In many other cultures, human beings are conceived of in continuity with nature. In Genesis, God encourages man to exploit the Earth and this has profoundly influenced the way we understand the world in the West. This idea persists among Christian thinkers and authors such as Descartes in Discourse on Method – the founding manifesto of modernity – which explicitly states that the purpose of the method is for humans to become "lords and masters of nature". Some centuries later we have realised that this idea does not hold, since it generates all kinds of dysfunctional effects. The West is not the only civilisation with such a vision of the world. The ancient Easter Island civilisation devastated its own environment and disappeared, but the West has spread its culture throughout the world. We have power over nature, but not the maturity to use it wisely.

Why do we feel the need to buy things constantly?

JP. On the one hand, it is a response to emptiness. Many psychiatrists claim that modern human beings suffer from more existential emptiness than any other human beings in history. In the Middle Ages, the margin to change one's life was very limited. This perception generated resignation but also a feeling of certainty, while the vast range of possibilities we have today generates uncertainty. Individualism has also advanced at the expense of the sense of belonging to a community. I am not saying I don't like personal autonomy and freedom, I am just saying that freedom has its flipside in a feeling of alienation from the world. Most people's default response to this feeling is 'retail therapy', which provides us with material objects and a sense of belonging through brands (clothes, cars, and smartphones, etc.). ›

This dynamic is also based on a certain belief, which serves as a kind of faith, that possessing new objects will help us to overcome the emptiness. In fact, many advertisements, especially those for cars, suggest that by buying a particular vehicle you will have a full life, almost like heaven for a believer.

In our society, the purpose of individual life is to accumulate more and more things, while the purpose of collective life is to increase GDP. No one says this openly but, reading between the lines, this is the message. The paradox of consumerism is that the increase in consumption has no relationship with an increased quality of life. Countless studies on the subject have told us this. When we lack basic things, the act of buying them generates great satisfaction, but once the most important needs have been fulfilled, this is no longer the case.

What role do values play in this framework?

JP. Each of us has a background vision about the world that is largely unconscious. From this vision emanates a set of values that are more explicit and are part of our consciousness, and it is from here that our attitudes and then actions are produced. Values are the link between visions and actions. Before buying a product, for example, we can consult the price, but when values are involved other considerations appear, such as the social and ecological conditions under which the product was made.

Values can be seen as a series of obligations imposed by religion and certain traditions, but this would be a narrow view of the concept. When I refer to values, I mean psychological and ethical vectors that guide our attitude in life and our actions at a given time. Therefore, one cannot say that having values is in itself equivalent to human kindness because values can be of many types. Racists and fascists have their values too.

What kind of values could promote sustainability?

JP. There are a number of values that are essential to sustainability. First, there are the general values, such as reverence for life, celebration of diversity, recognition of the interdependence of all things, planetary consciousness and learning to live well with less. If we relate these general values to more classical values, then they have to do with common sense and with gratitude for living.

In the social sphere is a recognition that there is an appropriate scale for everything (and therefore that the largest or most powerful things are not necessarily the best), an appreciation for relocation (versus globalisation), sense of community, and action in networks. These values are derived from the two more basic values of participation and rebalancing, which are related to classical values such as humility and solidarity. In the personal sphere, we have resilience, continuous learning, the search for meaning and self-fulfilment. These are linked to consistency and creativity.

You said Descartes was one of the founders of modernity: what is the relationship between modernity and the values that you mentioned above?

JP. The current hegemonic vision of the world comes from Descartes. Although it has given us many good and useful things, it means we see the universe as a great mechanism. We therefore only accept things that can be measured as real (such as weight, height and speed), but what about beauty or justice? Are they illusions? This stance underlies most contemporary attitudes. In any discussion on any topic, figures are mentioned. They are useful when talking about unemployment, for example. However, their relevance may be debated depending on how the data has been collected as well as the particular context. A certain level of unemployment is not the same when there is an underground economy as when one is non-existent. On the other hand, if we all consider what is really important in life, we will quickly find that these are things that cannot be reduced to numbers. But numbers are everywhere today, tying in perfectly with a vision of the world where non-living matter is king and life is an accident, despite the fact that the latest findings would point to the contrary...

"A peculiarity of Western culture -both religious and secular- is the fact of clearly separating the human being from the natural world. In many other cultures the human being is conceived in continuity with nature"

Can you talk about that in more detail?

JP. We are usually told that the basis of reality lies in matter, and life comes from matter and then, as life evolves, consciousness appears. I want to stress how extraordinary it is that contemporary science, along with two Nobel Prizes for physics, have concluded that a number of quantum phenomena may only be accounted for if the basis of reality does not lie in matter but in consciousness. This is something that poets and mystics sensed before reaching similar conclusions. What if the history of the world's evolution did not begin with matter and then move towards life and consciousness, but instead departed from consciousness? You cannot get a more radical change of paradigm, because then our vision of reality would not be based on matter, but rather in consciousness. This kind of perspective promotes more of a communion with nature, making us feel part of the continuity of all life. A cosmos of matter in which consciousness is an accident is a hostile and even terrifying cosmos, where humans are nothing. And the most cutting-edge scientific thought is moving away from this vision.

Going back to the subject of sustainable development: do you think our society is truly committed to this goal?

JP. There are vested interests that fly the flag of sustainability merely to define their position in society, yet many initiatives involving sustainability are genuine and the business world participates in them. It would be an oversimplification to state that only activists are honest. Fortunately, we have people working on sustainability in a variety of fields. But the real key to change is the knowledge of our place in the cosmos and our purpose in life. When we consider these issues from a Cartesian point of view, there is a division between us and the world and between mind and matter, rendering sustainability impossible.

Just like many authors, you have studied a twentieth-century thinker called Ivan Illich who adopted a highly critical stance towards industrial societies. Do you think that Ivan Illich's thought could shed some light on the challenges of the twenty-first century?

JP. Ivan Illich was an important figure in his time who knew that many ideas that were presented as good were the opposite. However, I don't believe that we can apply his thought in a literal sense to today's society. He was writing in the 70s, and my personal impression is that although he often fought against things he didn't like, he failed to suggest any alternatives. He was against compulsory schooling, for example, because he thought that it taught the mass production system. The same thing happened with Michel Foucault, who made useful critiques without proposing other models. Perhaps some thinkers' role was to point out that the emperor had no clothes whenever nobody else dared to do so. In these cases, the value of their work is historic rather than practical. Naomi Klein, for instance, is just as critical as Foucault. She does not share the same philosophical background as the French thinker, but her approach is much more in line with facts that concern us all today and that Foucault could never have imagined. ›

You were a disciple of Raimon Panikkar, a highly prolific and universally recognised intellectual who used very structured speech and recognised the extreme complexity of the world. Is there anything in Panikkar's teachings that might be useful for building a more sustainable world?

JP. Raimon Panikkar spoke of the complexity of the world and the plurality of possible perspectives. I remember that in very difficult discussions where his followers were lost trying to follow him, he had the ability to re-focus the question in one brief sentence that synthesised and simplified the content of the debate. Panikkar, unlike Foucault and Illich, is much more relevant to our world today. On the one hand, he makes us think that complexity can be simplified for our understanding. Certainly sometimes we complicate things too much. Moreover, Panikkar opens up many lines for dialogue between the East and the West, and if we have to move towards a new vision of the cosmos, Eastern cultures can help us. Panikkar also said that no culture alone has the tools to renew the vision of the world. It's not about making a banal syncretism by taking a few ingredients from each culture for convenience's sake, but more about building a serious dialogue among civilisations. In the global scenario, however, non-Western civilisations appear as nests of contradictions due to the extent of their economic development. I'm referring to China, of course.

American essayist Susan George told me once that China has managed to combine the worst of capitalism and the worst of communism, which are two Western models. Chinese culture has made some very useful intellectual and philosophical achievements. In its traditional worldview, dualities are not opposed but complementary. That is the reason why they have been able to combine extreme capitalism, in the economy, with communism, in politics. Honestly, I think that Adam Smith and Marx would be shocked by contemporary China's vision.

"There are vested interests that fly the flag of sustainability only to define their position in society, yet many initiatives in sustainability are sincere and the business world participates in them"

Throughout this conversation you have referred to the power of ideas and values, but are these only ideas, or will they also become a reality that at some point will lead us to make radical changes in the way we live in the world?

JP. From studying environmental issues, my personal conviction is that the combination of climate chaos (because it is chaos rather than a change as it involves an increase in extreme events) and the depletion of materials and energy sources will force us to change our political, social and cultural systems and, more importantly, the way we relate to the world. This will happen over the next 15 years. But at the same time, I am also convinced that when new values take over, sustainability will move forward. Those who do not change will move towards collapse, as has already happened in the city of Detroit. A more sustainable society will be more just and more meaningful.

Jordi Pigem is a philosopher and writer. From 1998 to 2003 he taught on the MSc course in Holistic Science at Schumacher College of Dartington (England) and also at the University of Plymouth. In recent years, he has taught at the University of Barcelona and has been an invited lecturer at several universities, including Columbia, Oxford and Venice. He is the author of several books including *La odisea de Occidente*, *Buena crisis*, *Espiritualidad y política* and *La nueva realidad*. He also coordinates the Catalan edition of the philosopher Raimon Panikkar's *Opera Omnia* (complete works). He has received the Philosophy Award from the Institute of Catalan Studies and the Essay Prize from the English Philosophy and Ecology Magazine *Resurgence*. In addition, as a specialist on the ecological paradigm, Pigem is coordinator of Spanish Integral magazine and editor of the collective work *Nueva Conciencia: plenitud personal y equilibrio planetario para el siglo XXI*. He often collaborates with a variety of Catalan and Spanish media outlets.

www.resurgence.org/magazine/author258-jordi-pigem.html

Jorge Riechmann

POET, LITERARY TRANSLATOR, ESSAYIST AND
PROFESSOR OF MORAL PHILOSOPHY

The idea of limit is useful in various human activities. Certainly the limit tends to be viewed negatively, especially in contemporary culture, but it could also be seen in a positive way. Let's take for instance the rules that make coexistence in society possible. They are based on setting limits. Similarly, the limit is a key concept in sustainability since the availability of Earth's resources is not infinite.

"We have reached the end of expansion"

The idea of limits is inherent to the human condition. However nowadays, people – whether individually or collectively – show a strong tendency towards the unlimited in their desires and decisions, and in developments in science and technology, etc. How do you account for this contradiction?

JR. We are undoubtedly finite beings, but you could say that deep inside of us is the idea of infinity (we are beings of language and desire, or in Freudian terms, beings of impulse). So, assuming our finitude requires some work and some self-building efforts on our part. We must use cultural tools to develop human finitude, which is so hard to accept (because it forces us to confront illness and death, among other unpleasant realities). As a line in a poem by Isabel Escudero reads: "Under the same sky / cherry blossom / and me dying". Once we learn to accept finitude, from there on we will be able to develop values urgently required today, such as solidarity, biophilia and care.

The problem is that instead of helping us with the difficult task of accepting finitude, the dominant culture under capitalism projects us in the opposite direction: consider, for example, the promises of immortality that technoscience entertains us with. This leads me to believe that the main goal of the scientific and technical revolution is to give humanity eternal life, as Israeli historian Yuval Noah Harari has remarked. It is, at least, the carrot dangled in front of us. Personally, I really like Terry Eagleton's reflections on these issues, as developed in his book *On Evil*.

Nowadays, as capitalism slides more quickly towards *necropolitics*, social environmentalism (as well as ecosocialism and ecofeminism) has an enormous advantage stemming from its immediate connection, first, to life and second, to community bonds.

There are no magical solutions: this is all about rationing, cooperating and sharing. But the majority still wants social prosperity based on the kind of expansive commodification that will no longer be viable. We must support each other in order to face the power of death, accepting our finitude and welcoming our neighbours. If we are able to do these things, we will radically transform the world. "Our rejection of death," according to Quebecois writer Monique Proulx, "is a rejection of life".

What are the consequences of this drive towards the unlimited for us as individuals and for the environment?

JR. There are many consequences, but I will focus on the main one: the attempt to create unlimited material expansion in a finite environment (as is our home, planet Earth) is self-destructive. This is something that environmentalism has been warning us of for over half a century, with a sound scientific basis. Consider, for example, a key article published in PNAS, the journal of the United States National Academy of Sciences, in the summer of 2015.

Researchers John R. Schramski, David K. Gattie and James H. Brown suggest a rigorous and didactic means of interpreting the enormous planetary trouble we are in. Arguing from the point of view ›

of thermodynamics and biology, they consider the Earth as a chemical energy battery to have been charged over hundreds of millions of years, where our planet is the cathode (organic chemical energy stored) and space is the anode (the state of balance), creating the cell or battery called Earth-space. But as humans we are dissipating this energy ultimately coming from the sun and accumulated throughout the Earth's geological history, with the energy finally radiated as heat into the sterile thermodynamic equilibrium with inhospitable outer space. We are therefore rapidly draining the battery without being able to recharge it. As these scientists have rightly pointed out:

"It took millions of years for photosynthetic plants to slowly charge the battery, gradually converting diffuse and low-quality solar energy into high quality chemical energy temporarily stored in the form of living biomass and more permanently stored in the form of fossil fuels: oil, gas and coal. Only in recent centuries – a blink of an eye in evolutionary terms – has energy been used by humans to propel the rise of modern civilisation. Our technological-industrial-informational society has drained the Earth-space battery inducing the flow between the terminals, degrading high quality biomass energy in order to transform the Earth for human benefit, irradiating the resulting low-quality energy into deep space. The laws of thermodynamics dictate that the difference in pace and time scale between the slow charging of the battery and its rapid depletion is unsustainable. The current massive draining is rapidly leading the Earth from being a living biosphere capable of maintaining a highly developed human civilisation into a barren lunar landscape."

In recent millennia, the combination of what could be referred to as the biological imperative of Malthusian-Darwinian dynamics (which encourages organisms to use all available resources) and the social imperative (that pushes innovation and the improvement of human welfare) has resulted in some 10 millennia of slow growth in populations and economies, and then in an explosion of exponential growth in the last two centuries, driven by the dynamism of capital accumulation. So we have gone from being a few million hunter-gatherers to more than seven billion modern humans, and from a subsistence economy based on a sustainable use of plants and animals (in balance with the photosynthetic energy production) to a modern economy (out of balance due to the unsustainable draining of the biomass battery). The researchers' conclusion is bleak:

"We have entered an area of scientific uncertainty in which the slightest disruption could trigger a catastrophic change of state in the biosphere and the human population and economy. As we move quickly towards the chemical balance of outer space, the laws of thermodynamics offer little room for negotiation. (...) The implications of past collapses at local level [e.g. Greece, Rome, Angkor Vat and Teotihuacán] and global growth are not as relevant to the current situation because for the first time in history, humanity is facing a global energy-chemical limit. The paradigm of the Earth-space battery provides a simple framework for understanding humans' historical effects on the energy dynamics of the biosphere, including the unalterable thermodynamic limits that now pose serious challenges to the future of humanity. Living biomass is the energy capital that makes the biosphere work and maintains the human population and the economy. There is an urgent need not only to stop the depletion of this biological capital, but to move as quickly as possible towards a rough balance between Net Primary Production and breathing. There is simply no biomass reserve tank for planet Earth. The laws of thermodynamics have no mercy. The balance is bleak, barren and final."

"Ecology, as a thought of the limits, analyzes the structural constraints for human actions and projects derived from the finitude and vulnerability of the biosphere, from the entropic nature of the universe and from the organic, psychological and social characteristics of human beings"

Nowadays the idea of a limit is often seen negatively, as an obstacle to getting something essential. What would the positive vision of this idea be? Could the idea of a limit serve as a principle for freedom?

JR. To accept limits is not against freedom: it is the condition for freedom (for these finite beings called humans). "Limiting oneself is not giving up: it is achieving," said Jose Bergamín. We must realise that for every human capacity there is a limit: what we can do goes along with what we cannot do. All limits set on human action actually facilitate action (if everything was possible, nothing would be). Consider, for instance, language, an essentially human capacity without which Homo sapiens would be unrecognisable. It is from severe restrictions – a discrete number of rules on morphology and syntax – imposed on a small set of phonemes, that a speaker's infinite creativity is demonstrated.

Now consider perception: the world "speaks" to us through our sensory apparatus and our neurological system "filters" this information. Actually there are filters – some stimuli are captured while others ignored – and also constituent devices – the environmental information is processed and organised in a specific way – that give us some experience of that which is "built", "made" by the peculiar kind of conscious animal that we are. The important thing is realising that seeing, hearing and tasting are at once capacities and limitations. Ortega y Gasset explained it beautifully in a 1930 article entitled Vicisitudes en las ciencias (Vicissitudes in science): "Let us respect the blindness which allows man to see something. Everything we are is because of some limitation. And it is this state of being limited, this lack, which is destiny and life. What we lack and what oppresses us is what constitutes and sustains us."

Every advance in knowledge of the conditioning factors of human action does not reduce but instead allows us to exercise our freedom. To put it more precisely: knowledge of limits makes it a condition for freedom. Finding out a conditioning factor that we were not aware of before (coming from biological inheritance or from the human psyche) will allow us to incorporate it into our action, and thus – in an important sense – to go beyond it.

Architect and urban planner Luis Fernández Galiano recalled the following anecdote a few years ago: "While on a jury in Beijing, when called to select the project for a great museum of modern and contemporary art, the head of the institution responded to my surprise at his ability to wave off the services of the interpreter by looking me right in the eye and uttering the only English phrase in a three-day meeting: " I am dancing in chains."

Isn't that interesting?! A Nietzschean Chinese leader! Indeed it is in Beyond Good and Evil that the German philosopher describes humans as "dancing with chains." It is a very good image of human freedom: to be able to dance with chains. A meditation by Fernández Galiano on building in the Arab Mediterranean and in Japan similarly led him to underline how "every constructive culture teaches us to create comfort and beauty with limited means, producing poetry in a framework of restrictions."

Finally, considering the concept on a political level, it was Cornelius Castoriadis who rightfully pointed out that democracy is a regime of self-restraint, with the limit the constitutive element of freedom. Freedom exists because it is through policies and laws that human beings place limits on living.

In your book Un buen encaje en los ecosistemas (A good fit among ecosystems) you suggest how best to adapt human systems to ecosystems. In this work you diagnose our current situation and note that "we have filled the world." What do you mean by that?

JR. If the entire planet had Spain's current level of consumption (with its enormous inequalities and existing social divide), the Earth could not support more than 2,400 million people. Two-thirds of humanity would be surplus. Furthermore, a world that used its natural resources and environmental services at the level the US does today could only support 1,400 million people. If we continue along the path of these "development models", we may as well pre-programme genocides. ›

We have reached the end of the expansion (to use the title of a book by Ricardo Almenar). As George Monbiot eloquently stated in 2002: "Capitalism is a millenarian cult, elevated to the rank of world religion" As Christians imagine that their God will save them from death, capitalists believe that theirs will take away finitude. They think the world's resources have been guaranteed eternal life. A brief reflection shows that this cannot be true. The laws of thermodynamics impose intrinsic biological production limits. Even the repayment of debt, a prerequisite for capitalism, is only mathematically viable in the short term. Heinrich Haussmann has calculated that a single pfennig invested at 5% of compound interest in year zero of our era would add up a volume of gold of 134,000 million times the weight of the planet today. Capitalism pursues a production value commensurable with the debt refund..."

Material production cannot grow at the rate of compound interest that builds debt (or investment returns) but such an impossible feat is a basic assumption of capitalism.

You have also underlined that the technosphere and the biosphere are in opposition. Could they be reconciled?

JR. There are "four linked yet uncontrolled engines" moving Spaceship Earth according to Edgar Morin, with these namely science, technology, industry and capitalism. These engines have led us to a violent clash with the biophysical limits of the planet. It is time to thoroughly review these engines. It's time for an economy with "a biophysical balance and moral growth", such as the steady state economy described by Herman E. Daly in the statement: "It will be very difficult to define sufficiency and build the concept within economic theory and practice. But I think it will be much harder to keep on acting as though there is no such thing as 'enough'."

Our problem should not be what we do with waste but how to organise production, work and consumption. The problem with waste (pollution, global warming) lie in the organisation of production, work and consumption. Principles of social organisation such as sufficiency (or self-restraint), biomimicry (consistency between human systems and natural systems) and caution should feature in the equation we need to consider in order to move towards more sustainable societies. From the perspective of sustainability, the most important shift in values is moving from "more is better" to "enough is enough".

Self-restraint appears in this context as a decisive value. What is your definition of the term? What are its anthropological, cultural and historical foundations? What are the chances of self-restraint becoming a hegemonic value?

JR. Self-restraint is about placing limits on yourself in order to let others exist. Another related concept – that of self-construction – is a political-moral bricolage used to remedy our flawed ape condition. It must be stressed that the *self* prefix does not refer to an individual effort, or more accurately, not only individual, but fundamentally to a collective project. Otherwise, as John Dewey said in 1930, it would be like believing in magic, only this time in terms of morality.

In *The Imperative of Sustainability*, one of the central books in twentieth-century ecological thinking, Hans Jonas wrote: "Wholly unchained, Prometheus, with whom science has provided unprecedented strength and the economy indefatigable drive, calls for an Ethic which can help prevent humans from falling into disaster by means of voluntary restraint." This idea of voluntary restraint leads us to another essential twentieth-century thinker, Walter Benjamin, who states that "Marx says that revolutions are the locomotives in world history. But perhaps something completely different is at work. Perhaps revolutions involve the use of the emergency brake by the human race travelling on a train. "

"All men always reach the limit of their power," said the Greek historian Thucydides. If this were literally true, it would not make sense to recommend an ethic of self-restraint, in the sense of restraining ourselves to leave others be. I think that it instead must be read as a warning in the following way: we have great propensity for limitlessness, to destructive and self-destructive *hybris*, but we must be able to counter it with good institutions and our work on individual and collective self-construction... With good *paideia*, as Aristotle would have said.

The ways in which neoliberal capitalism rules the world – and here a lengthy reflection could be made on the notion of governance, which has been developed to stop us dreaming about democracy – are ultimately incompatible with the structure of reality. Let me be more precise: such methods are incompatible with the realities of a biosphere in which the web of life is articulated as a complex system of ecosystems. For neoliberalism, "to set definite limits, either by establishing sovereign borders or by an unquestioned distinction between man and machine or between human beings and nature, belongs in the past. We have moved beyond a limited world. The new metropolitan 'society' is distributed over an open, expansive, less smooth area than that fundamentally slobbering, flat space", writes the Comité Invisible in *A nuestros amigos* (To our friends). But the neoliberal fantasy of a "flat Earth economy" with indefinitely expanding markets and powerful technologies collides with the basic biophysical realities of our world.

In terms of moral philosophy, environmentalist thought can be summarised by two simple principles: consider the before and after and consider limits.

Also in terms of limits, ecology analyses the structural constraints for initiatives and projects derived from human finitude and the vulnerability of the biosphere, from the entropic nature of the universe, and from the organic, psychological and social characteristics of human beings. More specifically, we can refer to the following three fundamental limits: the first is our dependence on thermodynamic and physiological processes that take place under the sign of entropic decay; the second is the finitude of the sources of natural resources and the limited capacity of the biosphere for "recycling" pollution; and the third is the irreversibility of the loss of biodiversity and the destruction of the ecosystem (in other words, nature's limited abilities to "repair itself" after serious attacks).

Our problem is that asking "how much is enough?" does not make sense within capitalism, because the blind dynamism of capital accumulation cannot be stopped without the collapse of the system. There is no sustainability without self-restraint; and there is no possibility for collective self-containment within capitalism.

The terms efficiency and eco-efficiency crop up very frequently in speeches on the concept of sustainable development. However you have argued that an economy can become increasingly eco-efficient and at the same time increasingly unsustainable? Why?

JR. Eco-efficiency is a necessary condition for sustainability. Unfortunately, it is not a sufficient condition for it (as the business and government vulgate of "sustainable development" seems to believe), and it can also become a trap that keeps us from achieving our goals. Indeed, under capitalism, gains in efficiency – with which the economy harnesses energy and materials – have not led to alleviating pressure on ecosystems but to lower prices and increases in consumption (in a process well characterised by economists as the "rebound effect"). In the lexicalised expression "savings and efficiency" (referring to energy) we see that often in practice efficiency works against savings. ›

To what extent can an economy that tends towards dematerialisation (and thus diminishing its impact on resources) generate enough wealth? Are we really shifting towards a period of dematerialisation?

JR. The first thing would be to ask what "enough wealth" means, wouldn't it? More generally speaking: how much is enough to give human beings a good life in a finite planet we share with many other living things? A quote from Gandhi in 1907, brought up frequently in the discussion on human needs, states: "The Earth provides enough to satisfy everyone's needs, but not everyone's greed." I would say that even about the greed of the 1% located at the top of the pyramid of power.

Research carried out in recent years is conclusive: in some cases we may refer to a relative "dematerialisation" of production, that means gains in eco-efficiency (while production continues to grow), but not of absolute dematerialisation. In Spain, studies by José Manuel Naredo, Oscar Carpintero and other economists have clearly demonstrated this.

Designed as reductions of impacts, the transfer of impacts is a sleight of hand which has been used in "advanced" environmental policies in the world's most industrialised regions over the past four decades. Therefore the leitmotiv or guiding thread in these policies, which is the goal of "decoupling economic growth from environmental impact", is misleading. In the EU several member states achieved a relative decoupling from 1995-2005 between GDP growth and energy use, but this has not resulted in a reduction of environmental pressures in absolute terms, because resource consumption in absolute terms has remained more or less constant over the past two decades.

But more importantly still is the fact that the decoupling I mentioned within the borders of the EU has been mainly due to an increase in imports of natural resources, which make up for reduced production or extraction in Europe. This therefore serves as an outsourcing of impacts in which damage is exported, and is not a true decoupling. In fact, declines in impacts (e.g. emissions of greenhouse gases) from rich countries may largely be accounted for by the transfer of energy-intensive production to countries such as China or India.

You have also delved into the debate on weak sustainability and strong sustainability. What are the arguments for choosing strong sustainability?

JR. Nowadays the exploitation of renewable resources and the depletion of non-renewable ones is reducing future availability of resources without which human life could lose its quality or even become inviable. What are the chances of remedying such deterioration by technological means? This is where the concept of capital is usually introduced to distinguish between three subspecies within the total capital: Natural Capital made of assets from the natural world which are used (or may be used) in human socioeconomic activity; Capital made by man which includes both artefacts and inventions and "human capital" (skills, knowledge, values); and Grown Capital formed by domesticated animals and cultivated plants, and their derivatives.

Weak sustainability is a principle that can only guarantee a non-declining level of total capital (assuming that the three forms of capital are completely substitutable with each other, and this would be allowing technology to replace nature, for example), while strong sustainability tries to ensure that the level of natural capital does not decline.

The hypothesis of perfect substitutability between natural capital and capital made by man is equivalent to the belief that scientific and technological development in the future will be able to give us all that nature provides, which is highly unlikely. Nature has many vital functions that may not be reproduced by technical means. And if this is so, then all forms of "weak sustainability" must be discarded and only "strong sustainability" must be considered as true sustainability.

"Research carried out in recent years is conclusive: in some cases we can talk of relative 'dematerialization' of production, but not of absolute dematerialization"

How do you take the strong sustainability option towards policy implementation when in our representative democracies it is not viable to completely alter the status quo? Do you think that achieving sustainable development requires a specific political system? If so, what features should this system have?

JR. A civilisation whose basic social bond is trading with profit is self-destructive to an extent that we do not fully fathom. It is no exaggeration to say that our current business-as-usual approach will lead to ecocide plus genocide. The only thing that could save us is an eco-socialist and eco-feminist revolution of almost global reach and in record time, such as the movements of 1789 and 1917, or instead a movement to bring about an emergency economic global contraction. Such a decrease, accompanied by wealth redistribution, could in a few years bring us back from the planet's biophysical limits that industrial societies have irresponsibly breached. But do we have the political and cultural resources required to meet such strict deadlines? What we lack is not sound scientific analyses, but the political and sociocultural drive.

Whether we like it or not, there will be a decrease in materials and energy. Physics and biology do not allow for millenarian capitalist fantasies: as the authors of the study about the rapid draining of the "battery Earth-space" said "as we move quickly to the chemical balance of outer space, the laws of thermodynamics offer little room for negotiation." We will then have to implement radical redistribution policies and equality, or we will be plunged further into an increasingly cannibalistic world. A modernised post-capitalist subsistence economy is still within our reach, and it would be enough to meet everyone's basic needs. But we remain trapped in commodity fetishism and capital accumulation.

Do you think that energy transition, which is inevitable at some point in this century, could be a catalyst for these changes you highlight in order to reduce pressure on the planet?

JR. At some point in this century is a very long time! Peak oil began in 2005, when the peak of extraction of conventional oil of better quality was achieved (as was later recognised by an organisation as devoted to productivism as is the International Energy Agency). We have already hit peak oil: which means that energy has decreased and economic contraction will occur in decades to come. Our only possibility of transition to a sustainable society, while retaining some of the best features of industrial society, lies in a very rapid decarbonisation of our economies and the transition to an energy matrix composed of renewable energies. However, although such energies can provide enough to meet the basic needs of humanity (more than 7,300 million people), they cannot maintain the energy overconsumption that we consider to be standard today. This brings us again to decreasing energy and materials. A large group of researchers –of which I am part – has addressed this issue in a collective book entitled *Los inciertos pasos desde aquí hasta allá: alternativas socioecológicas y transiciones poscapitalistas* (The uncertain steps from here to there: socio-ecological alternatives and post-capitalist transitions). ›

Some have spoken of an opportunity for the transformation of society towards greater equity and participation with the digital world. Do you share this vision?

JR. I think that unfortunately the development of the Internet, telecommunications and digital cyberworlds is an ambiguous phenomenon. Jonathan Crary recently warned about this in his major work *24/7:* "the importance of the concept of reification – or any similar concept – is paramount to any understanding of global capitalism and technological culture. There is no escaping the role of the Internet and digital communications as engines driving the relentless commodification and commercialisation of more and more areas of individual and social life, whether your point of view is Marxist or not. Frank Schirrmacher and Byung Chul-Han (among others) have also offered enlightening analyses on these issues. The aim of generalised hyperconnection regardless of place and time via portable telecommunications devices (smartphones, tablets, netbooks, etc.) is presented as a given in our society, masquerading with the expression "knowledge society" (as though knowing and generalised knowledge were that easy). Hyperconnection is counterproductive. It is presented as being connected to freedom, but can easily generate new servitudes. How? Let's think for a moment. Even the less demanding conceptions of human autonomy such as the one represented by Arnold Gehlen, for example, consider what might be called a moment of disconnection. In philosophical anthropology Gehlen points to human beings' capacity for "offloading" (Entlastung) with respect to the overabundance of stimuli in the environment, as well as the ability to defer the satisfaction of impulses as the basis for autonomy (it really is a minimalist concept). Human freedom requires this sort of retraction regarding overstimulation, so that an inner space of deliberation opens up and autonomous decisions can be made. But IT hyperconnection tends to cancel out such inner spaces. *Technolatry* is the latest line of defence of an irrational faith in progress that, at this point in history and in our Century of the Great Trial, should be completely discredited. x

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His academic activity deals with specialized post-capitalist transitions; ecosocialism; political ecology; green political philosophy; philosophy of sustainability; environmental ethics; and ethics applied to new technologies. Riechmann is the author (or co-author) of an extensive work which comprises 30 essays on issues such as environmental ethics, political ecology and ecological thinking; poetry, and also translations. His poetic work has been awarded various prizes and translated into several languages.

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