VEOLIA INSTITUTE

THE VEOLIA INSTITUTE REVIEW

FACTS REPORTS

2022

THE SOCIAL AND ECONOMIC CHALLENGES OF ECOLOGICAL TRANSFORMATION

In partnership with

Archipel&Co.

THINKING TOGETHER TO ILLUMINATE THE FUTURE

THE VEOLIA INSTITUTE

Designed as a platform for discussion and collective thinking, the Veolia Institute has been exploring the future at the crossroads between society and the environment since it was set up in 2001. Its mission is to think together to illuminate the future.

Working with the global academic community, it facilitates multi-stakeholder analysis to explore emerging trends, particularly the environmental and societal challenges of the coming decades. It focuses on a wide range of issues related to the future of urban living as well as sustainable production and consumption (cities, urban services, environment, energy, health, agriculture, etc.).

Over the years, the Veolia Institute has built up a high-level international network of academic and scientific experts, universities and research bodies, policymakers, NGOs and international organizations. The Institute pursues its mission through publications and conferences, as well as foresight working groups.

Internationally recognized as a legitimate platform for exploring global issues, the Veolia Institute has official NGO observer status under the terms of the United Nations Framework Convention on Climate Change.

THE FORESIGHT COMMITTEE

Drawing on the expertise and international reputation of its members, the Foresight Committee guides the work of the Veolia Institute and steers its development.

The current members of the Foresight Committee are: **Harvey Fineberg**, President of the Gordon and Betty Moore Foundation and former President of the American Institute of Medicine; **Pierre-Marc Johnson**, international lawyer and former Premier of Quebec; **Philippe Kourilsky**, Honorary Director General of the Pasteur Institute; **Amy Luers,** Global Lead Sustainability Sciences at Microsoft; **Mamphela Ramphele**, former Managing Director of the World Bank and **Amartya Sen**, Nobel Prize-winning economist and Professor at Harvard University.

THE REVIEW

Issue coordinated by Mathilde Martin-Moreau, David Ménascé and Iris Levy, Archipel&Co

The Veolia Institute Review - FACTS Reports is an international publication compiling diverse perspectives on topics at the crossroads between society and the environment.

The review was launched in 2007 with the aim of sharing best practices from the field, to help find solutions to problems in the economy, development, healthcare, environment, agriculture and education, in both developing and developed countries.

The interdisciplinary review is a vehicle for sharing the experiences and expertise of different stakeholders (researchers, academic experts, policymakers, companies, NGOs, international organizations, etc.), with the aim of taking advantage of a diversity of perspectives on a given topic, by combining feedback on best practices from the field and expert analysis.

www.institut.veolia.org |

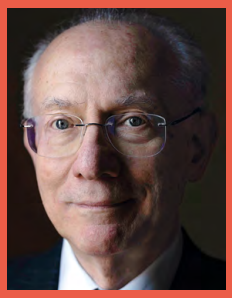
CONTENTS

FOREWORD

Harvey V. Fineberg
President of the Gordon and Betty Moore Foundation
Member of the Veolia Institute Foresight Committee

"The future cannot be predicted, but futures can be invented."

Dennis Gabor, 1963 (inventor of holography, winner of Nobel Prize in Physics, 1971)



Our climate future is invented through human action, though not by an ingenious stroke of any single inventor. What we experience as climate and climate disruption is the product of many decades of human invention, mainly in the name of economic progress—to extract materials, generate power, multiply the harvest, and market new products. Mastery of chemistry and electricity, refinement of fossil fuels, advent of more precise tools and measurement, industrial-scale manufacturing methods, and technological advances all contributed to where we are today, and all play a part in the invention of our climate future.

A measure of climate disruption is baked into the coming decades. The UN Intergovernmental Panel on Climate Change estimates that global temperatures have warmed by 1.1°C since the 19th Century and are on track to rise to 1.5°C over the next couple of decades. Global warming has already begun to take its toll in worsened floods, droughts, heat waves, and wildfires; in intensified cyclones, melted glaciers, and lost sea ice. And these are mere harbingers of what may be in store beyond 2050 in the absence of steep, sustained reduction in greenhouse gas emissions.

The climate crisis is the centerpiece of a triad of troubles that beset humanity and the planet: climate disruption, degradation of the natural world, and global inequality. Engineers teach us that every system is perfectly designed to produce the results it obtains. Extreme poverty is not a flaw in the world's economic system; it is the product of that system. To eliminate poverty, the economic system must be changed. Commercial fishing to the brink of species extinction can be averted, if we are willing to change the rules that govern fishing and enforce ocean protected areas. The triad of troubles in climate, nature, and inequality and the systems that create them—all the result of human invention—form the backdrop for the compelling essays in this issue of FACTS.

The essays raise many provocative questions and pose some promising elements. Is a long-term solution possible without abandoning increased material acquisition as the measure of social progress? Will re-framing global warming and inequality as matters of human security make these problems more salient and their solutions more politically palatable? Will the public demand action when climate change can be seen to pose direct threats to human health? Can the technologic prowess that got us into this mess hold the key to working our way out? And can technologies that reduce greenhouse gas emissions or reduce poverty come on-line and at scale quickly enough to make a difference? Enlightened companies and civic leaders are showing how to reduce waste, rely on renewable energy, and increase efficiency. Can such examples of attainable success cumulate to the massive transformation needed?

Many realities of history, the global political order, economic self-interest, and human psychology impede progress against the triad of troubles. The drive to enlarge economies while polluting land and sea benefits some and shifts burdens onto others. Human psychology does not readily link remote causes to future consequences; hence, scientific understanding of fields such as evolutionary biology or geo-physics are not readily apprehended by the public. Few prove willing to diminish their personal standard of living for an uncertain and distant public benefit. Independent nation states may negotiate agreements despite ideological rivalries and global tensions, yet no senior authority can legally require sovereign nations to act for the common good against their perceived national interests. The needed solutions for climate, nature, and equity are poorly matched to the global capacity for urgent, substantial, and sustained change.

If there is hope, it rests on the human capacity to choose to invent a better future and on leadership at every level that shows the way. When the late Dr. Bernard Lown accepted the Nobel Peace Prize in 1985 on behalf of International Physicians for the Prevention of Nuclear War, he was asked whether he was an optimist or a pessimist about the nuclear age. "I am a pessimist," Dr. Lown replied, "about the past, because there is nothing to be done about it. But I am an optimist about the future, because that is ours to make."

As illustrated in this issue of FACTs, immediate and concerted action can enable society to mitigate and adapt to climate change, to sustain vital ecosystems, and to reduce global inequity. As individuals and as citizens, as farmers and as city dwellers, as corporations and civic organizations, as scientists and as teachers, as celebrities and as political leaders, all can do our part for the future of the planet and humanity's place on it. With leadership and will, humans can invent the future posterity deserves.

INTRODUCTION

Nicolas Renard - Executive Director, Veolia Institute

The fight for ecological transformation is waged across multiple fronts: decarbonizing the economy, preventing or processing pollution, recycling wastewater and waste, and combating soil sealing are just some of them. There is no doubting that, in many respects, this transformation resembles other major industrial revolutions that have marked technological progress, such as the arrival of the steam engine or electricity.

But why do we talk of transformation rather than transition? Because the scale and urgency of the climate challenge facing humanity are such that half-measures are simply not enough. We have to embrace far-reaching, radical and sweeping changes to our modes of production and consumption. We have to adopt an approach that is faster, more ambitious and more resolute than simply a transition. Another reason for choosing the term transformation is that we need to engage in a movement based on substitution and replacement, not addition. This sets it apart from previous energy transitions, where oil then renewables were used as energy sources in addition to coal and biomass, supplementing but never supplanting them.

Current projections paint a gloomy picture for the future of matters like biodiversity, natural resources and the planet's livability. Whatever happens, the future will be all the more alarming if we fail to prepare for it. Ecological transformation is not optional. It seeks to limit the excesses humanity is responsible for and a victim of: excessive plundering of nature's resources, causing scarcity; excessive discharges into the environment, causing pollution. Happily, many solutions for remedying these ills already exist. What we need to do now is roll them out massively and invent those that do not yet exist.

We also need to find ways to finance them until financially viable models are created, because if we have to wait for green technologies to become competitive before mass uptake occurs, it is likely we will have to wait for a long time. For the truth is that green transition requires enormous investment. It will lead to the sudden obsolescence of countless facilities and infrastructures, which will have to be replaced with newer technologies. This will in turn lead to large price spikes, for energy in particular, which is why economists have coined the term *greenflation*. But how can the price be made manageable to those who, ultimately, have to pay it?

And how can these solutions be made socially acceptable? This is one of the largest hurdles to ecological transformation, because to be accepted it has to be just, and seen to be just. Otherwise it will lead to massive social upheavals. Take one emblematic example, abandoning coal, the most polluting of all fossil fuels. This is an industry that employs over 70,000 people in the USA, over 100,000 in Poland and over 200,000 in Germany. Most of these jobs will disappear, and ways will have to be found to compensate for the losses. Other industries, such as automotive, oil and gas, will also lose countless jobs, while yet others, like renewables and insulation for buildings, will create plenty of new ones. But this is not a like-for-like process. The jobs will not require the same skills and will not be offered in the same locations. Massive efforts will be needed in terms of workforce reskilling and mobility. Social measures to accompany ecological transformation will be essential, compensating for loss of employment and supporting vocational retraining.

Ecological transformation involves a fundamental reappraisal of our societies' relationship with nature. It forces us to alter our choices and behaviors as citizens, consumers, and professionals. Are we truly ready for this? And what are the real-life incentives needed to help us make the leap? Day in day out, through countless tiny daily decisions, we constantly say Yes or No to ecological transformation. If the greatest possible number of people are to adopt environmentally beneficial behaviors, it is critical that such behaviors should be as easy and inexpensive to them as can be.

Ecological transformation involves a fundamental reappraisal of our societies' relationship with nature

For their part, businesses have to learn to think of their products and services not only in relation to the market, but also in relation to ecosystems and how much they can bear in terms of resources removed, and accept in terms of residual pollution. In parallel, businesses must also create a multi-capital accountancy model that reflects financial, social and natural capital.

How can we make ecological transformation deliverable and acceptable from the social and economic standpoints? These are the issues explored in this latest issue of the *Veolia Institute Review - FACTS Report*, offering a mix of cross-disciplinary studies and field reports from emerging and developed economies. It looks at a variety of topics, including employment and the restructuring of different areas of the economy, governance and the role of policy-making, green finance and training. Contributions from across the spectrum give us a glimpse of the seeds of change, introducing us to another world, a world so different from ours and so necessary, so near and yet so far away.

1. UNDERSTANDING AND RECONCILING THE ISSUES

Most people now recognize the urgent need to take action to meet the challenge of the climate emergency: 64% of those taking part in the largest ever survey of public opinion on the climate emergency (50 countries, 1.2 million responses) believe climate change is an emergency.[1]

Despite this, many people still know little about the complexities of global warming. In France, 46% of young people stated that they do not properly understand the meaning of the term greenhouse gas.[2] Nonetheless, the emergence of environmental considerations and the challenges of transition are by no means new. This is part of a process with roots reaching back to the 19th century, a period that saw the emergence of differences of opinion that remain with us today. As philosopher **Dominique Bourg** points out, relationships to ecology are by nature divisive, offering competing views of modernity.

Aside from a lack of consensus about what ecological transformation should look like, climate-related issues also have to overcome conflicts between and within states, both geopolitical and social. Because it is synonymous with strategic decisions on trade, commerce and regulation, the battle against the climate emergency is, as **Sébastien Treyer** reminds us, a key geopolitical consideration that may lead to the emergence of new opportunities – or renewed tensions. The recent Russian invasion of Ukraine has provided us with a tragic reminder of this reality.

Climate-related issues also underscore ongoing, if not worsening, divisions between countries of the North and South, as well as within national boundaries. This highlights the urgent need for climate justice to emerge: between states as well as within them, the climate question is now firmly entwined with the issue of inequalities. In an attempt to reconcile these goals, the paradigm of a "just transition" has entered public debate. **Patrick Schroeder** and **Jack Barrie** apply it to the concept of circular economy and waste management in emerging countries. The question of the social acceptability of transition also arises in developed economies. Fair Energy Transition for All, an initiative presented by **Pascale Taminiaux**, gives a voice to vulnerable households in Europe, for whom transition often equates to higher costs than for wealthier households. These conflicting realities were recently illustrated by the symbolic opposition *"end of the month versus end of the world"*.

As well as the social, environmental and geopolitical challenges, ecological transformation also involves technological challenges and raises major questions about our relationship to innovation. **Sara Trærup** highlights the key role that climate technologies could play in accelerating transformation while maintaining access to essential services such as water, energy and waste, particularly in developing economies.

Iris Levy
Mathilde Martin-Moreau
David Ménascé
Archipel&Co,
Issue coordinators

1 *Peoples' Climate* Vote, UNDP, 2021.

2 *Les jeunes et la science* [*Young People and Science*], Ipsos, 2021.

FROM ECOLOGICAL TRANSITION TO ECOLOGICAL TRANSFORMATION: consensus and fault lines

Iris Levy, Mathilde Martin-Moreau, David Ménascé
Archipel&Co

David Ménascé, founder, Mathilde Martin-Moreau, associate director, and Iris Levy, consultant in charge of prospective topics, work together at Archipel&Co, a social innovation and impact strategy agency. Archipel&Co has over 10 years' experience of working with businesses, NGOs, public bodies and social entrepreneurs to invent economically effective and socially desirable solutions for a just transition.

At a time when there is growing consensus in international policy-making about the urge to act on climate change, debate continues to rage over the approach and mechanisms to adopt for implementing the ecological transition. The events of 2022, including the rising number of environmental disasters during the summer, have served as a wake-up call, heightening the sense of urgency. But ecological transition is a complex matter, raising issues that involve more than just environmental and climate challenges. It is also vital to look at how such a transition interacts with the fight against inequalities, the realities of crises and geopolitical relationships, and the specific growth — or degrowth — model that we collectively wish to put in place.

INTRODUCTION

The climate emergency is without doubt the greatest international challenge of the 21st century. Recognition of this fact has undoubtedly accelerated around the world in 2022, with the proliferation of climate crises, including unprecedented heatwaves, flooding, drought, and megafires, resulting in heavy losses of life and property, and accompanied by fresh warnings from scientists with an announcement that two further planetary boundaries have been exceeded.[1] In France, President Macron has not hesitated to refer to the end of an era of carefree abundance.

Although the first reports warning about climate change date back to the early 1970s and the 50th anniversary of the Meadows report published in October 1972 is fast approaching, public opinion seems at last to accept the analysis and urgency of the situation. Nevertheless, consensus about how the transition should be implemented is yet to emerge.

1 Research teams at the Stockholm Resilience Centre developed the concept of planetary boundaries in 2009. It aims to make it easier to grasp the risks of brutal global environmental changes resulting from human activities that are likely to impact ecosystems and well-being. It sets out nine boundaries that must be respected if we are to ensure a safe and fair world for humanity to develop. These include ocean acidification, erosion of biodiversity, and disturbance of the phosphorus cycle. In 2022, the scientific community warned about limits that had been exceeded for chemical pollution and freshwater, vital to the prevention of deforestation, while four others of the nine in total have already been exceeded.

Fiera di Primerio - Panoramic view of the city from the bridge. The river is partly dried up - 02 08 2022

INCREASINGLY STRONG CONSENSUS CONCERNING THE DIAGNOSIS: THE URGENT NEED TO ACT AGAINST THE RISKS OF INACTION

Anthropocene: the impact of human activities on the climate emergency

In physical terms, global warming refers to the increase in average temperature at the earth's surface over the course of the 20th and 21st centuries and, in a more general sense, to the resulting disruption of major weather patterns.

The IPCC states that average annual emissions of anthropogenic greenhouse gases in the years 2010-2019 continued to grow, reaching levels greater than those recorded during preceding decades. These net emissions from human activities increased in every sector, from energy to manufacturing, transportation to agriculture. Fossil fuels still account for over 80% of energy use worldwide, a proportion that has scarcely changed in 30 years. The IPCC experts stress that if the targets agreed at the Paris Climate Conference are to be met, drastic action must be taken before 2030, notably the early abandonment of existing fossil-fueled infrastructure (coal-fired power plants, internal combustion cars, etc.) without waiting for them to reach the end of their technical lifetimes.

The risks of inaction are significant, and they are well-known. The IPCC has identified 127 of them across every part of the world and every economic sector

The risks of inaction are significant, and they are well-known. The IPCC has identified 127 of them across every part of the world and every economic sector. They include growing pressure on land and water resources, accelerating food insecurity. In its annual report, the FAO sets out its concerns over failure to make progress in the target of eliminating hunger in the world by 2030.[2] Another source of concern is the future growth in the number of climate refugees, combined with conflicts rooted in environmental factors. In a report published in 2021,[3] the World Bank modeled population movements which could be triggered by the climate emergency. Under the most pessimistic scenario, based on high greenhouse gas emissions, around 170 million people, and up to as many as 216 million, could be forced from their homes by 2050 for climate-related reasons. Disruption to ecosystems presents a further threat to human survival.[4] The most recent report from IPBES,[5] "the Biodiversity IPCC", points to the link between people's ability to survive and the preservation of a certain umber of ecosystems. Worldwide, some 50,000 wild species meet the needs of billions of people, around 10,000 of them providing a food source.

2 FAO, *The State of Food Safety and Nutrition in The World*, 2021.

3 World Bank, *Groundswell Part 2: Acting on International Climate Migration*, 2021.

4 For example, the 2020 WWF global Living Planet index shows an average 68% fall in monitored vertebrate species population between 1970 and 2016.

5 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, created in 2012.

Interconnected environmental crises

A number of scientific reports published in 2022 by the IPCC and IPBES stress the interdependency of environmental crises:

- the health of the ecosystems we depend on, along with all other species, is deteriorating faster than ever. Biodiversity is a central plank of the international agenda with the 2021 IUCN World Conservation Congress and the COP15 on biodiversity scheduled for December 2022 in Canada;
- oceans are suffering from their climate-regulating role and are getting warmer, more acidic and less productive. Glaciers and the cryosphere are melting faster than ever, and the permanent Arctic ice pack is shrinking, contributing to a rise in sea levels;
- the vicious circle formed by overuse of land coupled with the climate emergency creates a systemic threat to the planet.

The health impacts of these crises are also of increasing concern, with countless reports citing the effects of plastics and microplastics and indoor and outdoor air pollution as well as infectious diseases, mental health issues and other consequences of the climate emergency. Because they trigger instant anxiety about our individual health, these effects magnify the importance accorded to the crises that produce them.

Ecological transition is not simply about environmental and climate policies

Concepts such as a "just transition" and "climate justice" are a growing feature of national and international public debate.

Climate injustice towards Southern countries

The concepts of climate justice and just transition are rooted in recognition of a form of structural inequality: countries with the most industrialized and developed economies are historically more responsible for the climate emergency, whereas the first to suffer its consequences are the most fragile countries. This phenomenon of "double inequality" is synonymous with the inversely proportional distribution of risks and responsibilities. It is estimated that close to 80% of the current and future impacts of the climate disturbances will be concentrated in countries with developing economies. Annual costs of adaptation to climate change in these countries are currently thought to be around $70 billion, and are predicted to rise to between $140 and $300 billion by 2030, and $280 to $500 billion by 2050.

A third form of inequality also needs to be acknowledged on the international scale, centering on the under representation of the most vulnerable countries, particularly in international negotiations.

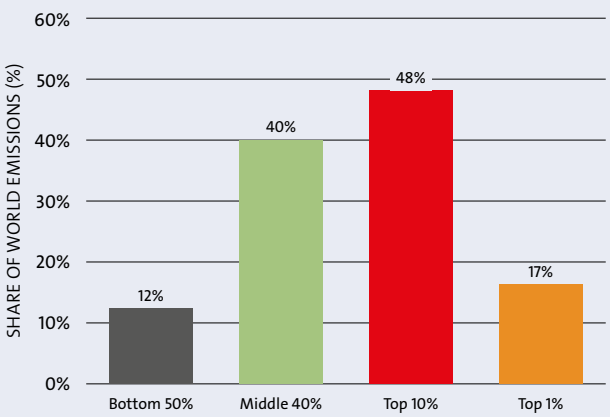
***"End of the month vs. end of the world"*: from consensus to the new class struggle?**

The idea of double inequality is increasingly applied to households and individuals rather than simply to states, highlighting households' unequal contribution to greenhouse gas emissions as a function of income. The lifestyles of the richest individuals are singled out for special condemnation, most recently for totemic issues, such as the use of private jets, which crystallize tensions.

According to a study by the World Inequality Lab led by Lucas Chancel, the richest 10% of the global population are responsible for close to 48% (47.6%) of global CO_2 emissions.[6] Faced with this reality, many members of civil society and international bodies such as the IPCC stress the need for the richest to make a greater contribution to ecological transition and its financing.

Little consensus exists regarding the approach and path to follow. Which interconnections could be made between ecological transition and the fight against inequalities? Which growth or degrowth models should we adopt for the future?

Global carbon inequality, 2019[7]



Interpretation: 50% of the least wealthy individuals are responsible for 12% of world carbon emissions. Personal carbon footprints include emissions from domestic consumption, public and private investments as well as imports and exports of carbon embedded in goods and services traded with the rest of the world.

6 Lucas Chancel, *Climate Change & the Global Inequality of Carbon Emissions*, World Inequality Lab, 2021.

7 *World Inequality Report*, World Inequality Lab, 2022.

The climate emergency also raises the question of territorial inequalities. Not all regions are equally impacted by, or vulnerable to, the climate emergency and the consequences of ecological transition. This applies particularly to regions that are heavily reliant on fossil-fuel energy. For example, in Europe a large number of jobs depend on coal mining, especially in Poland and Romania.

A "systemic" vision of inequalities in the face of the climate emergency

More recently, questions of intersectionality, driven by academic research in the US, have entered the climate debate. These questions examine links between climate inequalities and inequalities based on gender (women are more exposed to climate risks)[8], ethnicity (driven by the movement for environmental justice)[9] and intergenerationality (denouncing debts passed on to future generations by past and current generations).[10]

Aside from agreeing on the facts, little consensus exists regarding the approach and path to follow. The nature of actions to take sparks fierce debate. Which interconnections could be made between ecological transition and the fight against inequalities? Which growth or degrowth models should we adopt for the future? Should we talk about ecological transition or ecological transformation?

THE CHALLENGE NOW FOCUSES ON IMPLEMENTATION MECHANISMS

Origins and evolution of the concepts of ecological transition and ecological transformation

Science provides us with an endless stream of proof, but there is nothing new in the basic reality itself, or in the demands from certain civil society actors for a change in models. Back in 1972, the Meadows report formulated the concept of ecological transition to describe a shift from a growth model judged unsustainable to a balance described as global. Historically, the idea of transition linked to the notion of sustainable development as called for in the Brundtland report, "transition to sustainable development," which was then taken up by international policymakers. The concept of transition implies a change of state, a system-wide reconfiguration over the long term.

8 The UN states that pre-existing inequalities make women 14 times more likely than men to die during a natural disaster.

9 The concept of environmental racism is used by several actors, primarily from civil society environmental bodies such as the NRDC.

10 A recent study funded by the NGO Avaaz found that 45% of young people in 10 countries state that eco-anxiety impacts their daily lives: Elisabeth Marks et al., "Young People's Voices on Climate Anxiety, Government Betrayal and Moral Injury: a Global Phenomenon", *The Lancet Planetary Health*, 2021.

In today's parlance, ecological or green transition is the preferred term used by national and international bodies to cover all public environmental policies. In France, it received the official imprimatur of the state with the establishment in 2012 of the National Council for Ecological Transition, and the 2017 decision to replace the Environment Ministry with a Ministry for Ecological Transition. As a far-reaching structural change that encourages the emergence of new ways of producing, consuming and trading, transition is not a process to be underestimated. Some people rather use *transformation*, as it evokes fundamental changes to social and economic structures. Although it is true that both terms are employed today, sometimes in a very similar manner, certain academic specialists identify transformation as a more macro-led approach that goes beyond the fight against global warming and the protection of the environment. Comité 21, in reference to Karl Polanyi's *The Great Transformation*, explicitly chose the term for its eponymous prospective report published in 2020[11] to distinguish the process (transition) from the true destination.

11 Comité 21, *La Grande Transformation. Freins, leviers, moteurs* [The Great Transformation. Obstacles, Levers, Drivers], May 2020.

Transition, transformation: whatever the terms used and the vision underpinning them, tackling the ecological question and attempting to provide solutions demand a 360° approach to the problems facing us, requiring us to consider their social and economic ramifications. Social, because environmental policies cannot stand apart from the issue of fighting inequalities, as illustrated by the "just transition" concept mentioned above; economic, because we need to create a new model of society if we are to achieve a sustainable balance in a world where resources, fossil fuels in particular, are finite.

Green growth, sufficiency, post-growth, degrowth: which models for future use?

Several development models are currently being suggested in an attempt to reconcile economic, social and environmental challenges from a sustainable perspective. Their ideological roots and operational implications can sometimes be radically opposed.

To start with, the concept of green growth seeks to solve a twofold challenge: increase economic opportunities worldwide at a time when the global population is expanding, while simultaneously protecting the

environment and climate. The concept is widely used by international bodies, institutions and public authorities to describe policies and reforms put in place to deliver sustainable growth, often based on new investments and technological innovations.

Other concepts challenge, more or less vehemently, the reality of continuing with a world of non-stop growth. The sufficiency (or sobriety) and degrowth approaches, despite their differing ideological roots, both advocate values and behaviors in stark contrast to current modes of consumption, centering on a certain form of frugality, or even a dramatic reduction of consumption and needs.

Sufficiency aims above all at moderation, or a form of voluntary simplicity, while also more broadly calling into question the value of our individual and collective needs. This idea is gaining wider traction, not just among committed campaigners and ecologists: it featured for the first time in the latest IPCC report, and in 2021 the International Energy Agency included it in its scenario for zero net emissions by 2050. In France, national energy and environment agency ADEME has developed several scenarios for reaching carbon neutrality by 2050, one of them based on sufficiency.[12] It also crops up more frequently in government messaging and strategies: increasing numbers of governments are exhorting their citizens to adopt "sober" behaviors and uses as a result of the Russian invasion of Ukraine and energy supply tensions.

The degrowth model advocates a more radical approach that directly challenges the very idea that it is possible to sever the link between increasing GDP and greenhouse gas emissions. More closely aligned with campaigning groups, it is nonetheless experiencing an uptick in interest, particularly in France. Several initiatives, such as the launch of the Observatory of Post-Growth and Degrowth in France in 2022, and publication of the Prophil report *Post-Growth for Business,* advocate for the emergence of new, more disruptive models. The IPCC also refers to degrowth in its most recent report, but only for information purposes and without flagging it as a deliverable solution for meeting climate targets.

We still have a long way to go on the pathway to ecological transformation as the economy undergoes fresh upheaval, with trade-offs and, sometimes, contradictory injunctions persisting. These tensions are exacerbated by the crisis in Ukraine and its geopolitical and energy implications.

Crisis of the decision-making process itself

While ecological transition brings countless conflicts (social, political, territorial, generational, etc.) to the surface, a crisis of decision-making is making it harder still to organize it in a democratic manner.

In the words of French demographer Alfred Sauvy, *"democracy does not unite [...] Quite the opposite, it is the art of dividing."* But the art of civil conversation and peaceful dissent appears to be in crisis with the decline of representative democracy. The latter is afflicted by a "performance crisis" (Yascha Mounk[13]) even as the fault lines multiply: societies across the OECD countries are characterized by a climate of suspicion focused on political and economic elites, leading to a weakening of the social contract.

Deciding on just and socially accepted mechanisms for ecological transformation becomes even harder when the decision-making processes themselves are subject to criticism. In response to this, there is a clear preference for local actions, including via initiatives in favor of participatory democracy, while the clamor for transparency grows ever more widespread and insistent.

12 *Transition(s)* 2050, ADEME. See the Frugal Generation scenario in particular.

13 In *The People vs. Democracy* (2018), political scientist Yascha Mounk analyzes liberal democracy's "performance crisis" and the rise of so-called populist movements in a number of countries.

ENVIRONMENTALISM AND CRITICISM OF MECHANICAL MODERNITY

Dominique Bourg
Philosopher and Honorary Professor at Lausanne University

Opposing positions about the ecological transition are part of a long tradition. They pit those who espouse the age-old movement championing modernity against those who contest it, based on the movement sparked by modernity itself. There is no likelihood of these conflicting interpretations suddenly disappearing. The points of disagreement that led to the emergence of ecological thinking in the 19th century are still very much present, reflected in contemporary opposition between the "solutions" offered by green growth and eco-modernism and the partisans of degrowth in terms of material wealth. The outcome of the transition currently underway, commensurate with the obstacles it seeks to overcome, is profoundly uncertain. Ecological transition demands, at the very least, deep-reaching changes in how we live our lives, changes that go beyond purely technical solutions, as it invites us to engage in an in-depth reassessment of our relationship with ecosystems and the living world in general.

Dominique Bourg is a philosopher and Honorary Professor at Lausanne University who specializes in environmental issues. At *Presses Universitaires de France (PUF)*, he edits the *L'écologie en questions* series, *Nouvelles Terres* with Sophie Swaton and *Grands articles*, as well as the journal *La pensée écologique*. He has sat on several panels examining environmental issues, including the French Commission for Sustainable Development (CFDD), the National Sustainable Development Council (CNDD), and the Grenelle Environment Roundtable. He is a member of several scientific councils (ADEME, the Nicolas Hulot Foundation, the foresight body for the canton of Vaud, and the Zoein Foundation). He is an Officer of the French Legion of Honour and Officer of the French National Order of Merit. He won the Promeneur Solitaire prize in 2003, and Veolia Foundation Environment Book Prize in 2015.

INTRODUCTION

There is no consensus on what the ecological transition of our societies might mean; there never has been and never will be. The fault line of the past which, starting in the 1990s in the context of sustainable development, opposed strong sustainability versus weak sustainability, remains, all things being equal, unchanged today. This fault line can be traced back much further, all the way to the 19th century and the foundation of ecological thinking, as we will briefly demonstrate. There can be no consensus because ecological damage results from the very success of our modern mechanistic civilization; it is the necessary consequence of its triumph. It is for this reason that the possible interpretations cannot be consensual. We will also quickly touch on the reasons for the current damage to the planet's livability and will show that they center on this same fault line.

The lack of consensus applies not only to what green transition of modern societies might mean, but also to the advisability of such a transformation. Denials of ecological problems do not disappear even as they grow in severity and visibility. Reactions to the publication, on August 9 2021, of the physical science basis of the Sixth Assessment Report by the Intergovernmental Panel on Climate Change, amid a summer of extreme climate events, are enough to remind us of this. We were treated to a flurry of articles by climate skeptics and countless reactions from politicians in denial. Republicans in the US, in thrall to Trump and his baroque penchant for denialism – covering everything from his electoral defeat to the climate – remain firm climate skeptics. And ecological denial is not limited to the climate; it is also gaining ground in issues relating to damage to biodiversity and wildlife populations.[1] And if we look further than these two first environmental battlegrounds, the climate and living beings, to examine a third, the availability of vital resources for our economic activities, we find that denialists are present there too. All you have to do is go in search of them beneath the oceans, on asteroids, on the moon, or even on Mars. In addition to outright denials there is another, more sophisticated, form of denialism, centering on space and planet B. The idea of fleeing to Mars has been popularized by billionaires like Musk and Bezos, who are to ecology what Nero was to wisdom and compassion. We should not overlook the limitations of human physiology, tailored as it is to earth's gravity and little-suited to a seven-month weightless journey in a cramped capsule that would, on arrival, transform passengers into inert lumps incapable of moving unaided.

There is, clearly, nothing more absurd than the idea of terraforming Mars. Even if it were possible, and in under a billion years, Mars does not have the mass to maintain an atmosphere similar to Earth's.[2] Yet hundreds of millions of people probably believe this nonsense, and much more besides.

Nor is there consensus on what must be done to make our societies greener. There is very little new under the sun when it comes to this topic. The points of disagreement that led to the emergence of ecological thinking in the 19th century remain present.[3] As part of a school of thought that was initially very much in the minority, a twofold idea has gradually come to dominate: first is mistrust of the capacity of our technologies to overcome any difficulty, to surmount whatever resistance nature may offer them; second is an aspiration to reboot our relationships with nature, starting with a shift away from anthropocentrism. These two related ideas came increasingly to the fore in the years after the Second World War, ultimately forming a specific school of thought distinct from other major forms of modern thought such as

There is no consensus on what the ecological transition of our societies might mean; there never has been and there never will be

1 See Stéphane Foucart, « L'aube du biodiversité-scepticisme » [*The emergence of biodiversity skepticism*], *Le Monde*, May 23-25, 2021.

2 For more on the deluded idea of an exodus to Mars, see Sylvia Elkström and Javier G. Nombela, *Nous ne vivrons pas sur Mars, ni ailleurs [We won't live on Mars or anywhere else]* Paris, Éditions Favre, 2021, and Louis d'Hendecourt, « Avec sa faible gravité, Mars est incapable de retenir une atmosphère et personne, ni M. Musk ni le pape n'y pourra rien changer » [*Low-gravity Mars cannot maintain an atmosphere and nobody, neither M. Musk nor the Pope, can do anything about it*], *Le Monde*, August 8, 2021.

3 See Dominique Bourg & Augustin Fragnière, *La Pensée écologique. Une anthologie [Ecological thinking: an Anthology]*, Paris, Puf, 2014.

socialism, liberalism, conservatism, and so on, and clearly identifiable for that reason. However, the opposition that lies within the sustainable development movement, between partisans of weak or strong development, is integral to ecological thinking and its foundations. Strong sustainability is characterized, in the first instance, by the idea that reproducible capital, our technologies, can in no way replace the natural capital that has been destroyed; furthermore, it is not simply human well-being that needs to be considered, the welfare of all living things also has to be taken into account.[4] This is another illustration of the criticism of all-powerful technologies and anthropocentrism. Contemporary expressions of these fundamental oppositions take the form of green growth "solutions", eco-modernism, espousing the same technical credo, standing against any degrowth in material wealth, linked to the desire for harmony with the natural environment.

This is not about purely technical measures to reabsorb our excessive emissions, and not about simply changing our lifestyles and behaviors, when what is needed is a far more deep-reaching shift in our values

These successive oppositions find their origin in the foundation of ecological thinking itself. Ecological thinking is as much a criticism of mechanistic modernity as it is the fruit of its self-overcoming. Time for a quick reminder. The late 16th century saw a new vision of the world emerge, notwithstanding its ancient forebears: a mechanistic view whereby the natural world is no more than an aggregation of inert material particles. Humanity, self-aware and inseparable from time's arrow, thus appears, in essence and by destiny, a stranger to the natural world when seen through this prism. What was presented as progress would henceforth appear to be an endless separation from the natural world. The idea, consubstantial to the neoclassical economy, of open-ended destruction of natural capital is the expression of this metaphysic. That humanity is incrementally destroying the galaxy, as posited by Nikolaï Kardashev then Michio Kaku,[5] is another similar idea.

Ecological thinking pertains as much to a critique of modernity as to its self-overcoming. The spread of knowledge, itself encouraged by the mechanistic approach, is increasingly leading to the disputing of modernity,

4 See Bryan G. Norton, *Sustainability: A Philosophy of Adaptive Ecosystem Management*, Chicago, University of Chicago Press, 2005.

5 See Michio Kaku, *Une brève histoire du futur [A Brief History of the Future]*, Paris, Champs-Flammarion, 2016.

particularly in terms of the humanity-nature dualism, from ethology and new ways of thinking about animals, far removed from the animal-as-machine, to the wealth of expressions of the living plant world.[6] It is no more feasible to use algorithms to produce a mathematical theorem than a viable living molecule.[7] To which must be added the practical consequences of a mechanistic civilization that results in the partially anthropic character of former natural disasters.

We thus remain trapped in an age-old conflict, indissoluble both from the external difficulties triggered by the development of our mechanistic civilization and its internal self-overcoming movement. Which means there is no reason for it to disappear, still less to do so quickly. Added to this is the fact that, through the centuries, modernity has instilled in our minds that nature is fundamentally stable and generous, that it cannot take us by surprise and would never resist our technologies in any real and lasting way.[8] The 30 years of post-WW2 prosperity seared success into our cultural memories. Our failure is inaudible to the modern people we still are. The message we want to hear from the Anthropocene is that we have become the preeminent geological force on earth, but not that, due to the resulting boomerang effect, we are weakened and condemned to inhabit a planet whose livability is altered and impaired, a phenomenon that is already underway.

Let us not duck the truth. It is our material success and the comfort it brings, at least to those who feel its benefits, that are the root of the situation of near-collapse we now face. This is a form of civilizational double bind. The underlying causes of the alterations to the livability of the planet are clear to see and uncontested. Responsibility lies with the flows of materials and energy that underpin our growth, which are distributed extremely unevenly. The richest 1% are responsible for 15% of greenhouse gas emissions, the richest 10% for 52% of global emissions, while the poorest 50% are responsible for just 7% of these emissions.[9] The distribution of material flows is just as poor.[10] On the other hand, when it comes to damage to living systems, the fact that each human needs more or less the same surface area to regenerate its air and water and produce its essential food supply, responsibilities in this sphere are more evenly divided.

If, therefore, we renounce the absurd and, more importantly, dangerous attempt to endlessly perpetuate modernity, the path ahead is clear. We simply need to bring a halt to the energy and material hubris we have allowed ourselves to be pulled into. Specifically, as a recent report by the European Environment Agency[11] points out, we need to drastically reduce the production of objects and creation of infrastructure. The report mentions that "maintaining this position does not have to depend on economic growth. Could the European Green Deal, for example, become a catalyst for EU citizens to create a society that consumes less and grows in other than material dimensions?". The IPCC's SSP1-1.9 scenario is rooted in extremely rapid energy, and therefore material degrowth.[12] It recommends lowering our emissions, halving them by 2030 and achieving carbon neutrality by 2050; based on 2017 data, this would avoid overshooting the target rise of 1.5 degrees – which makes no sense five years later at a rate of 50GT/year of emissions.

It goes without saying that, in both cases, this is not about purely technical measures to reabsorb our excessive emissions, and not about simply changing our lifestyles and behaviors, when what is needed is a far more deep-reaching shift in our values. The challenge facing us is to develop activities, modes of distinction and expression, with fewer material corollaries. In other words, ways to fulfill ourselves and our humanity that do not demand much in the way of energy and material flows – quite the reverse of the habits we have learned since the rise of industrial civilization. These goals are evidently part of a movement to radically remodel our relationship with ecosystems and the living world in general.[13] Namely, we need to come up with a model for human development, on the background of demographic decline, that supports the blossoming of life on Earth rather than destroying it.

CONCLUSION

If we agree to overcome the denialism described above, the task of achieving ecological transition is enormous, and we can only proceed by trial and error. And by keeping three constraints in mind: first is the social and political opposition the task is bound to elicit; second is the time constraint when, after at least half a century of inaction, if we take the Club of Rome report and Stockholm Conference as the starting point, we need to dematerialize and partially transform our societies in a mere decade, while the third constraint arises from the extreme weather events that are set to become increasingly severe against the backdrop of the biodiversity crisis.

6 See the feature published by *La Pensée écologique*, *Repenser le statut des plantes [Rethinking the Status of Plants]*, Vo. 6, 2021, https://www.cairn.info/revue-la-pensee-ecologique-2020-2.htm.

7 See Nicolas Bouleau, *Ce que Nature sait. La révolution combinatoire de la biologie et ses dangers [What Nature knows. The combinatorial revolution of biology and its dangers]*, Paris, Puf, 2021. See also https://lapenseeecologique.com/les-dangers-insoupconnes-de-la-biologie-de-synthese/. See also N. Bouleau with D. Bourg, *Épistémologie et écologie [Epistomology and Ecology]*, to be published by PuF in 2022.

8 See Amitav Ghosh, *The Great Derangement. Climate Change and the Unthinkable*, University of Chicago Press, 2016.

9 https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621052/mb-confronting-carbon-inequality-210920-en.pdf.

10 Heinz Schandl & al., *Global Material Flows and Resources Productivity: Assessment Report for the UNEP International Resource Panel*, Nairobi, UNEP, 2016.

11 https://www.eea.europa.eu/themes/sustainability-transitions/drivers-of-change/growth-without-economic-growth.

12 Initially published with Special Report 15 in 2018, republished in the Sixth IPCC Assessment Report, *Climate Change 2021. The Physical Science Basis. Summary for Policymakers*.

13 For a more general discussion of the paradigm shift currently underway, see Dominique Bourg & Sophie Swaton, *Primauté du vivant. Essai sur le pensable [Primacy of the Living World. Essay on the Thinkable]*, Paris, Puf, October 2021.

GEOPOLITICS AND GREEN TRANSITION: new balances, new challenges

Sébastien Treyer
Executive Director, Institute for Sustainable Development and International Relations (Iddri)

Ecological transition is a critical geopolitical and geoeconomic challenge, the wellspring for several competition-cooperation scenarios that are now more sensitive than ever. The Russian war against Ukraine has shone a harsh light on the issues involved in securing energy supplies. But the ecological transition can also be synonymous with new opportunities for cooperation, particularly between Europe and Africa. To ensure that these opportunities are not confined to the short term, however, they must also be accompanied by a significant rebalancing of the international economic and trade system, which is decried as asymmetrical by many southern hemisphere countries. Europe would be well advised to take a proactive role in tackling these multiple challenges, in alignment with its strategic interests and values.

Sébastien Treyer joined Iddri in 2010 as Director of Programs and has been its Executive Director since January 2019. He is also Chairman of the Scientific and Technical Committee of the French Global Environment Facility (FFEM) and member of the Lead Faculty of the Earth System Governance Network. A graduate from École Polytechnique with a PhD in environmental management, he oversaw foresight studies at the French Ministry of the Environment, where his work included coordinating Agrimonde, a foresight exercise looking at how to feed the world in 2050. He has played an active role at the interface between science and policy and in scientific programming for the European Commission, the French National Research Agency, and regional bodies such as the Seine Normandy Water Agency.

The question of the ecological transition in general, and the energy transition in particular, raises a great many geopolitical considerations. On the one hand, protecting certain fossil resources is a matter of national sovereignty and independence for some countries; on the other hand, decarbonizing energy mixes may lead to new questions being raised or new patterns of inter-state dependency. Aside from the central role of energy in Russia's invasion of Ukraine, what do you think are the main areas of tension or, conversely, the opportunities for cooperation likely to emerge in terms of the energy and ecological transition in the year ahead?

Sébastien Treyer: Sustainability is a central theme, geopolitically and geoeconomically, that triggers several different competition-cooperation dynamics. There is a lot of concern about maintaining energy security, a corollary to the relative uncertainty about the geopolitical shape of a world dominated by renewables. A recent report from the European Council on Foreign Relations[1] examined the security and stability of Europe's energy supply from this perspective. It seems that the energy transition is, or will be, the source of potential clashes between client and supplier countries – which generally have a relationship marked by instability – such as Algeria, a supplier of gas and oil. The reality is that maintaining peaceful relations with some of our neighbors, such as Russia for example, is directly linked to

1 Mark Leonard, Jean Pisani-Ferry, Jeremy Shapiro, Simone Tagliapietra, Guntram Wolff, *The Geopolitics of the European Green Deal*, 2021.

the relationships that exist in terms of energy supply. Given this, how can we improve the security of energy supplies within the European Union? Renewables are certainly part of the response to this complex equation.

In a report published in 2019,[2] the International Renewable Energy Agency (IRENA) examines the main geopolitical features of the world of renewables. One of the key elements that is regularly emphasized is the gradual shift from a geopolitical world structured by oil-dependency during the 20th century and concentration of oil resources in the hands of a small number of countries, to a world characterized by the curse of raw materials that afflicts countries like the Democratic Republic of the Congo (DRC) and/or by a greater dependency on China in this regard.[3] We certainly need to anticipate these issues so that we avoid reproducing with mineral resources the same sourcing patterns we have seen with oil. The DRC, as we just mentioned, is already wracked by "the curse of raw materials" against a background of corruption and cronyism that purchasing countries are equally responsible for.

The environment is no longer simply a pretext for forging relationships rooted in other priorities; it is now the focus of structural negotiations with its own agenda

But there is more to the question than this aspect alone, and the analysis put forward by IRENA looks at the issues in greater depth. In a world of distributed renewables production, we will need to think of security in terms of networks rather than of securing geographically concentrated natural resources. How are we to guarantee the security of the electrical and digital networks needed for producing and distributing the energy of tomorrow? How can we optimize distributed production of renewables? These are the challenges to tackle in the coming years and, from the international perspective, they are sensitive issues owing to the ever higher levels of interconnection between various discrete networks.

And although securing a network-administered resource is potentially easier than a quasi-military approach to securing a territorial supply source, such as a pipeline, it does nonetheless demand a change of perspective. Tomorrow's physical energy networks will no longer be dependent on fixed sources but on deterritorialized network models, synonymous with new opportunities for energy sovereignty for some as well as bringing a new set of constraints. Moreover, these questions are inextricably linked to issues of governance and security of the data and management systems used by these various networks. And we have to remember that ecological transition is about more than just questions of energy. It also shines a spotlight on issues surrounding access to technologies, ownership rights, and international equity in a wider sense. From the viewpoint of Southern hemisphere countries, the current global economic system seems profoundly unfair and asymmetrical. It is critical to make sure that ecological transition does nothing to accentuate these imbalances.

It is vital that we identify and encourage opportunities for cooperation arising from the ecological transition, particularly between Europe and Africa. And I feel that the time is right for cooperation. The model that dominates the relationship between the European Union and Africa has less to do with competition for technologies the EU would prefer to maintain ownership of, and more to do with a mutual desire to learn how to implement the transformation of certain sectors. From this perspective, it is very much in Europe's interest to coopt Africa as an ally for co-constructing ambitious strategic positions in relation to the coming transition.

The issue of trade is central to the conditions needed for establishing a harmonious and long-lasting collaboration. But the EU's carbon border adjustment mechanism, currently being adopted, puts out some very mixed signals. Although discussions on the mechanism are mostly focused on internal EU issues right now, external factors are every bit as essential. Many emerging and developing countries, in Africa, Latin America and the Middle East, have not yet reached complete industrialization, and see this seemingly protectionist mechanism as hampering their development. Overcoming this reticence will only happen if the technical details of the adjustment mechanism are co-designed with these states, proving them that the idea is not to cut them off from our market but to find the tools needed to accelerate transition. From the sustainability standpoint, it is sometimes better to import sustainable palm oil from Malaysia than to use European rape seed oil produced using pesticides. The pivot back to locating trade within Europe is already underway and will very likely lead to misunderstandings and perhaps tensions with our partners.

Another major point of potential conflict or cooperation centers on harmonizing sustainable finance standards. This issue, while apparently more technical, has major geopolitical ramifications.

Although international finance actors are currently collaborating closely in terms of fighting the climate emergency, this outward convergence between positions adopted in Paris, London, Frankfurt, New York and Shanghai serves simply to mask fierce competition to establish sustainable finance standards. If we are too hasty in accepting the supremacy of a particular standard, European taxonomy for example, countries such as India, Indonesia or South Africa might feel they were once again being cut off from equal access to global capital markets. Paradoxically, we actually need to slow down this rush to codify to ensure that all countries can have unfettered access to future markets created by the transition.

2 IRENA, *A New World: The Geopolitics of the Energy Transformation*, 2019.

3 Supplies of rare minerals are essential to the computer industry and for the production of renewables, among others.

What are the conditions needed so that the cooperation model you described can triumph over the competition model?

S.T.: In October, the IDDRI held a three-day debate on renewing multilateralism through sustainability: the views expressed during this event underlined the central role played by the ecological transition in crystallizing potential inter-state conflict or cooperation in the years ahead. The environment is no longer simply a pretext for forging relationships rooted in other priorities; it is now the focus of structural negotiations with its own agenda. It is worth remembering certain historical precedents: in the late 1980s, during the Cold War, negotiations on acid rain between the countries of Eastern and Western Europe, instigated by the environmental and scientific communities, led to far-reaching changes to industry on both sides of the Iron Curtain. The environment is an effective lever for encouraging economic and political change, even at a time of heightened geopolitical tensions.

With modern-day geopolitics seemingly conditioned primarily by power struggles between China and the USA, or Russia and Europe, we are also, in a way, seeing the return of non-aligned nations to center stage

There are two further factors to consider when assessing these possibilities.

First, we are currently seeing countries of the South returning to the geopolitical center stage, coupled with their deeply felt disillusionment with how the world is run and reservations about how the ecological transition is being managed.

Globally, there is certainly a strong consensus around Agenda 2030, backed up by the Paris Agreement and the Addis Ababa Action Agenda on financing sustainable development. Most countries, both North and South, have enacted a new social contract for the planet, combining the fight against inequalities with decarbonizing their economies and preserving biodiversity. Civil society is also showing an increasing convergence of societal and environmental interests centering on Agenda 2030. But this form of social contract remains theoretical, and real-life applications are hard to achieve.

Specifically, countries of the South justifiably point to the broken promises made by Northern countries in terms of international solidarity and the rebalancing of the economic system which, in their view, is a prerequisite for the environmental agenda to succeed. Mindful of the South's new-found geopolitical clout, this chasm between expectations and realities has potentially severe consequences. There is a real risk that these countries will give up and disengage from efforts to protect the climate, or indeed from multilateral cooperation mechanisms in general.

Listening to the change of tone in messaging from our African colleagues is eye-opening: they are no longer simply appealing to the North's moral responsibility toward less developed countries, victims of the climate emergency or a system felt to be unfair, but are primarily stressing the fast-rising economic and geopolitical power of these emerging economies. Their demands are not new. They can be traced back to the 1960s and the call by non-aligned countries for a New International Economic Order. With modern-day geopolitics seemingly conditioned primarily by power struggles between China and the USA, or Russia and Europe, we are also, in a way, seeing the return of non-aligned nations to center stage. "Time for another Bandung"[4] seems to be what most of the planet is calling for! Unlike in the 1960s, however, these actors now have the means to act and ensure that their voices are heard. Their markets count, are sought after, representing a powerful lever for demanding a seat at international bodies such as the IMF and World Bank, which are no longer the exclusive prerogative of OECD countries.

At a more structural level, countries from the Global South are demanding that all cooperation within the framework of the European Green Deal must be a genuine opportunity for root-and-branch reconfiguration of trading terms within global value chains, not simply a way of rubber-stamping European autarky.

The second factor to bear in mind is the structural inability of some countries to start on the road to ecological transition.

In many parts of the world, it is not knowing whether states are for or against transition that counts, but rather whether they have the capacity to put it into practice. These are states where governance is fragile, that rely almost exclusively on income from extractive activities and are in effect left outside of drives to improve sustainability and cooperation.

Civil society plays a crucial role in this context. It is therefore imperative to reshape the contours of international governance, not simply as the expression of inter-state relationships, but also to embrace non-governmental civil society actors including NGOs, trade unions, citizen movements, private sector economic actors and local communities.

At the recent IUCN World Conservation Congress, held in September in Marseilles, France, many contributors argued for greater weight to be given to the rights and interests of indigenous peoples and local communities during climate negotiations, citing strategic and political interests rather than moral considerations alone. A growing number of experts and civil society organizations are backing these demands and coming up with rigorous and deliverable political strategies to achieve them. Calls for indigenous communities to have a greater say are no longer utopian dreams but are now a well-understood element of realpolitik.

4 The Bandung Conference took place in Indonesia during the Cold War, from April 18-24 1955, and was the first gathering of representatives from 30 or so Asian and African states. It signaled the entry on the international stage of decolonized states from the "third world" who refused to join either of the two blocks, and the start of the non-aligned movement.

Can you give us some concrete examples of successful cooperation centering on the ecological transition that inspire you?

S.T.: The first concrete example that springs to mind is the transformation in progress in the steel industry, which is highly promising as well as extremely challenging. We now have technically credible zero-carbon steel available, made using decarbonized electricity and zero-carbon industrial processes. Despite being technically viable, the manufacturing cost of these processes remains too high and difficult to amortize owing to limited uptake to date. At the same time, some of the industry's major players are notably reticent about the transition. South Africa's steel industry, one of the country's major employers of non-whites, claims the transition would negatively impact employment in a country whose politics remain scarred by pervasive inequalities.

Faced with these constraints, how can we make sure that places such as sub-Saharan Africa can be equipped with essential infrastructure that relies on zero-carbon heavy industry? Squaring this equation requires convincing most of the sector's actors that it is worth investing in zero-carbon steel over the next decade, in place of stranded assets rendered valueless by the ecological transition.

This goal requires a powerful upstream policy commitment by the main steel buying countries – India, the USA, Europe and Canada – to zero-carbon steel, and agreements with the industry's economic actors to back up this commitment. The fact is that manufacturers need to be reassured about profitability if they are to start transitioning toward these new markets. This type of solution, associating public and private actors, echoes Pascal Lamy's notion of polylateralism, which could usefully be applied to the process of ensuring that the transition underway is a success. But multilateral frameworks, universal and therefore fairer for the weak than exclusively polylateral solutions, remain relevant to ensure that such agreements – more local and more specific, forming efficient small clubs – continue to be discussed, evaluated and contextualized within the UN framework.

A second standout example is the progress made following the signature of the Kigali Amendment in 2016, which ushered in the gradual discontinuation of highly polluting hydrofluorocarbons (HFCs) in air conditioners and refrigerators, meaning that the Indian air-conditioning industry is now zero HFC. Let us hope that similar initiatives will multiply over the next few years.

Is there a special role Europe can play in terms of these various issues at the intersection of ecological transition and geopolitics?

S.T.: Does Europe have to champion these demands for a new balance of powers? This is an open question. Some are opposed, arguing that it is a form of post-colonial repentance, or something utopian and non-priority. My own view, on the other hand, is that a seemingly utopian position can prove to be geopolitically relevant.

The Green Deal's leadership role in ecological transition, European cooperation with our neighbors from the African continent, the establishment of fairer trading models, and rebalancing of power to give greater weight to local communities are the components that can be used to forge a credible and intelligent geopolitical position for the European Union, in alignment with its strategic interests. This position, undoubtedly attractive to non-aligned states, would serve as the key building block for relationships characterized by long-term cooperation that is ultimately likely to yield economic benefits. Once again, it is not unrealistic to assert a convergence between utopia and realpolitik.

Are there any tangible signals that prove Europe's intention to assume this proactive role, or are we only at the start of a long-term process?

S.T.: One thing is certain in the short term. Europe has little leeway for prevarication in terms of ecological transition positioning if it wants to maintain its leadership in this area. Geopolitical rivalries and global economic balances are, by their nature, always liable to very rapid change.

With its Green Deal, Europe has already embraced a posture that is equitable, although difficult to live up to internally. To preserve its credibility with its international partners, it needs to successfully align its messaging with its internal interests and win over the most reticent sectors and countries, such as the agrifood sector or Poland, whose energy independence relies on coal. The next two or three years will determine whether — or not — the block can establish the conditions for harmonious and fruitful cooperation with non-aligned countries.

However, forging stable relationships rooted in cooperation requires an investment over the longer term. The African Union-European Union summit that took place in February is the starting point for a series of initiatives whose success will only be measurable in the medium term.

Lastly, support for civil society, peace building and strengthening the influence of minorities are all undeniably long-term goals. But Europe would be well advised to take a clear stand on these issues right now, even more so as others see authoritarianism as a way to accelerate transition. It is essential that Europe maintains its support for democracies and pluralistic civil societies as the values that guide its positioning. To take one example, when it co-finances projects in Africa with China, Europe must be unequivocal in terms of its expectations for transparency and respect for human rights.

IS GOING CIRCULAR JUST?

ENVIRONMENTAL JUSTICE AND JUST TRANSITION – KEY ELEMENTS FOR AN INCLUSIVE CIRCULAR ECONOMY

Dr. Patrick Schroeder, Senior Research Fellow, Chatham House
& Dr. Jack Barrie, Research Fellow, Chatham House

A successful circular economy transition relies on inclusiveness and social justice. Two main equity dimensions should be considered for the circular economy transition to be inclusive: rectifying existing injustices of mismanaged waste and pollution that affects hundreds of millions of people worldwide on the one hand, whilst anticipating and addressing the negative future impacts on workers and industries that the transition from a linear to circular economy will create, on the other hand. To do so, understanding the impacts of national transitions in Europe on workers and communities in developing countries will be key, notably how to improve economic diversification and retrain workers in producer countries, and how to increase stakeholder engagement.

Dr Patrick Schroeder is a senior research fellow in the Environment and Society Programme at Chatham House. He specializes in research on the global transition to an inclusive circular economy with a specific focus on policy analysis and multilateral environmental processes, collaborative opportunities between key countries, closing the investment gap and building an evidence base for trade in the circular economy. Prior to joining Chatham House, he was Research Fellow at the Institute of Development Studies, University of Sussex, where he conducted research on the circular economy in developing country contexts and the Sustainable Development Goals.

Dr Jack Barrie is an expert on the topic of circular economy. In his current role as Research Fellow at Chatham House, Jack leads on pioneering research examining the intersections between the circular economy and international trade, geopolitics, finance (including Green Taxonomies) and the Sustainable Development Goals (SDGs). Prior to joining Chatham House, he was a Circular Economy Policy Analyst for Zero Waste Scotland. He holds a PhD (University of Strathclyde) on circular economy innovation policy.

INTRODUCTION

Inclusiveness and social justice are key issues that need to be addressed for a successful circular economy transition to achieve positive social-ecological outcomes.

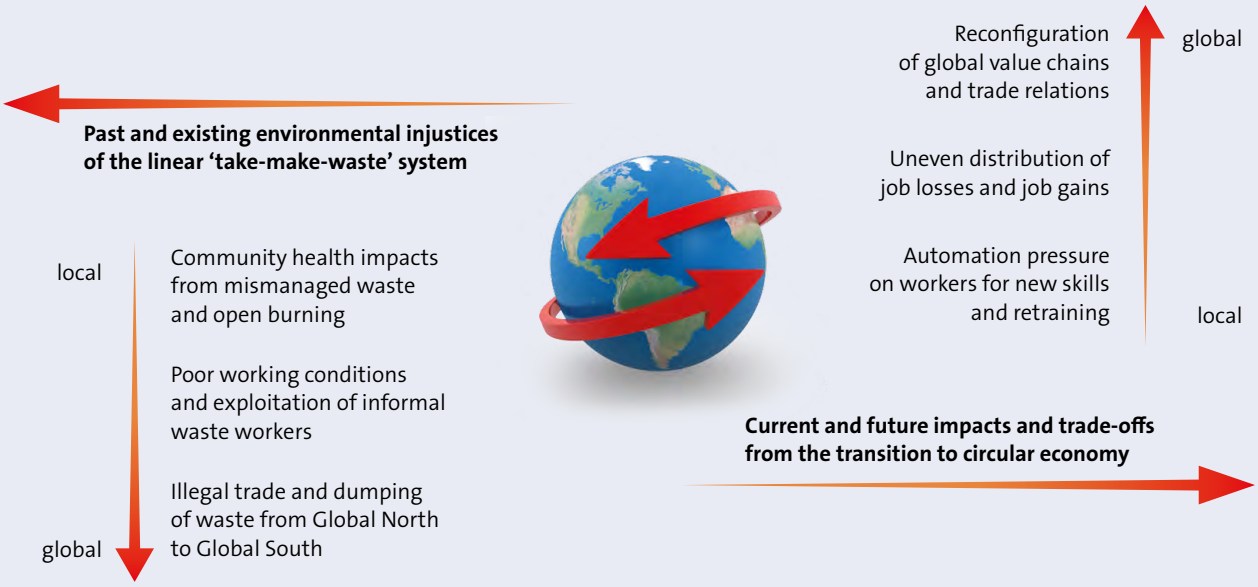
Without addressing the human and social dimensions of the transition, the circular economy will not deliver on important social goals such as improved health, decent working conditions, or reduced inequality. It might even prevent a transition from taking place, since unjust and unequal societies are unlikely to be stable in political terms.

The good news is that the need to address social issues in circular economy transitions, alongside environmental concerns and building the circular business case, is receiving more attention in the mainstream approaches.

Temporal and spatial justice dimensions of the circular economy transition

For the circular economy transition to be inclusive there are two main equity dimensions to be considered. These issues are connected, but still distinct from each other.

1. Rectifying existing injustices of mismanaged waste and pollution that affects hundreds of millions of people worldwide – this is the environmental justice dimension of the transition. Examples here are illegal dumping of waste into low-income communities or waste shipments to low- and middle-income countries which result in severe health impacts on communities, waste workers and their families.
2. Anticipating and addressing the negative future impacts on workers and industries that the transitions from a linear to a circular economy will create – this is the Just Transition dimension. An example here is the shift away from 'fast fashion' production and consumption patterns that will likely affect millions of small businesses and workers in developing Asian economies.



ENVIRONMENTAL JUSTICE

Applying an environmental justice perspective or framework is an important first step to fill the social gap in the circular economy. The direct impacts of waste dumping and pollution on communities have been documented for decades in the United States, including cases of structural environmental racism.[1] Similarly, in Europe the available data dating back to the 1980s provide consistent indications that waste facilities are disproportionally located in areas with more deprived residents, or from ethnical minorities. The observed inequalities in exposure to waste and toxins, and the health impacts thereof, represent a case of environmental injustice.[2]

Global health impacts

In the 21st century, the environmental justice dimension of waste has taken a global dimension. Illegal trade and dumping of low-grade waste sharpen environmental inequality and exploitation along the lines of class and race on a global scale. Vulnerable communities who did not produce the waste are often the ones who suffer the negative impacts.[3] Waste and plastic pollution is creating a growing public health emergency in many towns and cities around the world. Research and analysis by the organization Tearfund suggest that between 400,000 and 1 million people die each year in developing countries because of diseases related to mismanaged municipal

1 Pellow, D. (2004), "The Politics of Illegal Dumping: An Environmental Justice Framework", *Qualitative Sociology*. DOI: 10.1023/B:QUAS.0000049245.55208.4b.

2 Martuzzi, M., Mitis, F., Forastiere, F. (2010), "Inequalities, inequities, environmental justice in waste management and health", *European Journal of Public Health*, Volume 20, Issue 1, February 2010, Pages 21–26. https://doi.org/10.1093/eurpub/ckp216.

3 Dreau, A. (2022),"Why is the global waste crisis a social justice issue?" Zero Waste Europe. https://zerowasteeurope.eu/2022/02/why-is-the-global-waste-crisis-a-social-justice-issue/.

waste.[4] Reducing the burden of pollution from the poorest in society, especially for communities affected by mismanaged waste and degraded environments in developing countries, is an urgent priority for the circular economy.

Hazardous waste exported to the Global South includes electronic waste which contains toxic materials. Formal recycling activities are not keeping pace with the global growth of e-waste – an estimated 53.6 million metric tons (Mt) of e-waste was generated in 2019, according to the UN Global E-waste Monitor.[5] Most of the e-waste generated, about 44.3 Mt, is managed outside the official collection system and in many cases is shipped to developing countries where it is mostly dismantled in substandard facilities by workers without any protective equipment, exposing workers through direct contact.

A recent Lancet Commission report confirms that still up to 9 million people die prematurely every year due to pollution.[6] Despite ongoing efforts by the UN and other actors, little progress has been made. Urgent attention is needed to control pollution and prevent pollution-related disease, with an emphasis on air pollution and lead poisoning from unsafe e-waste and battery recycling. Lead pollution disproportionately affects children living in developing countries.[7]

There is a clear role for international development cooperation programmes to promote circular economy approaches to reduce the environmental and social impacts of pollution. An example is the recently launched Sustainable Manufacturing and Environmental Pollution programme.[8] It is established by the UK's Foreign, Commonwealth and Development Office (FCDO) and is implemented in partnership with the United Nations Conference on Trade and Development (UNCTAD). The aim is to improve existing knowledge and address the environmental health and socio-economic impacts of selected manufacturing sectors across target countries in Sub-Saharan Africa and South Asia.

Inclusiveness and social justice are key issues that need to be addressed for a successful circular economy transition to achieve positive social-ecological outcomes

Waste picker inclusion and gender equality

Waste pickers and informal workers are already integral part of many existing circular systems. They recover and create value from waste – but their contributions are not valued by society. Waste pickers deal with many issues ranging from poor working conditions, poor health, poverty and social stigma. Despite their contributions waste pickers are often considered a social problem. Especially in low-income countries the number of waste pickers is very high, mostly driven by the lack of better economic opportunities and low human development levels.[9]

Women play a key role in informal waste picking sectors across many African, Asian and Latin American countries that are finding themselves flooded with plastic waste. The plastic waste crisis is overwhelmingly affecting poor, socially marginalised people, and women residing in informal settlements where waste easily accumulates due to poor rubbish collection services. It's imperative to improve the situation for women by reducing their exposure to mismanaged waste and pollution, if we are to realise a truly fair and more equal circular economic system.[10] Although women are disproportionately impacted by waste and pollution, gender continues to be a relatively marginal issue in environmental justice debates and the circular economy more generally, and yet it remains an important aspect of injustice. Women tend to experience inequitable environmental burdens (distributional injustice); and are less likely than men to have control over environmental decisions (procedural injustice), both of which impact their health (substantive injustice).[11]

Achieving inclusive circular economies requires re-conceptualization of solid waste management systems that integrate waste pickers as partners, as key to building just, inclusive, and liveable cities. There are many examples of how this has been achieved and of existing best practice models that can be applied.[12] It is important to have institutional mapping to identify NGOs and other groups already working on the ground in organizing and/or providing assistance to waste pickers. Trust building amongst workers themselves and amongst different cooperatives and associations requires time, especially if external organisations are involved. As trust-building and dialogues evolve, so do the methods of cooperation.

4 Williams, M. et al. (2019), *No Time To Waste: Tackling the plastic pollution crisis before it's too late.* Tearfund, Fauna & Flora International (FFI), WasteAid and The Institute of Development Studies (IDS).

5 Forti V., Baldé C.P., Kuehr R., Bel G. (2020), *The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential*, United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR) – co-hosted SCYCLE Programme, International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Rotterdam.

6 Fuller, R. et al. (2022) "Pollution and health: a progress update", *Lancet Planet Health* 6: e535–47. https://doi.org/10.1016/S2542-5196(22)00090-0.

7 A recent study by UNICEF and Pure Earth estimates that more than 800 million children – nearly half of these in South Asia— are estimated to have blood lead concentrations that exceed 5·0 micrograms per deciliter (µg/dL), the level at which urgent action is required. UNICEF (2020), *The Toxic Truth: Children's Exposure to Lead Pollution Undermines a Generation of Future Potential*, UNICEF and Pure Earth. https://www.unicef.org/media/109361/file/The%20toxic%20truth.pdf.

8 Sustainable Manufacturing and Environmental Pollution Programme https://smepprogramme.org/.

9 Amorim de Oliveira, Í. (2021), "Environmental Justice and Circular Economy: Analyzing Justice for Waste Pickers in Upcoming Circular Economy in Fortaleza, Brazil". *Circ.Econ. Sust*, 1, 815–834 https://doi.org/10.1007/s43615-021-00045-w.

10 Wakunuma, K. (2021), https://theconversation.com/plastic-waste-is-hurting-women-in-developing-countries-but-there-are-ways-to-stop-it-166596.

11 Bell K. (2016), "Bread and Roses: A Gender Perspective on Environmental Justice and Public Health", *Int J Environ Res Public Health*. 2016 Oct 12;13(10):1005. doi:10.3390/ijerph13101005. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5086744/.

12 Dias, S. (2016), "Waste pickers and cities", *Environment and Urbanization*, Volume: 28 issue: 2, page(s): 375-390.

SWITCH TO CIRCULAR VALUE CHAINS PROGRAMME

For the circular economy transition to be just and inclusive, all actors along global value chains need to be engaged and empowered to participate, from the large multinationals down to local informal waste picker cooperatives. In recognition of the social justice and just transition challenges associated with the circular economy, the SWITCH to Circular Economy Value Chains programme[1] was recently launched, with the support from the European Union and the Government of Finland.

The programme supports suppliers in developing countries in the value chains of large EU manufacturers and buyers to jointly identify, adopt, and excel in circular economy practices in a way which is fair and inclusive. It seeks to do this through a combination of pilot projects and providing targeted policy development and capacity building support.

In Morocco, for example, the SWITCH pilot will work with a consortium of EU and Moroccan private sector partners and the Moroccan government to establish Morocco's first PET bottle-to-bottle recycling process. Apart from demonstrating the technical and commercial viability, key to the success of the pilot is empowering and integrating over 900 informal waste pickers into the value chain. The pilot will seek to address some of the key social justice issues facing informal workers including lack of formal legal recognition, lack of access to land to legally conduct collection and sorting facilities, and lack of traceability.

1 www.switchtocircular.eu.

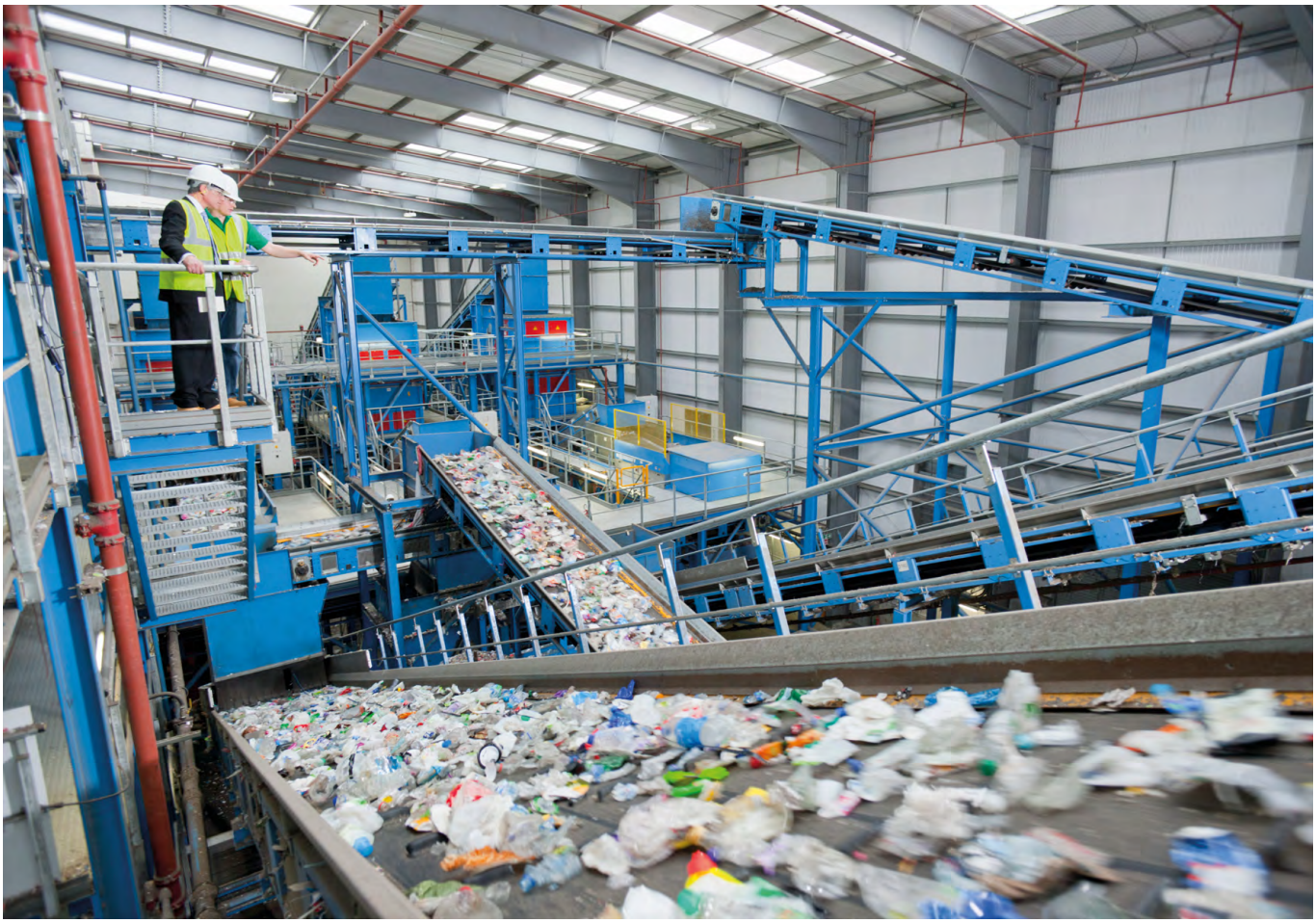
Going forward - Just Transitions

The second aspect of justice considerations for the circular economy transition is that of Just Transitions – a transition that ensures mitigating the industrial transition impact on workers and communities and ensure workers have the right skills for the future economy. It has started to penetrate political debates and research agenda on sustainability policy, particularly in the contexts of climate change and low-carbon energy transition. It is also necessary to connect the dots with the circular economy transition, as we first pointed out in a Chatham House report in 2020.[13]

Although the just transition guidelines published by the International Labour Organization (ILO) in 2015 do not explicitly mention the circular economy, the guidelines call on governments to "undertake steps and design measures to facilitate formalization and promote decent work, particularly in, but not limited to, the waste management and recycling sectors".[14] It is also necessary to integrate provisions into national plans and policies for the achievement of the SDGs. One of the overarching objectives should be to support informal workers and MSMEs affected by the transition. This is particularly relevant in the context of post-pandemic economic recovery.

13 Schröder, P. (2020), "Promoting a just transition to an inclusive circular economy", Chatham House, London. https://www.chathamhouse.org/2020/04/promoting-just-transition-inclusive-circular-economy.

14 ILO (2015), "Guidelines for a just transition towards environmentally sustainable economies and societies for all". https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_432859.pdf.



An inclusive circular economy is one that acknowledges workers' rights in shaping policies directed at them. Social dialogue and participatory planning are key elements. There is need for social protection measures alongside policies to close material loops, provide support to develop national just transition plans, design and coordinate re-skilling programmes and promote measures to ensure decent work. Yet, as has been observed in the energy transition, there are potential tensions between the need for inclusiveness and the speed of transitions. Enhanced citizen and stakeholder engagement is a way of introducing justice and equity dimensions in circular economy transitions and increasing social legitimacy, while working with front runners in the industry may accelerate transitions but entrench injustices.[15]

This trade-off is particularly relevant in the case of digitalization and Industry 4.0 technologies in manufacturing. Organizations and countries with existing advantages and digital strategies will be able to advance faster to circular manufacturing. Factories will change. Circular production facilities and the wider value chains will be relying on technologies like the IoT, automation and robotics, AI, and data analytics, which will be prominently featured in the circular economy of the future to save resources and reduce waste.[16]

New research projects are beginning to fill the gap in our understanding of economic, societal, gender and policy implications of the circular economy paradigm. An example is the EU-funded JUST2CE project[17] which aims to shed light on which stakeholder groups can be classified as winners and which one as losers. Other key questions include how to ensure inclusive and participatory mechanisms are applied when designing products and technologies and managing the transitions. The assumption underpinning the project is that the success of a transition towards a sustainable circular economy does not merely depend on the development of new technologies. It requires the reconfiguration of the governance of productive processes through more participatory mechanisms of designing and managing technology.

15 Newell, P., Geels, F. Sovacool, B. (2022), "Navigating tensions between rapid and just low-carbon transitions", *Environmental Research Letters*, 17, 041006 http://sro.sussex.ac.uk/id/eprint/105119/6/Newell_2022_Environ._Res._Lett._17_041006.pdf.

16 Laskurain-Iturbe, I., Arana-Landín, G., Landeta-Manzano, B., Uriarte-Gallastegi, N. (2021), "Exploring the influence of industry 4.0 technologies on the circular economy", *Journal of Cleaner Production*, Volume 321, https://doi.org/10.1016/j.jclepro.2021.128944.

17 European Commission (2021), *A just inclusive transition to circular economy – project description*. CORDIS https://cordis.europa.eu/project/id/101003491.

Understanding impacts of national transitions in Europe on developing countries

The international impacts of the European transition are not yet an explicit consideration of current circular economy policies at EU level. But this is changing, too. The Netherlands Environmental Assessment Agency (PBL) looked into the future implications of the Dutch circular economy transition. The analysis shows that creating a circular economy with positive impact abroad will require building in safeguards for low- and middle-income countries from the outset.[18] It will also require enhanced coherence between national circular economy policies and international policies on trade and development cooperation. This can help to strengthen the Dutch circular economy transition as well as contribute to achieving the Sustainable Development Goals, in the Netherlands and abroad.

Furthermore, understanding the impact of changing consumption patterns in the Global North on producing countries in the Global South requires attention as the shift to sustainable lifestyles is underway with lowered material consumption, less waste, and lower carbon footprints. On the one hand, this should provide opportunities to address existing inequalities in environmental justice, including addressing inequalities in resource consumption and unequal access to essential goods and services. On the other hand, there will be impacts on workers and communities working in manufacturing. Many low- and middle-income countries that rely heavily on 'linear' sectors such as mining, manufacturing of non-repairable fast-moving consumer goods, textiles and agriculture, and the export of these commodities to higher-income countries, are likely to be negatively affected by the shift to circularity. These countries will need support from the international community through targeted assistance programmes if international trade in established commodities and manufactures declines in the medium to long term. For that reason, discussions about just transition need to move from the national to the international level to address and rectify existing and emerging inequities between countries.

CONCLUSIONS: DESIGN OUT WASTE, DESIGN IN SOCIAL JUSTICE

To avoid the circular economy transition to widen existing inequalities, it will be necessary not only to design out waste, but to design in social justice.

Addressing the environmental injustices of the existing linear system, especially illegal waste dumping, is a short-term priority. Bilateral and multilateral approaches to trade arrangements can help addressing these issues of illegal waste dumping. There is a potential role for the WTO to make trade in waste and secondary materials more transparent and environmentally sustainable, hold actors accountable, as well as to reduce social injustices associated with processing and recycling. Initiatives like the WTO's Aid for Trade are well positioned to mobilize resources for developing countries and addressing emerging trade-related impacts of the circular economy.

From a distributional perspective, the key issue is how to support economic diversification and retraining of workers in producing countries. Financial mechanisms to enable just transitions will be important to enable this type of industrial diversification. For example, in the context of multilateral development banks' work on climate and decarbonization, a set of just transition principles were developed and launched at COP26. A next logical step could be to adapt these principles for the fast-evolving financing frameworks for circular economy transitions.

An inclusive circular economy is one that acknowledges workers' rights in shaping policies directed at them

More International cooperation programmes to provide technical assistance and capacity building are needed.

Finally, the political economy and geopolitics of the circular economy transition are little understood. If and how the existing unequal power relations in global value chains can be reconfigured as we design circular systems needs more attention. In times of rising geopolitical tensions and risks, these considerations are becoming increasingly important to ensure both a just and accelerated transition.

18 Lucas, P., Brink, H. and van Oorschot, M., *(2022), Addressing international impacts of the Dutch circular economy transition. Challenges and opportunities for low- and middle-income countries.* PBL Netherlands Environmental Assessment Agency. https://www.pbl.nl/en/publications/addressing-international-impacts-of-the-dutch-circular-economy-transition.

WHO'LL PAY TO SAVE THE PLANET?

Pascale Taminiaux
Senior Project Coordinator, King Baudouin Foundation

Pascale Taminiaux is Senior Project Coordinator at King Baudouin Foundation, based in Brussels, working on Social Justice and Poverty related issues such as Energy Poverty and Fair Energy Transition. Previously, she notably worked as a consultant in environment, health, safety and CSR issues for numerous Belgian and international companies. For over 45 years, the King Baudouin Foundation has been acting for the common good together with numerous partners, experts and donors. Its activities aim to foster sustainable and positive change in society, in Belgium, Europe and around the world. Thanks to the support it gives, the Foundation empowers organisations and citizens working to create a better society. It encourages philanthropy and supports individuals and organizations who want to commit to a better world.

"I live on benefits. What can I do about climate change?" The comment comes from Germany, but it was echoed across the continent during an unprecedented listening exercise commissioned by a philanthropic consortium led by the King Baudouin Foundation. The aim: to sound out Europe's most disadvantaged citizens on the challenges of weaning our economies off coal, oil and gas to protect the planet and develop recommendations for fairer energy transition policies.

The remark underscores the challenge facing governments that are committed to raising vast sums to move toward renewable energies while substantial sections of society can already barely afford to heat their homes or maintain mobility, not least since fuel price inflation has rocketed in the wake of the war in Ukraine.

More than 900 vulnerable people took part in focus groups across nine EU countries as part of the KBF-led project, Fair Energy Transition for All, or FETA.[1]

Hearing directly of their hopes, fears and difficulties has provided the foundation for policy recommendations which aim to ensure that Europe's drive to cut carbon secures broad social backing.

The high-profile setback for the French government's climate strategy prompted the search for a new approach. Indeed, the *"Gilets Jaunes"* ('yellow vest') protests erupted in France in 2018 over an increase in fuel duty. The tax was meant to help reduce emissions, but it caused hardship for people on tight budgets – and in the end the protesters forced the government to abandon it. Coming up with climate-saving measures that can avoid a grass-roots backlash as it happened in France is precisely the goal of FETA. The focus group findings pave the way for EU and national policy recommendations due this fall in November.[2] The survey confirmed some expectations, but also highlighted vital nuances.

DEMAND FOR FAIRNESS

The survey finds out very few profiles of 'climate sceptics' during the focus groups. Most vulnerable people believe that the climate is changing and that something needs to be done.

The focus groups also revealed some willingness to take a little more economic pain, especially if it fairly benefits all – notably future generations. Many are already cutting energy use – albeit mainly for reasons of personal economy than global ecology.

Yet, against a background of widening inequalities in Europe, participants from the Netherlands, to Spain, to Bulgaria, voiced a profound mistrust of politicians. Many felt their modest consumerism meant that others – big business or wealthier compatriots – should bear costs, not themselves: *"Why should I, when all those big firms are polluting the environment without paying a penny?"* said the German welfare claimant quoted above.

The policy experts must take account of differences across groups and countries: habits of frugality among the old, for example, and enthusiasm for technological fixes among the young; or Poles' post-communist determination to retain personal choice contrasted with a preference among the Danes for more collective measures.

To be factored in, too, are obstacles to change such as rented accommodation, that limits incentives to

1 For the purposes of this project, the term 'vulnerable people' refers to those groups who are socially or economically disadvantaged and whose interests are often not sufficiently represented in political debates. This includes unemployed people, low income earners, single parents, young people or elderly citizens as well as workers threatened with the loss of their jobs due to increasing regulations on energy-intensive industries.These groups tend to suffer the negative effects of environmental policies far more than others and are excluded from most of the benefits.

2 To get more information, please consult: www.fair-energy-transition.eu.

insulate homes or a lack of alternatives in rural areas to private cars and heavy agricultural machinery. Taking aim at urbanites' new embrace of the bicycle, one Spanish farmer fumed: *"You can't run a tractor on pedal-power."*

UNHEARD VOICES

At the initiative of the King Baudouin Foundation and with the support of five other philanthropic institutions - the Open Society European Policy Institute/OSF, the Mercator Stiftung, IKEA Foundation, the Deutsche Bundesstiftung Umwelt and the Fondazione Cariplo - focus groups were held over the past year in Belgium, Bulgaria, Denmark, Germany, Spain, France, Italy, the Netherlands, and Poland.

FETA experts distilled focus group responders into six broad personae[3] :

The Truster

Aida, 35,
wants a state-led transition:
"If the government helped people change their old appliances for more energy-efficient ones, then we could go a long way. But nobody wants to pay for it, so..."

Simple Life

Arlette, 70,
worries she'll have to use new technology: *"We should get back to the simple life we lived before. One can live simply and be happy. Learn from the past without nostalgia."*

The People Person

Nora, 40,
says the transition must bring communities together:
"If even one person is left behind, it's not fair."

The Threatened

Zofia, 46,
worries about affording care for her family: *"Industry, technology, more cars... We buy more things, so there is more waste. Always something new, always something different. It's a disease of humanity."*

The Powerless

Osman, 28,
a recent immigrant, says transition is for the rich: *"We're very much outsiders: it's hard to rent a home or find work. They give us crumbs, but they don't give us the resources to be autonomous."*

The Next Generation

Ayoub, 37,
cares about his children's future:
"Saving energy is a good thing, but I don't want to limit my kids by cooking less or telling them to take a cold shower."

3 Names and quotes are created to represent a variety of responses.

THE ROLE OF CLIMATE TECHNOLOGIES IN GREEN TRANSITION PATHWAYS

Sara Trærup
Head of Technology at UNEP-Copenhagen Climate Center (UNEP-CCC)

Sara Trærup is Head of Technology at UNEP-Copenhagen Climate Center (UNEP-CCC). She is an expert in the processes around technology transfer and the international policy context around it, and focuses on the provision of research and advisory support on developing countries' climate technology needs.

UNEP-CCC is a leading international research and advisory institution on energy, climate and sustainable development. UNEP-CCC works with a wide range of international institutions, national governments and research organizations to assist developing countries in their efforts to move toward low carbon, climate resilient and sustainable development.

Battling climate change is one of the greatest challenges of our generation, and climate technologies have a key role to play in our efforts to move towards sustainable pathways through a green transition. It stands clear that climate change is not solely an environmental issue but is intricately linked to challenges of eradicating poverty. There is already great potential in the climate technologies that exist and those that are under way, however, it is key to enhance the scale of action that will create the frameworks that will facilitate this transition.

A key starting point to enhance the effectiveness of our actions is to understand what kind of technologies are best suited to a country's specific climate change situation. There is no one-size-fits-all technological solution or transition pathway, and all technologies must be adjusted to fit within the specific local socio-political and institutional context. Under the UN Climate Convention, countries are reporting on their climate technology needs, and the energy, agriculture and water sectors are clearly those where most action is required.

INTRODUCTION

Two of today's greatest challenges are those of ending poverty and fighting climate change. New and existing green technology has the potential to save our climate while lifting millions out of poverty. In other words, upscaling the development, use and transfer of climate technologies are key to meeting the Sustainable Development Goals, as well as the 2015 Paris Agreement. There is an urgent need to act strongly now and expect to continue efforts over the coming decades.

The transition to a low-carbon future can bring major economic gains. Energy efficiency can help boost incomes. Low-carbon technologies can open up new sources of growth and jobs. New technologies could help create a comparative advantage for some of the poorest countries. Using the example of cell phones, developing countries can avoid some of the cost of large grids through cutting the need for telephone wires. At the same time smarter grids can both enhance energy efficiency and enable new technologies whilst cutting costs of diffusion.

TECHNOLOGY NEEDS OF DEVELOPING COUNTRIES

All countries, including developing countries, should ultimately want to go on low emission development paths. Not only is it the future, but it brings huge benefits beyond climate change. Renewable energy sources can free countries from a dependence on imported fossil fuels. Cleaner transport and cooling mean less pollution and better health. Halting deforestation protects water supplies, controls flooding and provides biodiversity and so forth.

There is no one-size-fits-all technological solution or transition pathway, and all technologies must be adjusted to fit within the specific local socio-political and institutional context, influenced by cultural norms, attitudes and assumptions. Understanding what kind of technologies are best suited to a country's specific climate change situation is hence the starting point for effective climate action. Before investing in technologies that reduce greenhouse gas emissions and adapt to climate change impacts, it is essential to assess and analyse a country's specific needs. This information can then be used to set priorities and identify appropriate technologies.

As an established process back in 2001 under the United Nations Framework Convention on Climate Change (UNFCCC), the Technology Needs Assessments (TNAs) are designed to do precisely this type of in-depth analysis, being defined as "a set of country-driven activities that identify and determine the mitigation and adaptation technology priorities of Parties".[1] Today, countries are using their TNAs as a means to concretize implementation pathways to reach their nationally set targets for both sustainable development and low carbon climate resilient pathways.

Since 2009, UNEP DTU Partnership and UNEP have led the implementation of the GEF-funded Global Technology Needs Assessments (TNA) project[2] in close to 100 countries, mainly being developing countries. Looking into the climate technology priorities of the developing countries that have undertaken a TNA since 2010,[3] which actually counts almost all developing countries, - and more than half of all the countries in the world, it stands out very clearly that (not surprisingly) the energy sector is a key focus for reducing greenhouse gas emissions, while agriculture and water sectors are top priorities for protecting and increasing resilience of economies and our nature to the unavoidable impacts of climate change.

Understanding what kind of technologies are best suited to a country's specific climate change situation is the starting point for effective climate action

Priority sectors, Adaptation Technologies

The analysis is based on data collected between 2013 and 2021 from 79 countries' TNAs available on www.tech-action.org.

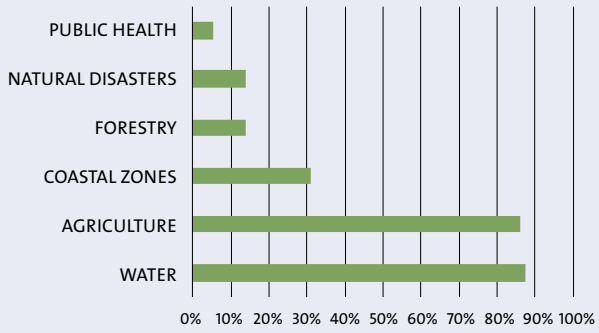


Figure 1

Priority sectors, Mitigation Technologies

The analysis is based on data collected between 2013 and 2021 from 79 countries' TNAs available on www.tech-action.org.

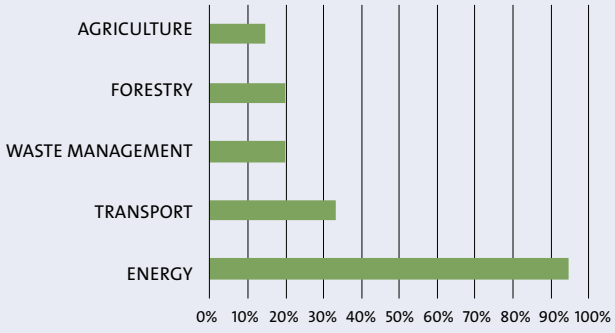


Figure 2

Within the sectors, the technology needs identified for mitigation cover a broad array of technologies, from small scale solar PV, hydropower and electrical vehicles to improved forest management, waste recovery and improved public transportation. In the energy sector, a majority of technologies are related to electricity generation. Other technologies focused on energy efficiency, energy management (energy strategies and plans as a technology) or heat production (often linked to electricity generation). Solar energy (including solar PV, solar thermal/ concentrated solar power) was the most prioritised technology, followed by hydropower, energy efficiency in building and lighting system and bioenergy.

1 UNFCCC 2001, Decision 4/CP.7.

2 www.tech-action.org.

3 All country reports are available on www.tech-action.org.

The technologies prioritised for adaptation include capital intensive technologies such as irrigation systems and drought-tolerant crop species for agriculture, and storm surge barriers and seawalls for coastal protection, as well as technologies such as water, crop and soil management technologies, where enhanced awareness and capabilities are key factors rather than capital expenditure requirements. In the agriculture sector, the top prioritised technologies are within crop diversification and new varieties, including introduction of climate resilient crops and diversification of crops. Drip irrigation systems, and water catchment and harvesting are as well ranking high in the agricultural sector, pushing water related technologies as a high priority for many.

UPSCALLING USE OF SMART WATER METERS IN TANZANIA

Tanzania experiences water resource scarcity, which are already further exacerbated by climate change impacts.

Non-Revenue Water – water that is produced for consumption and lost before it reaches the customer – is a serious challenge in the country. On average 37% of the water supply in urban areas is lost as Non-Revenue Water, while in a large city as Dar es Salaam it is estimated to be up to a 50 % loss. The challenges that the national water authorities in Tanzania face with Non-Revenue Water, result in water supplies that do not meet the demand. The consequence of water losses is reduced financial viability of water utilities, which again results in poor services and inadequate water access, availability and affordability. Tanzania's TNA[4] for the water sector identifies Smart Water Meters as a key priority technology for Tanzania to address this problem. The TNA identifies and analyses barriers and the enabling framework conditions, which are required for introducing water leakage management through smart water metering systems, and thereby to start the digitalization of the water sector in Tanzania. Embarking into a smart water metering programme is a huge challenge and involves extensive planning, training of personnel, customer information system and management. A higher awareness of water consumption is a key contribution by the smart water meters, but digitalization will also have a significant impact on preserving the country's water resources in general.

Technologies like Smart Water Meters, together with the implementation of enabling actions, will contribute to alleviating the climate change-induced impacts on the water sector, threatening people's livelihoods, infrastructure and ecosystems.

4 Available at www.tech-action.org.

CHALLENGES AND ENABLING FRAMEWORKS FOR TECHNOLOGY TRANSFER

An enabling framework denotes the entire range of institutional, regulatory and political framework conditions that are conducive to promoting and facilitating the development, use and transfer of technologies. This includes the country-specific circumstances that encompass existing market and technological conditions, institutions, resources and practices, which can be subject to changes in response to government actions. Enablers may target both technology supply- and demand-side aspects of the development and transfer of technologies.

To create the frameworks for the wider use of climate technologies, a key aspect to consider is access to and cost of finance. From what countries have reported, through their TNAs, on the challenges they identify for specific technologies and their successful development, use and transfer, it stands clear that access to capital and investments remain the main challenge for developing and most vulnerable countries to access green technology. The role of the private sector in developing and transferring technology could be extended if provided with the right incentives. This leads us back to the role of national governments in creating the right enabling conditions for both domestic and international technology development and transfer. The introduction of incentives, such as subsidies for investment and tax exemptions, would likely result in an increase in profitability for the private sector in investing in the required implementation of technology, hence encouraging further investments.

Challenges to Technology Transfer

The analysis is based on data collected between 2013 and 2021 from 79 countries' TNAs available on www.tech-action.org. Challenges to technology transfer are identified for 787 technologies with a total of 4079 reported challenges.

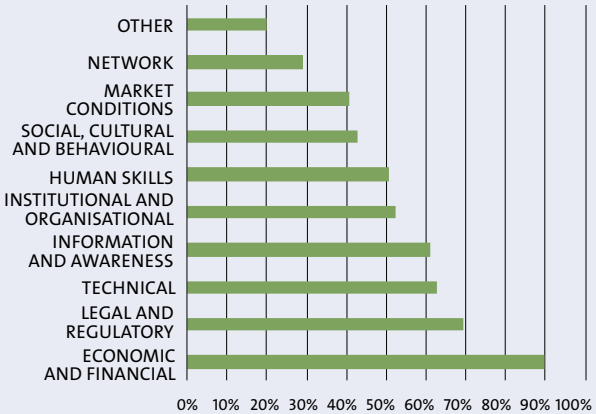


Figure 3

To enhance the engagement of the private sector in the green transition and accelerated uptake of climate technologies, there is a need to implement initiatives to: 1) grow market demand for renewable energy, 2) increase focus on higher energy efficiency, and 3) create a greater role for the carbon market. Private sector participation in low-carbon green growth initiatives is oftentimes hindered by limited financing options and access to technology in developing countries, biased supply chain dependence on imports, limited partnerships between the public and the private sectors, a lack of capacity, regulatory uncertainty, and the absence of a long-term price signal for the carbon market.

Besides access to and cost of finance, it is key to look into the structural factors that inhibit the transfer and deployment of a technology, including regulatory, policy or other features that define a given sector. For example, in the energy sector, legal and regulatory constraints are identified for the transfer and use of 66% of the technologies. Therefore, by updating and enforcing technical regulations for appliances and strengthening the associated governance and legal frameworks, use of, for example, energy-efficient appliances in the residential and public sectors can be increased, thus contributing to climate change mitigation.

The role of the private sector in developing and transferring technology could be extended if provided with the right incentives

Several mitigation technologies, notably solar PV but also wind power, have seen dramatic drops in prices and large-scale deployment in world markets. However, many climate technologies are still at a stage in the technology life cycle where they exhibit limited maturity and affordability and entail special capacity requirements. Their advancement towards market maturity is likely to come through continued development and support measures in the major markets that are technology leaders, enhancing both their performance and bending the cost curve.

Considering the economic and environmental potential of the transition to a climate-neutral economy, while also taking into account the short-term structural changes that may affect already vulnerable populations, it is clear that carefully designed policies are imperative to harness transition benefits and limit its downsides.

The transition to a low carbon climate resilient economy provides both an opportunity and a challenge. Ensuring an inclusive and just transition requires achieving deep emission reductions both reducing the effects of climate change on the most vulnerable and ensuring the benefits and burdens of climate action are equitably distributed. To have a complete range of solutions to reach a full transition to low carbon climate resilient development paths, there is a need for international technology transfer but also a need for local anchoring with local production, skills upgrading and strengthening of local markets.

Finally, to be successful in the green transition, there is an urgent need for increased cooperation among private actors, public actors and international actors to build global and national partnerships for upscaling the use of climate technology.

2. REINVENTING OUR MODES OF PRODUCTION AND ORGANIZATION

While there is increasing unanimity about the diagnosis, the same cannot be said for the question of how to implement ecological transformation. The debate is intense between those who maintain that it is possible to sever the link between increasing GDP and greenhouse gas emissions, and those who refuse a view they judge unrealistic and likely to keep us prisoner of present-day models.

Fabrice Bonnifet invites us to think of businesses' purpose in new ways, rendering them "contributive" and compatible with planetary boundaries. The idea is to rethink economic models, for example by turning to the circular and functional economies. Various more radical voices, primarily from younger generations, advocate a form of abandonment of the dominant capitalist model,[1] whilst contemporary writers explore the implications of, and mechanisms for, an "ecology of dismantling."[2] Other economic and political actors argue that we should make the most of opportunities offered by ecological transformation while limiting any harmful impacts. **Sangji Lee** looks at various attempts to decarbonize activities, such as transitioning to renewables and renovating infrastructures and, of course, new employment opportunities. **Maud Texier** describes Google's strategy for decarbonized data centers by 2030, and how the company is making the goal of cutting emissions a lever for innovation.

Above and beyond business, cities, the largest contributors to climate warming as well as its first victims, are faced with the question of which models they need to adopt for a successful ecological transition in an ever more urbanized world. **Ilan Cuperstein** looks at solutions to reduce urban inequalities in South American cities, improving access to essential services whilst cutting emissions. Now that the time for transition has arrived, countless paradigms are emerging for rethinking urban planning in its entirety, including "15-minute", biomimetic, symbiotic and modular cities. Urban planners **Nils Le Bot** and **Pauline Detavernier** explain the unique features of the low-tech city, which questions need and sufficiency, focuses on sobriety, guarantees accessibility and always opts for the scale appropriate to the need.

Whatever the model, an increasing number of actors are stressing the need to adopt an ecosystem-based vision of ecological transformation, to efficiently reimagine modes of production and organization and capitalize on synergies. In a world where almost one-in-six deaths can be attributed to toxins from the environment,[3] the transition of the chemical industry, analyzed by **Anna Lennquist**, has ramifications that extend into the health and environmental spheres. Taking a broader overview, **Serge Morand** explains the advantages of the One Health approach, updated by the coronavirus crisis, and offers an innovative approach for transforming current models.

Iris Levy
Mathilde Martin-Moreau
David Ménascé
Archipel&Co,
Issue coordinators

1 For example, during their May 2022 graduation ceremony, students at AgroParisTech exhorted their peers to "desert" jobs that "destroy" the environment.

2 See in particular: Emmanuel Bonnet, Diego Landivar, Alexandre Monnin, *Héritage et fermeture, une écologie du démantèlement [Heritage and Closure, an Ecology of Dismantling]*, 2021.

3 "Pollution and Health, a Progress Update", *The Lancet*, 2022.

BUSINESS AND PLANETARY BOUNDARIES: WHICH MODELS FOR TOMORROW?

Fabrice Bonnifet
Director of Sustainable Development and QSE,
Bouygues Group

Faced with the climate emergency, businesses have no choice other than to fundamentally reinvent their economic models. An imperative that Fabrice Bonnifet makes evident in this interview, and that lies at the origin of his thinking about the model of the contributive company. According to this idea, the myth of simply greening our linear economy is a sham. We must instead promote an economy of functionality, so that businesses can make their activities compatible with planetary boundaries. A range of levers are suggested in order to meet this goal: encouraging adaptation to the climate emergency, adopting a statement of purpose, and a new accounting model to protect natural capital. Fabrice Bonnifet believes that younger generations also have a key role to play in companies, helping to kick-start change and alter mindsets and business models.

Fabrice Bonnifet is Director of Sustainable Development and QSE at the Bouygues Group. He helps to develop operational units' business models and runs cross-disciplinary projects in support of Group strategy, focusing on energy and carbon, sustainable cities, the circular economy, and the economy of functionality. President of the College of Sustainable Development Directors (C3D), he is also co-author, with Céline Puff Ardichvili, of *L'Entreprise contributive. Concilier monde des affaires et limites planétaires* [The Contributive Business: Reconciling the Corporate World and Planetary Boundaries], 2021. Fabrice Bonnifet is a graduate engineer from the Conservatoire des Arts et Métiers. He teaches at Université de Paris Dauphine in the Master in sustainable development and organizations, and at ENSAM and ESTP in the Master in habitat and construction.

The contributive company model that you advocate implies that businesses must stop simply cutting or offsetting their negative externalities, working instead to make a positive contribution to society and their environment. What is the current state of thinking among companies, and are we truly at a turning point?

Fabrice Bonnifet: There's no doubt that awareness is growing: sustainability is pretty much at the top of the list. But that hasn't led, as yet, to the transformation of business models. Only a handful of businesses have begun to alter their economic models. And these initiatives remain very much in the minority. By and large, businesses that thrived in yesterday's world, as part of an economy that blithely ignored physical constraints, have not altered their production-centered approaches. As president of C3D, I can see quite clearly that the conditions needed for ecological transition have not yet been met. There have been plenty of commitments in favor of carbon neutrality or the energy mix, to name just two issues, but there's a lack of the ambitious delivery on the ground that would demonstrate that we've met our targets.

Green growth is a myth. Believing that it's enough to simply greenwash a business and earn more money is clearly not something that can be applied to every business sector

We must face the reality that the climate emergency we've heard about for so long is happening today: the IPCC, which provides the science, has been warning us for the past 40 years. Looking forward to 2100, we can only emit a maximum of 400 metric gigatons of CO_2 if we are going to stay under the 1.5°C target. At current emission rates we will hit this carbon ceiling within the next 10 years. We are going to fail to reach the Paris Agreement targets. We will exceed the average 2°C increase in global temperatures in 2035, not in 2100. At current emission rates we're looking at a temperature rise in the 2.7°C to 3.5°C range by the end of the century; humanity is facing a crisis.

Green growth is a myth. Believing that it's enough to simply greenwash a business and earn more money is clearly not something that can be applied to every business sector. At C3D, we think that certain sectors of the economy need to be slowed down whereas others should be accelerated, that we need to promote sufficiency and re-examine our lifestyles. We have to cut emissions by 5% a year for 60 years. There are certain hard realities we need to bear in mind. No, renewables will not replace fossil fuels, neither will nuclear. Hydrogen will never totally replace oil. Sure, we need to promote these new techniques, but we have to stop kidding ourselves that we can carry on as usual simply by changing our mix; it's not true. The key lever lies in accepting that we have to make the complete lifecycle of commercial solutions less energy-intensive.

At C3D we advocate for a more just division of resources between those in the North who often waste them, and those in the South who need to rise above their material poverty, primarily by making sure they can access safe water, sanitation services and electricity, and so on. It is a fallacy to imagine that one day these countries will achieve the same level of development seen in the West: we're already living beyond planetary boundaries. If we are to live in a world at peace, we also very much need to improve how technologies as well as natural resources are shared.

Concretely, how can we get the ball rolling?

F.B.: In our book *L'entreprise Contributive. Concilier monde des affaires et limites planétaires*, we cite a number of inspirational examples of businesses that have set up business models based on planetary boundaries. Which shows it can be done! Companies have to think of their products and/or services in terms of what ecosystems can produce and how they can assimilate the negative externalities associated with human activities, rather than purely in terms of the market, with its mistaken view that resources are unlimited.

The first thing to do is to explain the situation: ignorance is the number one stumbling block to taking action. It is imperative that we clearly explain the relationship between energy and the economy, between GDP and greenhouse gas emissions. Once these basic concepts are clear to everyone, we then have to accept that companies will need to redefine their purpose. Businesses must serve their customers while also respecting the common good, working to establish business models that are more inclusive. Creating value cannot be based on manufacturing products with planned obsolescence, nor on condoning a desire for excessive consumption of the superfluous in place of what is essential. Businesses need to shift to eco-design approaches for bio-inspired solutions that are ultra-frugal. The underlying idea is to produce less and, therefore, increase the intensity of usage. It also involves ensuring reparability with recycling as the solution of last resort. This is the approach that characterizes the economy of functionality, and is something every business needs to adopt.

There are many examples of companies that can rightly claim to be contributive. Some have been from the outset, such as Phenix and Too Good to Go, which offers the chance to donate, or sell at a discount, surplus unsold food. Another example is Fairphone, offering repairable smartphones with a focus on ethics. Other businesses have radically altered their model. Interface, for example, opted for a complete overhaul to become carbon neutral.

At Bouygues, we've invented a concept called the Positive Economy Hybrid Building, designed to combine exemplary environmental performance with positive financial performance. The aim is to promote the reuse of construction materials after their first use in a building, ensure their reversibility so they can have several uses during their lifecycle (from housing to offices and vice-versa) and, lastly, increase their intensity of usage. We achieve this via a community management process to allow spaces to be occupied by secondary occupants whenever the primary occupant does not need it. This makes buildings more cost-effective and avoids the unwanted construction that contributes to soil sealing. What we no longer earn via construction we will earn instead through renovation and operation.

Businesses will not make meaningful progress toward transformation if we do not shift to a multi-capital accounting model

We need to accelerate the rollout of new models such as these. But businesses will only make meaningful progress toward transformation if we decide to shift to a multi-capital accounting model. And since every business uses natural capital, it needs to be protected. What we remove and what we have to reconstitute or preserve have to be perfectly balanced to prevent the environmental deficit from getting any worse. Every business's economic model must be reviewed with the aim of maintaining material living conditions at levels that are acceptable to all while ensuring that sufficiency and responsibility are prioritized. This is what sustainable development means, everything else is just greenwashing. Younger generations are increasingly engaged with these issues, providing the drive for change, and that is definitely a positive point.

THE CONTRIBUTIVE COMPANY IN ACTION

Interface: a pioneering company that became carbon neutral several years ago while remaining profitable, its next target is to become carbon negative.

At a time when the company generated close to a billion dollars in revenue and was perfectly profitable, Ray Anderson decided to question every aspect of the business: from procurement to design and manufacture, everything was re-examined in terms of its carbon impact. He created a method that looks at seven different factors: zero waste, reducing emission of greenhouse gases and other pollutants to a minimum, use of renewables, closed loop recycling, offsetting for any residual emissions, working to build ties with the local community, suppliers, clients and, within the company, changing the commercial model itself.

Phenix: a smartphone app that helps people donate, recycle or sell at a discount their unsold food stocks. The French company with ESUS and B Corp certification was founded in 2014 by Jean Moreau. Its goal is to cut food waste by proving to its trade clients (supermarkets, manufacturers, and events companies) that recovering what might otherwise be waste will help them first and foremost. Since it was first set up, the company has saved 120 million meals from the trash can and created 200 jobs in France. Revenue is up from 4.6 million euros in 2017 to 15 million in 2019, and the company is making a healthy profit.

Mud Jeans: a Dutch fashion brand that designs and makes denim wear in a closed loop using a circular economy model. Its jeans are designed to be worn, collected, rented, returned and recycled, but never thrown away. The business model is based on monthly rental payments for its garments. Consumers choose a style and rent it before becoming the owner after a year or swapping it for another style. The company founder is determined that its jeans must be made only from organic or recycled cotton, and that all dyes are nontoxic. He has also tried as far as possible to ensure that all jeans are designed in his home country, the Netherlands.

Fairphone: a Dutch brand that takes a 360° approach and has being offering more ethical smartphones since 2013. Since the beginning, the company's founder has constantly been obliged to demonstrate to mass-market electronics manufacturers that it is possible to source raw materials in a different way, and to design products that are modular, repairable and long-lasting. Fairphone also encourages consumers to consider their own impacts, including by vowing not to change their smartphone so often and embracing reparability

How much time have we got left to act?

F.B.: We're already 50 years late! We must act immediately. But everything depends on leadership. Too few company CEOs understand the gravity of the situation. A change of governance is required to explain to shareholders that cash is not an end in itself but the means for ensuring a company will last. It takes courage to speak the truth, that we are now in the era of the finite.

Sadly, there is nothing we can do to stop the climate emergency, we can only lessen the severity of future crises, adapting as much as possible. We need everybody to pull together to make this happen: strong regulations (bans, directives backed by fiscal policy and legislation), generalized awareness by all members of society, and a change of business model by companies. Businesses do of course have a key role to play.

You've mentioned young people, and the short amount of time available to act.

Students at AgroParisTech recently called on the younger generation to turn their backs on large corporations and build alternative models. What advice can you give young graduates eager to make a difference?

F.B.: I would call on young people who are aware of what is happening to act from the inside, challenging their bosses and asking questions about how genuine the CSR strategy in place really is. A tipping point will be reached if young people as a whole start to challenge current models. Businesses have every incentive to change their sustainability messaging and strategies, otherwise they risk losing young talents who will decide to quit companies that fail to act responsibly. Although far from democracies, businesses do have forums for people to state their views, such as internal social media and annual general assemblies. These are forms of pressure that may encourage company leaders to embrace a paradigm shift. Young people must appropriate them.

TOWARD A JUST GREEN ECONOMY TRANSITION

Sangji Lee
Climate Change and Green Economy Technical Specialist, UNDP

As a Climate Change and Green Economy Technical Specialist at UNDP's Climate Strategies and Policy Team based in New York, Sangji provides support to countries in the formulation and implementation of their Nationally Determined Contributions (NDCs), while leading the development of strategic approaches aligning NDC processes with green economy as a thematic lead on Green Economy and Just Transition. In this role, she helps countries to understand the development co-benefits of climate action and provides tools for evidence-based policymaking and a just transition. Before joining the team, Sangji worked with UNDP Mozambique, the UNDP Global Policy Centre in Seoul, OHCHR Regional Office in Fiji, UN Department of Political Affairs in HQ, research institutes, and government. As a Chevening Scholar, she earned a Master's of Science in Environment and Development from the London School of Economics. She is also a certified expert in environmental governance (Korean Ministry of Environment) and in climate and energy finance (Frankfurt School of Finance).

As more and more governments seek to find ways to handle the compounding crises of climate change, a pandemic, and other development challenges, the concept of a green economy has received significant international attention over the past few years. Defined by the UNDP as low carbon, resource efficient and socially inclusive, the transition to green economy can be achieved by leveraging the Paris Agreement and countries' national climate pledges, or Nationally Determined Contributions (NDCs). Anticipating the impacts of green transition, guaranteeing institutional support and ensuring a fair process throughout implementation are key conditions for scaling green economy, particularly in emerging economies and developing countries.

INTRODUCTION

The war in Ukraine and the COVID-19 pandemic have added a new dimension to our understanding of the multi-dimensional and interconnected nature of development and climate action. The war in Ukraine has triggered spikes in energy prices and disrupted global markets and food security. The pandemic has led to a significant socio-economic crisis and perpetuated existing inequalities within and across countries. In addition to the many lives lost, more than 500 million jobs were put in jeopardy by the COVID-19 pandemic, with at least 100 million permanently lost. These numbers reflect not just an economic crisis, but a livelihood crisis. Behind every job lost is a person, if not a family. Many of these people are women, youth and already vulnerable informal economy workers.

At the same time, the climate crisis is still raging. The latest IPCC report states that half the human population could be exposed to periods of life-threatening climatic conditions arising from heat and humidity. Climate change, like other crises, such as COVID-19, is a non-linear risk multiplier with severe socio-economic impacts that grow disproportionally among different social groups, and even catastrophically once certain thresholds are breached.

Against this backdrop, it is important to examine various development pathways and understand how best to handle the climate crisis while also taking into account the imperatives of sustainable development – creating jobs, securing food, and ensuring equality for all. All of these crises are clearly interlinked, and the scale and nature of the policy decisions being made now will crucially affect climate outcomes far into the future. By identifying the synergies and trade-offs between climate action and broader development needs, policymakers can enhance the positive impacts of climate policies and drive systemic changes. Carefully designed climate policies can indeed contribute to economic growth, job creation, and social and gender equality. For example, the International Labour Organization (ILO) estimates that the move to low-carbon, greener economies has the potential to create 60 million jobs by 2030. With more and more energy being produced locally, mostly from renewable energy sources, dependency on imported oil and gas will be reduced and thus improve national energy security. Reduced air and water pollution will also bring enormous health benefits. One study estimated global average health co-benefits at $58–380 per ton of CO_2, reduced, with benefits higher in developing than developed countries.[1]

1 Wei, YM., Han, R., Wang, C. et al. "Self-preservation strategy for approaching global warming targets in the post-Paris Agreement era", *Nat Commun* 11, 1624 (2020). https://doi.org/10.1038/s41467-020-15453-z.

What is a green economy?

With many governments seeking to find ways to handle the compounding crises of climate change, a pandemic, and other development challenges, the concept of a green economy has received significant international attention over the past few years. The concept was first mentioned as a tool to address the 2008 financial crisis. Later, in 2020, it regained popularity when suggested as a model to guide green recovery efforts in response to the COVID-19 pandemic. At the United Nations Sustainable Development Conference (Rio+20), governments agreed to acknowledge green economy as an important tool for sustainable development: "one that is inclusive and can drive economic growth, employment, and poverty eradication, whilst maintaining the healthy functioning of the Earth's ecosystems." The outcome document also highlights the importance of capacity building, information exchange and knowledge sharing as key enablers.[2]

There is no internationally agreed definition for "green economy." Several types of sustainable pathways exist, and it is important to understand the key components of different approaches to find the most suitable pathway for each individual country in line with their nationally defined development priorities. According to the United Nations Environment Programme (UNEP), a green economy is defined as low carbon, resource efficient and socially inclusive. In a green economy, growth in employment and income are driven by public and private investment in such economic activities, infrastructure and assets that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. Achieving a green economy will require efforts at all levels of society as well as new skills, collaborations, innovations, and investments. Not only governments, but private sector and financial institutions should be part of this effort to capitalize on the opportunities it brings.

Achieving a green economy will require efforts at all levels of society as well as new skills, collaborations, innovations, and investments

Implicit in transitioning to a low-carbon economy and achieving a green economy is decoupling economic growth from environmental degradation. Decarbonization does not mean reducing economic activity in a green economy, but instead doing more with less. This means promoting sustainable production and consumption that protect and nurture natural capital and increase resource efficiency. A green economy therefore puts a heavy emphasis on the economy, investment, capital and infrastructure, skills and employment, and positive social and environmental outcomes. This notion creates a new focus on the economy, investment, capital and infrastructure, employment and skills, and positive social and environmental outcomes.[3] Degrowth, on the other hand, puts the emphasis on scaling down the global economy while keeping the focus on systemic change and redistribution.

2 Sustainable Development Goals Knowledge Platform, https://sustainabledevelopment.un.org/topics/greeneconomy.

3 UNEP, *Green Economy / UN Environment Programme.*

NB: the highlighted text redirects to hyperlinks.

For the reasons described above, green economy can be a particularly useful concept for many developing countries given their low carbon profile and rich natural capital assets. Well-designed public policies, targeted spending and incentives can spur green investments. For example, Africa has rich mineral and energy resources, such as lithium, graphite, cobalt, nickel, copper, and rare earth minerals – all of which provide new market opportunities for the green transition. With Africa's limited lock-in to fossil-based energy technologies, these opportunities could help the continent build a climate-resilient and integrated sustainable energy sector.

Leveraging the Paris Agreement as a robust framework for achieving a green economy

The sheer scale of human, technical, and financial resources required to shift toward a green economy may represent a particular challenge for many countries. It requires careful planning and a clear understanding of pathways.

There is good news. We now have an international policy framework which provides a strong direction of travel and guides our efforts toward a green economy. To address climate change, countries adopted the Paris Agreement at the COP21 in Paris in December 2015. Countries' official pledges under the Paris Agreement, known as Nationally Determined Contributions (NDCs), can be a useful tool to guide a country's green economy efforts.

NDCs and Long Term-Strategies (LTS) that are aligned to governments' national development plans and the Sustainable Development Goals (SDGs) can spur economic growth, technology transformation, job creation and address key social inequalities that are critical to a green economy. A recent study found that by following the current emissions reduction efforts, the world would experience a washout of benefit, amounting to almost 126.68–616.12 trillion dollars until 2100 compared to 1.5 °C or well below 2 °C commensurate action.[4]

Countries' national climate pledges under the Paris Agreement offer unique, politically backed blueprints for investment in areas that can drive transition toward a green economy

The UNDP's Climate Promise – which works with more than 120 countries and territories on their NDCs – demonstrates that these pledges offer unique, politically backed blueprints for investment in areas that can drive transition toward a green economy.

Under the Climate Promise, we have seen many countries start to seize opportunities to advance their NDCs. A further exploration is provided below of key components of a green economy and how countries are seizing the opportunities they offer while meeting national carbon emission reduction targets.

Concrete ways in which we can achieve a green economy using Climate Promise examples

Anticipating the impacts of a green economy transition

Much of the green economy literature points to the potential benefits of the green economy and co-benefits of climate action. But all countries have different socio-

4 Wei, YM., Han, R., Wang, C. et al. "Self-preservation strategy for approaching global warming targets in the post-Paris Agreement era", *Nat Commun 11*, 1624 (2020). https://doi.org/10.1038/s41467-020-15453-z.

economic realities which need to be carefully examined to understand what type of policy can bring co-benefits to a particular country. To do this, we need to use hard data to show how climate action, and shifting to a green economy, will have overwhelming benefits, both for the environment and by promoting economic growth that generates more jobs. We therefore need to measure the environmental, social, and economic implications of climate policies and investments. This involves looking at the data, but also asking questions, such as: Will everyone benefit equally? What would investment in hydropower plants or green infrastructure mean? Would this create jobs only for skilled urban workers or would it also benefit women working in informal economies? Are the skills, labor and technology to build and run such projects domestically available?

By identifying the synergies and trade-offs between climate action and broader development priorities and needs, policymakers can enhance the positive impacts of recovery packages and drive systemic changes. This work has already taken place in many developing countries.

With UNDP's Climate Promise support, countries like Zimbabwe and Nigeria were able to quantify how climate and green economy policies could affect economic growth, job creation, including for women and youth, and income distribution. The assessment has yielded some interesting and instructive results, with the modeling revealing very different medium- and long-term job growth implications.

In Zimbabwe, of the twelve climate investments and policy scenarios modeled – covering industrial processes, energy, agriculture, and forestry – investments in conservation agriculture appear to have created up to 30,000 jobs for every million US dollars invested. This number stands in high contrast to the only 100 jobs created for each million invested in a hydro dam and 25 in commercial solar. Nigeria also conducted the same assessments to look at the co-benefits of climate policies. According to the assessment, 12 million jobs could be potentially created in renewable energy, and some 25,000 jobs could be generated through investments in public transportation. Agriculture and forest-related policies were found to offer the best value for money, with water efficiency initiatives appearing to create more jobs for women in the long run.[5]

These findings provide insights for policymakers in Zimbabwe and Nigeria, especially helpful in understanding the development co-benefits of climate action and choosing the right policies that can not only reduce greenhouse emissions but also bring considerable economic and social benefits. We can help policymakers find the best path by providing evidence, and this is a key step in achieving a green economy.

5 UNDP, *Nigeria: Measuring the Socioeconomic Impacts of Climate Policies to Guide NDC Enhancement and a Just Transition*, 2021; *Zimbabwe: Measuring the Socioeconomic Impacts of Climate Policies to guide NDC Enhancement and a Just Transition*, 2021.

Policy and institutional support

Governments play an important role in accelerating the transition to a green economy. They can design integrated policies, regulations, and frameworks, in order to channel necessary investments toward the green economy. One good example is to price carbon to change behaviors and the focus of highly polluting industries. For example, countries with substantial tropical areas (e.g., Indonesia, Brazil, Mexico, and India) could consider adopting a "tropical carbon tax"[6] – a levy on fossil fuels that is invested in natural based solutions aimed at conserving, restoring and improving land management to protect ecosystem and biodiversity. According to a recent study, natural climate solutions could possibly reduce about one quarter of emissions from all tropical countries in the coming decades at less than USD$100 per ton of CO_2.[7] Costa Rica and Colombia have already adopted a tropical carbon tax strategy acknowledging this potential. If a policy similar to Colombia's was put in place by India, it could raise $916 million each year to invest in natural habitats; Brazil could raise US $217 million annually; Mexico $197 million; and Indonesia $190 million. A more ambitious policy of taxation and revenue allocation could yield over $6 billion each year for natural climate solutions in India, $1.5 billion in Brazil, $1.4 billion in Mexico and $1.3 billion in Indonesia.[8]

Policy and institutional support also mean creating an enabling environment for public and private investment and innovation to catalyze green economy. This includes the repurposing of fossil fuel subsidies toward clean energy development, education and skills training, incentives, innovative financial instruments (e.g. blended finance) and public-private partnerships to foster private innovation and investments. A number of quick-win solutions exist. For example, energy-efficiency retrofits can be a quick-win solution from both short-term employment and long-term low carbon development perspectives. In most cases, investments in building retrofits require low-skilled workers, which makes this measure particularly attractive during an economic downturn.

There are already insights we can learn from the African continent. In Ghana, the government has integrated strong social elements into its fossil fuel subsidy reform to avoid social reactions driven by concerns over distributional impacts. The government established the National Petroleum Authority, an independent governing body comprised of government officials, trade union and oil company representatives, experts and some NGO representatives, and conducted a Poverty and Social Impact Assessment. The reform was shared widely with all stakeholders while accompanied by complementary social measures financed by the savings from the subsidy reform. They include the introduction of a conditional cash transfer program to link fuel subsidy reductions to the elimination of school fees for primary and secondary education, additional funding for the healthcare system, and a rise in the minimum wage.

6 Barbier EB, Burgess JC, "Sustainability and development after COVID-19", *World Dev.* 2020;135:105082. doi:10.1016/j.worlddev.2020.105082.

7 Bronson W. Griscom & alli, "National mitigation potential for natural climate solutions in the tropics", *Philosophical Transactions of the Royal Society Biological Sciences, 2020.*

8 *Ibid*.

Costa Rica is also leading the way in the shift toward a green economy, showing in particular that it is possible to finance climate action by correctly pricing nature. Costa Rica is implementing Payments for Environment Services (PES) to improve forest conservation and sustainable management, reforestation, agroforestry and sylvo-pastoral systems.

An inclusive and fair process

The transition toward a green economy has far-reaching implications for every part and sector of society – governments, business, employment, and education, among others. While the transition to a greener economy is a clear business opportunity given the scale of the transformation needed, it will also lead to reallocations both between and within economic sectors. If not managed properly, it also runs the risk of increasing social inequality, civil unrest and less competitive businesses, sectors and markets. Transition pathways have distributional consequences. Job losses are likely to occur in sectors, regions, and communities, particularly where dependence on fossil fuel is high and opportunities for economic diversification are limited.

History has shown us that issues of justice, inclusivity and transparency must be at the heart of transformation. This applies to climate action. You cannot address the climate crisis without addressing equity and fairness. Look no further than the Yellow Vest, or gilets jaunes, movement in France, or to the civil unrest that took place in Chile and Ecuador. Questions of fairness and equity span national borders and have global ramifications for international cooperation and international financial flows.

Applying just transition principles and implementing them through collective and participatory decision-making processes is critical to enhancing broader public support and enabling more ambitious goals for accelerated climate action. According to the results of the UNDP *People's Climate Vote*, investing in green business and jobs is cited as one of the most supported climate policies, highlighting the importance of taking a multi-dimensional approach, aimed not only at cutting emissions but also at raising GDP, creating jobs, and ensuring a just and equitable transition for all. A just transition presents multiple opportunities and can be a net generator of decent green jobs that contribute to poverty eradication and social inclusion. The just transition will act not only as a key enabler but also as a necessary condition to address the political economy of net zero; without conscious strategies to manage the process and impact of change, political backlash could follow, slowing the process of decarbonization. It also builds a strong and resilient net-zero economy by bringing attention to the human and social capital required to achieve net zero.

Achieving a just green economy transition requires stakeholder consultations and social dialogue between workers' and employers' representatives and the government. This also requires governmental investment in strong social protection policies, green job opportunities, and skills training to future-proof countries' workforces, measures that will be key to ensuring a just transition that leaves no one behind and delivers more benefits to more people and the planet.

We are seeing a growing recognition of the need for a just transition in the context of the Paris Agreement implementation. As of June 2022, out of 164 countries that have submitted their NDCs, 62 countries have directly and/or indirectly referenced just transition in their enhanced/updated NDCs, and more than 19 countries have established a national just transition commission, task forces and dialogue (IPCC, WG3). At COP 26, the Just Transition Declaration was signed by countries in the Global North promising funding for climate action and decarbonization in poorer countries.

Through its Climate Promise Initiative, UNDP has been supporting countries to incorporate the principles of just transition into their NDC revision processes, and to move from commitment to action. One example is Antigua and Barbuda which is planning to conduct social dialogue with trade unions, employers' associations, and sector representatives on the transition to a climate-resilient and low-carbon economy, in order to build a consensus on sustainable pathways and manage the transition in an equitable and just way.

CONCLUSION

The experience with the Climate Promise has demonstrated that NDCs and LTS can be a powerful tool to define climate action through inclusive and whole-of-society owned processes and guide a just green economy transition. Specific NDC targets, policies, and measures on energy, adaptation, nature-based solutions, gender, and other areas are the starting point for transforming economies and societies. We have to use this momentum to invest in climate action as that will not only put us on to 1.5 degree trajectory but also boost our economy, create jobs, and support livelihoods if managed properly.

MAKING LOW-CARBON ENERGY AVAILABLE 24/7

Maud Texier
Carbon-Free Energy Lead, Google

Maud Texier heads the 24/7 Carbon-Free Energy project at Google, a company she joined in 2019. She leads a team responsible for developing and scaling 24/7 carbon-free energy for Google's data centers worldwide. Prior to joining Google, Maud was Head of Industrial Energy Products at Tesla. She previously worked for Electricité De France (EDF) as part of the Innovation unit in charge of new technologies for the group. She has an engineering MS in Energy and Power Systems from Ecole Centrale Paris.

In the face of the challenges raised by the accelerating climate emergency, the question of digital's environmental footprint is a major issue facing all the industry players. In response to this challenge, and in addition to a decarbonization drive set in motion several years ago, Google is running a program to ensure that all its data centers and offices run entirely on carbon-free energy by 2030, in real time, 7 days-a-week, 24 hours a day. The company is working on a number of fronts internally and externally, including local purchases of decarbonized electricity, technological innovations and infrastructure, and market reforms to make sure its entire value chain is actively working for the emergence of a decarbonized ecosystem.

Digital is increasingly central to solutions for ecological transformation. But the carbon footprint of digital infrastructures raises further questions. How does a business like Google intend to tackle these issues?

Maud Texier: It is entirely normal, desirable even, for civil society's expectations to focus on carbon footprints. Given the climate emergency, it is vital that every actor pays very close attention to their carbon footprint, taking responsibility and rolling out whatever steps are needed to reduce it.

In the case of Google, I'd first like to quickly remind you of how data centers and the internet operate. To simplify things, the internet is like electricity, with data centers being the internet's power plants. Just as an electricity grid is made up of power plants and cables carrying electricity from one place to another, so the internet is made up of, on the one hand, data centers where data is created and processed by servers and, on the other hand, fiber optic cables that connect the various data centers to places where the data will be used. This means that turning our data centers into sustainable infrastructures is central to Google's strategy, because most of what we do takes place at our data centers.

Google has always seen this imperative as a great opportunity for innovation, and technological innovations lie at the heart of the company's DNA. This is why Google has been developing its own data centers over the past couple of decades; we design them from top to bottom, from servers to the buildings themselves. We have made countless improvements to our designs in recent years, specifically in terms of boosting energy efficiency at data centers. Our sustainability targets have progressively evolved: over and above energy efficiency of buildings and servers, current projects such as our 24/7 Carbon-Free Energy program are focused on upstream issues in our value chain, such as the electricity supply. We're committed to decarbonizing our energy use, with the aim of operating worldwide, all week and around the clock, entirely on carbon-free electricity by 2030. Google did actually announce its target of net zero carbon by 2030 at COP26 in 2021. These two interlinked targets give us the ability to act on our direct and indirect greenhouse gas emissions.

We're committed to decarbonizing our energy use, with the aim of operating worldwide, all week and around the clock, entirely on carbon-free electricity by 2030

More specifically, what solutions are you putting in place to meet the goal of a round-the-clock real-time supply of decarbonized electricity for every data center by 2030?

M.T.: Our approach is based on driving progress in three complementary areas.

The first comprises identifying and purchasing decarbonized electricity for use across our entire electricity network. We took our first steps toward this target a

little over a decade ago, with our initial power purchase agreement for decarbonized electricity from a wind farm. We have come to understand that you cannot simply buy electricity produced anywhere worldwide at any time; it's critical that electricity is locally sourced and produced. This means rethinking our electricity purchase policies and sourcing renewable electricity even in parts of the world where the electricity market is not deregulated.

The second area concerns technological challenges. We know that we will certainly have to use a lot of electricity from wind and solar if we're going to reach our 24/7 target, but there are a variety of reasons why this alone will not be enough. First, they are intermittent sources that are not available round the clock. Then there's the fact that these energy sources remain very limited in some parts of the world, because of lack of space or opportunity. This is why we've developed a specific program designed to address these technological challenges: we're currently working with new hardware technologies to help us produce decarbonized electricity instead of renewable electricity, or to let us store this electricity more efficiently and cost effectively, which means we can use more of it.

As part of these efforts, we're also working on new battery technologies and solutions for storing and producing electricity, such as next-generation geothermal technology. For instance, we're piloting a solar with battery storage project in Nevada, and a battery storage project in Belgium. The goal is to identify new tools that will help us diversify our solutions.

We're working on the data and software side of things too, so that we can improve oversight of the various uses made of our electricity network and our own use. As an example, we're working to boost the flexibility of our data centers' power demands. This is quite a challenge when you think that they are famously inflexible, because the internet has to work all the time. The goal is to be able to dynamically shift the time and place where certain computing tasks are performed, to time slots and locations with more decarbonized electricity availability.

This shows how the challenge lies not just in identifying external solutions for producing decarbonized electricity, but equally in examining how best we, as client and user, can adapt to new conditions in electricity networks.

The final area concerns regulation and advocacy. We know that for Google to truly operate 24/7 using decarbonized energy sources will require major changes to electricity networks and the ways they are regulated, to allow for a massive uptick in the share of decarbonized electricity carried by these networks. The goal here is not to meet a set of targets set by a single company. It's actually about altering how electricity networks themselves are designed and the conditions governing access to decarbonized electricity.

This is why we're running a series of actions on this issue, collaborating with regional and local actors to support them in the push for change. They could include setting targets for decarbonized electricity in their network, or changes in electricity market regulations to accelerate

the rollout of decarbonized energy sources. Actions at this level are harder to highlight and not as easily quantifiable, but they represent critical changes that will help us meet our targets by 2030.

Is the challenge mostly about technology in your view?

M.T.: Google's size and importance mean it has a responsibility to represent consumers' voices. Alphabet companies are major customers of several electricity networks, which means we have a responsibility to encourage these markets to accelerate the shift to clean energy sources. Take the example of our data center in Taiwan. Six or seven years ago there was no decarbonized electricity available on the Taiwanese market, neither for businesses nor for private households. We teamed up with other electricity users to launch a campaign to promote decarbonized electricity, which led to changes in the regulations. Today, we can see that setting up these new power purchase systems has directly accelerated the development of renewables. A number of major companies have built large-scale wind farms in Taiwan. So, to answer your question, the challenge is not simply technological, it centers more on regulatory barriers and changes to rules and markets.

We absolutely have to collaborate with other actors in our value chain, not only with buyers like Google but also with companies that produce the electricity

Google also has a responsibility to help private individuals to better identify and understand actions they can take to help the general drive for sustainability. Today's consumers are fully aware of the scale of the challenge the climate emergency poses, and the many problems that need solving. Given that all our day-to-day actions create greenhouse gas emissions, it is very hard to know precisely which levers of action are the most useful. This is why we're trying to develop tools that offer transparency about emissions, and looking into ways to raise awareness of these issues.

For our data centers and the cloud, we're creating tools for our customers to give them a better understanding of the carbon footprint of the cloud services they use, mostly in the form of dashboards and assessment tools. Once they've run their diagnosis, we can then offer them some recommendations. For example, if machines are switched on but unused at certain times of day, we will suggest they are turned off; if we can see that they are running a service in a region that already emits a lot of carbon, we will suggest they shift it to a region with lower carbon intensity, without any loss in the quality of service. We take a lot of care to make it as easy as possible for our customers to take decisions that are actionable.

What are the main difficulties you face?

M.T.: First of all are the external barriers that hamper the rapid rollout of decarbonized electricity. In the USA, many projects face difficulties relating to supply issues or new regulations that can slow them up, or even put a stop to them. And processes in Europe for deploying renewables are just as slow.

We are lobbying to speed up these processes so that the production capacity for decarbonized electricity can be doubled or tripled, maybe even increased tenfold. This is absolutely critical, as demand for electricity will continue to rise, and as well as efforts to strip out carbon from economies, considerable electrification efforts will be needed to meet the growing need for electricity.

A second challenge centers on making sure that the entire ecosystem is on board. We understand that we can only reach our 24/7 target if the rest of the market and the entire industry also move in the same direction. We absolutely have to collaborate with other actors in our value chain, not only with buyers like Google but also with companies that produce the electricity. As we design and release 24/7 solutions and products, it will become easier for consumers to choose to purchase them, leading in turn to a reduction in cost. This can only be a virtuous circle if several actors pull together to work in the same direction. So, the overarching challenge we face is to move beyond designing a Google-only program, and instead adopt an approach that also works for other actors in the market.

I've seen a fundamental shift in the situation since I first arrived at the company three years ago. Back then, sustainability was something we were pushing to our customers. Today it's our customers who are reaching out to us for help with improving their sustainability strategies. This major change in the dynamic also signals a shift in focus. It underlines just how keen our customers are to align business opportunities with CSR principles, and is in itself an invaluable tool to develop new products. At Alphabet, we now have teams dedicated solely to supporting our customers in different sectors of the economy (manufacturing and services). We help them understanding how to use various services, the cloud, data analysis, optimization, to analyze their carbon footprint right across their value chain, then to run targeted actions to shrink it.

CITIES, AT THE FOREFRONT OF SUSTAINABLE TRANSFORMATION

Ilan Cuperstein
C40 Deputy Regional Director for Latin America

Solar panels on the roof of City Hall, Curitiba.
Picture credits: Pedro Ribas/SMCS.

Before serving as Deputy Regional Director for Latin America, Ilan Cuperstein has worked as C40 city adviser to Rio de Janeiro, helping the city implement its climate action plan in multiple areas and setting the first sustainability office in Latin America. As Deputy Regional Director for Latin America, Ilan has successfully launched the C40 clean energy network, which has now over 30 cities from various C40 regions. Ilan has previously worked at the China Brazil Center for Climate Change, where he worked with government agencies, energy companies and NGOs in bilateral projects related to biofuels, clean energy innovation policies, electric vehicles and carbon capture and storage in Rio de Janeiro and Beijing.

Cities have a crucial role regarding climate action: most greenhouse gas emissions occur in cities, while they also appear as one of the most active stakeholders leading sustainable and lasting transformation, as advocated by C40. Latin American cities, often depicted as "urban laboratories", illustrate this complex reality. In the absence of national leadership, Brazilian cities for instance, have been taking the lead and implementing sustainable innovative solutions, on many different areas: transport, renewable energies, urban planning... The region also demonstrates how social aspects can be fully integrated in climate solutions: a prerequisite given Latin America persisting inequalities. In this regard, innovative public-private business models emerge as well, to build economically viable sustainable solutions, without increasing costs for lower income users.

Cities play a paradoxical role regarding the fight against climate change. Often depicted, rightfully, as one of the main sources of greenhouse gas emissions, they also appear as one of the most efficient stakeholders to initiate real transformations towards sustainability. What can we really expect from cities?

Ilan Cuperstein: This paradoxical observation is shared by C40. Cities' responsibility regarding climate warming is no secret: according to UN Habitat, cities consume 78% of the world's energy and produce more than 60% of greenhouse gas emissions. However, we strongly believe that sustainable solutions will come out from cities. Given that more than half of the world population is urban, reinventing the way we live in cities is a prerequisite to tackle climate change.

Given that more than half of the world population is urban, reinventing the way we live in cities is a prerequisite to tackle climate change

To this end, two different dimensions should be highlighted.

On the one hand, we need to rethink how we build and manage our cities, regarding transport, infrastructure, waste treatment, housing... Adaptation strategies are required for all of these issues. Fortunately, numerous solutions already exist, such as promoting mass transit (train, subways) or walking and cycling instead of individual cars, using clean energy or increasing green and blue infrastructure.

On the other hand, it is crucial to reduce cities' consumption patterns. This second aspect is sometimes underestimated; yet some very "green" cities might prove to be unsustainable if we measure the emissions footprint associated to their food or resources' consumptions.

Those two aspects should be equally prioritized.

Expectations towards cities are great because they are the ones leading the fight against climate change, filling the gap left in the absence of more committed leadership at national levels. Of course, inherent geographical and political boundaries prevent cities from acting alone, and coordination with regional or national actors is vital to lift some barriers, such as lack of funding or limited mandate regarding some specific issues. But there are cities today trying to find innovative solutions in the realm of actions they have.

In Brazil, cities like Rio de Janeiro and Salvador have been taking concrete steps to foster renewable energies. Even though they are not responsible for energy policies, they decided to take proactive actions by building solar plants within the cities and introducing innovative tax incentives to promote solar energy. In Brazil, Rio de Janeiro and Curitiba have started to build solar plants on retired landfills, with the support of the C40 Finances Facility. They decided to rely on their own solar energy resources, by leveraging apparently useless assets – deactivated landfills, traditionally viewed as a burden for cities given

their environmental liabilities –, with the ultimate goal of providing most of the energy consumption of municipal buildings and operations. Those are unprecedented experiments, which could inspire many other cities in the region. In Salvador, the Renewable Energy Incentives Law provides incentives and discounts on land tax for those citizens that install solar panels in their homes.

In Latin America, focusing on the social aspects of climate solutions is core. (...) Sustainable development of urban projects is rather seen as a lever to include marginalized population or neighborhoods

Environmental and social issues are sometimes perceived as conflicting objectives. In Europe, this antagonism is encompassed through the expression "End of the month vs. End of the world". How does this issue resonate in Latin America, both one of the most urbanized and unequal regions on the planet? How is it possible to build sustainable models without increasing social inequalities, even more so in the aftermath of the pandemic?

I. C.: In Latin America, focusing on the social aspects of climate solutions is core. There are so many remaining challenges to guarantee access to basic services and basic quality of life to everyone that starting a discussion about climate action without raising its social outcomes is barely conceivable. This context often proves to be an opportunity rather than a burden, as it goes beyond the kind of antagonism perceived in Europe.

Sustainable development of urban projects is rather seen as a lever to include marginalized population or neighborhoods. For instance, studies show that mass transit, which is the main means of transport in Latin America, is more frequently used by low-income population, living far from city centers. Building on this observation, when looking to boost the transition towards electric buses, cities in Latin America seldom consider the option of increasing users' tariffs.

Of course, social and environmental dimensions are not always easy to conciliate. In Mexico, the fossil fuel industry, accounting for more than 2% of GDP, generates a great amount of taxes and jobs. How can we make sure to transition towards a low-carbon economy without undermining national economies and increasing unemployment?

Those kinds of dilemmas are analyzed in depth by the C40. In a recent report,[1] the C40 Mayors Task Force modelled what could happen if the world's major cities collectively prioritized a green and just recovery, consistent with limiting global heating to less than 1,5°C. One of the main findings of this work is that a green and just recovery could create over 50 million good, sustainable jobs by 2025 across the nearly 100 cities in the C40 network (which count around 550 million inhabitants),[2] and their supply chains, a third more than when investing equivalent funds into a high-carbon recovery.

Several key areas should be considered to implement such a green recovery approach, including:

- **Public mass transit**: while people are going back to their normal life, it is key to guarantee that public transport is clean and reliable, while providing alternatives to individual cars use. Additionally, studies from the C40 find that proper investment in public transport could create 4.6 million additional jobs by 2030 across the 97 cities in the C40 network.[3]
- **Renewable energy**: studies show that clean energy generates almost twice as much jobs as fossil fuels (for $1 invested), as it is more distributed (in particular, solar energy has a jobs multiplier of 12.2).[4]
- **Energy efficiency**: residential and office building retrofits and new energy-efficiency construction are by far the biggest job-creating actions identified by the C40. According to the International Energy Agency (IEA)'s estimations, average global jobs multiplier is 14.8 for building retrofits and 15.2 for the construction of new, efficient buildings.
- **Green infrastructure**: investing in green and blue infrastructure (trees, parks, rivers, wetlands, water treatment facilities, etc.) is also likely to generate long-term jobs in operations and management. It is however hard to identify a global average jobs multiplier for urban nature-based solutions.
- **Waste management**: in Latin America, where numerous cities still rely on informal waste pickers, improving waste management can be a tool to improve informal workers' status and inclusion. In Sao Paulo, the municipality endorsed a program including informal waste pickers in the city management, thus helping them move towards more formality and less uncertainty in their daily lives (registration, regular flow of income, etc.). This proved to be a huge step for them.

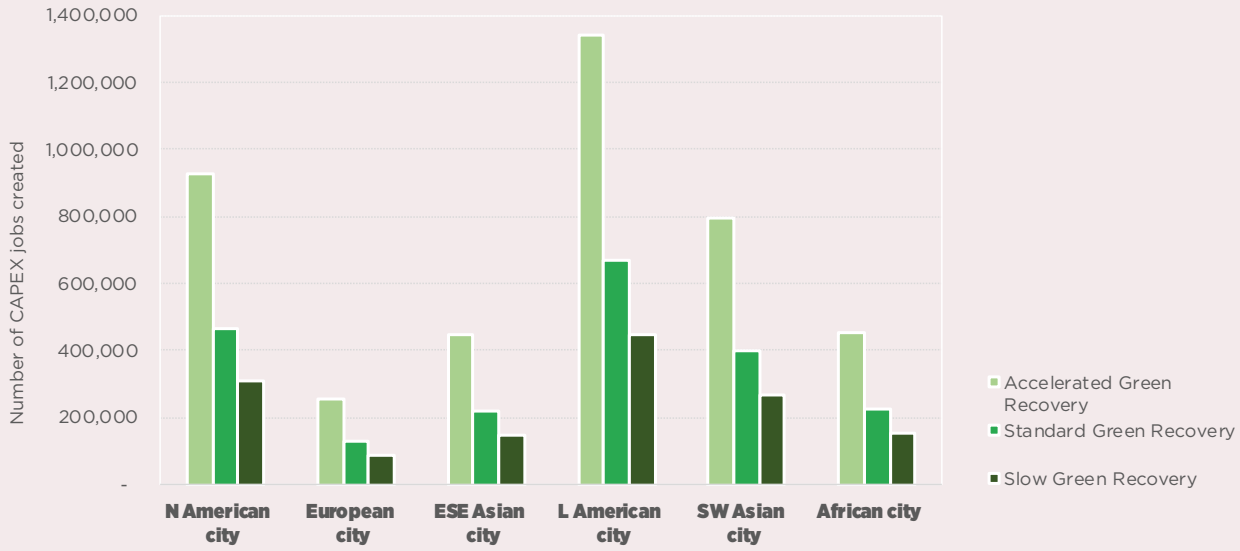
1 C40 Cities Climate Leadership Group, *Technical report: The case for a green and just recovery*, April 2021.

2 Oxford Economics (2020 data).

3 C40, *The Future of Public Transport: Investing in a frontline service for frontline workers*, March 2021.

4 *Ibid.*

Total number of jobs associated with capital expenditure under the Standard, Accelerated and Slow Green Recovery scenarios

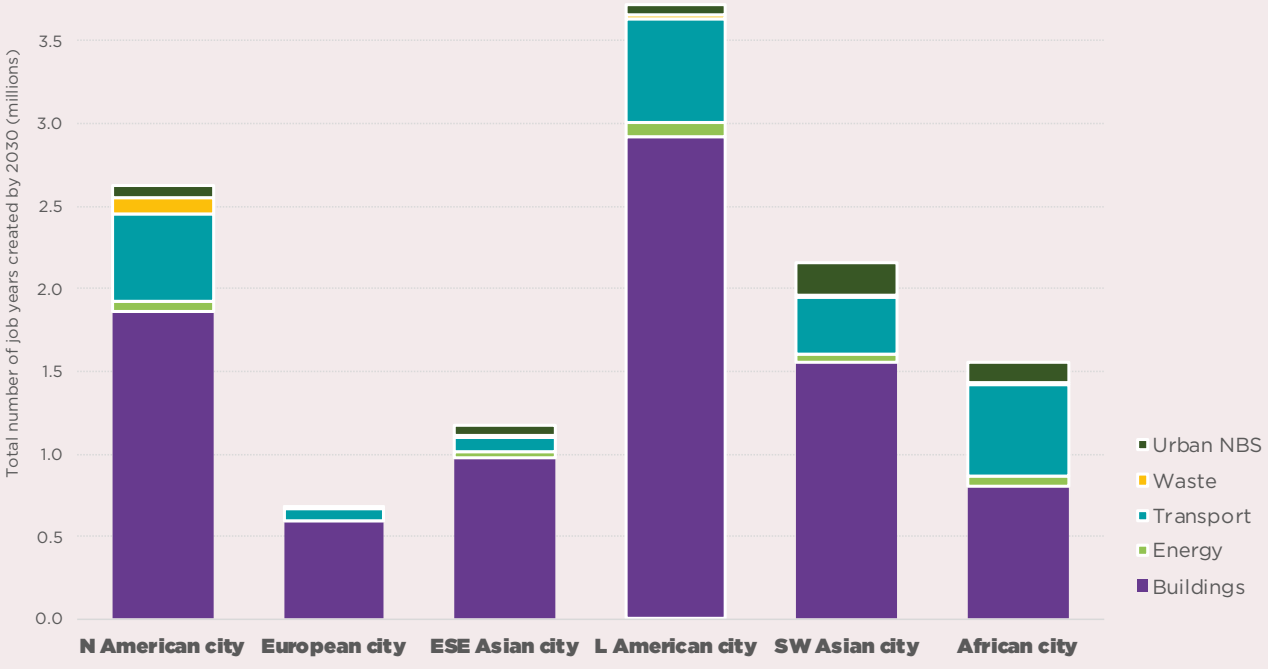


An Accelerated Recovery will generate a higher number of total jobs, as large capital investments are made over a shorter period. For example, if 10 houses are built in one year and each house generates one construction job for a full year, then building 10 houses will generate 10 construction jobs that year. If the same 10 houses are built over 10 years, the pace of construction will only generate one construction job per year. The first scenario would see 10 people working for one year, the second, one person working for 10 years.

Source: C40, *Technical report: The case for a green and just recovery*, 2020.

Figure 1

Job years created under a Standard Green Recovery scenario, by sector, 2020-2030



Source: C40, *Technical report: The case for a green and just recovery*, 2020.

Figure 2

Public transport station in one of the busiest avenues of the city. Bogotá. Colombia

Latin American cities are often described as "urban laboratories". What are the most innovative sustainable models being implemented successfully in the region?

I. C.: Many interesting and innovating cases can be pointed out in the region, highlighting Latin American cities' pioneering role in sustainable transition.

Public transport. Latin American cities have been leaders in the implementation of bus rapid transit (BRT) systems – high-quality bus-based transit system delivering fast, comfortable, and cost-effective services at metro-level capacities –, born in Brazil in early 1970s. Bogota's famous *TransMilenio* BRT system, ongoing since 2000, now covers more than 200km in the city. Moving further, many cities in countries such as Chile and Colombia are increasingly replacing fossil-fuel powered buses with battery-powered vehicles, to the point that Latin America currently has the largest fleet of electric buses outside of China. Many municipalities like Santiago, Bogota or Sao Paulo are committing to convert their bus fleet to zero emission technologies in the upcoming years: Santiago is the leader with over 700 e-buses operating under private contracts.

Some innovative initiatives also emerged during the pandemic, such as temporary bike lanes, launched in Bogota, Mexico City or Buenos Aires, and should be made permanent in many areas. Bogota, which started the pandemic with 117 kilometers of temporary bike lanes, is currently in the process of making permanent at least 21 kilometers, thus expanding its total network of bicycle lanes to 572 kilometers.

New urban planning models. More and more cities are also reinventing the way inhabitants move, shop or work on a daily basis. The 15-minute city, a residential urban concept coined by the French-Colombian urbanist Carlos Moreno, in which all city residents are able to meet most of their needs within a short walk or bicycle ride from their homes, is gaining popularity, even more so in the aftermath of the pandemic. In Latin America, where cities are usually more extended than in Europe, this concept has been adapted towards a "30-minute city". In Buenos Aires, current initiatives aim at better connecting pedestrian streets to mass transit systems.

If we look at the bigger picture, Latin American cities are also at the forefront of adaptation strategies. We recently finalized C40 Climate Action Planning program, an ambitious two-year initiative which helped cities part of our network in Latin America (Buenos Aires, Curitiba, Guadalajara, Lima, Medellin, Mexico City, Quito, Rio de Janeiro, Salvador, Sao Paulo) to draft climate action plans aligned with the Paris Agreement. These plans also included climate risk assessments, identifying the most serious climate impacts and the areas within cities they were likely to occur. These assessments are a powerful tool to plan for heat mitigation strategies, expansion of green coverage, sustainable drainage systems and integrated urban planning.

Which lessons can be drawn from the Latin American model when it comes to providing long term and economically viable sustainable solutions, considering cities' constrained budget and necessity to avoid increasing users' tariffs?

I. C.: This is a complex equation to solve. To illustrate this point, let me come back to the zero-emission transit solutions, which are a major lever to reduce cities' greenhouse gas emissions and air pollution. An increasing number of cities in Latin America push ahead plans to convert bus fleets to zero emission technologies, most notably battery electric buses (e-buses). To understand the backdrop for converting bus fleet to electricity, C40 recently published a report reviewing innovative business models currently used for municipal buses in Latin America.[5] This element is crucial. Like most battery-powered vehicles, the capital costs of e-buses tend to be higher and the operational costs tend to be lower than fossil fuel alternatives. For that reason, new business models and creative financial solutions have been at the heart of the conversation on e-buses, with public and private stakeholders working to develop alternative models to help municipalities overcome the high up-front cost premium associated with e-buses while taking advantage of the significantly lower operational costs.

In Latin America, several municipalities have chosen innovative public-private partnership and concession-based models for integrating e-buses into their systems. One of the key advantages of this model is to offer a better risk allocation amongst stakeholders, by involving third-party asset managers (fleet providers). Under this model of fleet leasing, the fleet providers finance, procure, own, and/or maintain the equipment, and provide e-bus fleets to operators and municipalities under stable long-term contracts. In e-buses, leasing can eliminate the need for large up-front capital expenditure by municipalities or operators. In emerging markets, where public resources are often scarce, those models are even more relevant. Cities like Santiago and Bogota are increasingly switching to these options.

A green and just recovery could create over 50 million good, sustainable jobs by 2025 across the nearly 100 cities in the C40 network (which count around 550 million inhabitants) and their supply chains, a third more than when investing equivalent funds into a high-carbon recovery

What will be required in the upcoming years to support cities in their transition towards sustainable models?

I. C.: Financial constraints are usually the first barrier to implementing sustainable and innovation solutions, even more so in emerging countries. In many countries in Latin America, cities' budget are largely incompatible with the responsibilities they have. Most of municipalities' allocation is spent on basic services, which does not leave much room for climate action. Making mechanisms like the Green Climate Fund accessible to cities would be a very efficient way to start lifting this structural barrier.

Another issue derives from governance. Climate change challenges the way cities are used to work. It requires a transversal approach and effort. Climate action is still considered to be a responsibility of the cities' environmental departments most of the time, while it should include roughly any topic, from education to transport, health and waste management. In this respect, some interesting initiatives are starting to emerge. Sao Paulo recently appointed an Executive secretary for Climate Change, who responds directly to the Secretary of Government, signaling a more encompassing and articulated implementation and monitoring of the city's climate action plan.

The ongoing social and economic crisis and the fight against the pandemic also tend to slow down the climate action agenda. Municipalities dedicate their resources to providing basic services, while facing more financial constraints (less revenues and more short-term expenses to allocate). This context poses a great challenge to mid and long-term investments.

Those are macroeconomic trends which are unevenly distributed among cities, depending on their size, location, resources... Large and medium cities face different obstacles and can build on contrasting assets as well. Small and medium cities, which are still growing, can learn from the flaws and successes of larger cities, and anticipate the challenges which derive from rapid urban growth (traffic jams, informal housing, etc.). They have an opportunity to benefit from the so-called "leapfrog effect". However, in many cases, smaller cities also suffer from a lack of human, financial and technical resources to innovate. To overcome those constraints, cities can organize as consortiums, to invest in bigger projects, with the support of national bodies, while relying on national and international funding as well.

5 *Accelerating a market transition in Latin America: New business models for electric bus deployment* (February 2020). See also: *Leading clean recovery with electric buses. Innovative business models promise in Latin America* (November 2020).

THE LOW-TECH CITY: A FIRST ATTEMPT

Pauline DETAVERNIER, architect, PhD in architecture, pauline.detavernier@arep.fr, 06 36 53 63 42 [1,4]
Nils LE BOT, architect, PhD in urban planning, associate lecturer, nils.lebot@arep.fr, 06 86 59 94 76 [2,3,4]
With thanks to Miriam Heipertz for translation assistance

This article shortly presents the results of work conducted during the research project *Urbalotek*: *for sober and resilient cities* (2020-2022), jointly led by AREP agency and Institut Paris Region, with the support of ADEME Île-de-France.[5] This work examines the possibility and relevance of translating low-tech approaches, hitherto applied to technical devices, to the urban and territorial scale. The work begins with a broad review of contemporary urban thinking. It highlights, through critical analysis, a set of convergences, divergences, and interrelations of the different urban concepts. It, then, proceeds to compare the *conceptual make-up* of these urban concepts with the low-tech approach. This comparison not only points out certain theoretical and practical aspects that various urban concepts have in common with the low-tech approach, but also identifies those that may be unique to the low-tech approach. Lastly, this reflection results in a possible definition of the low-tech city, not as a fixed concept but as the product of a new *urbanism of discernment*.

URBAN THINKING IN RENEWAL

In recent years, the elements of language in the fields of architecture and urban design, but also in much of the political discourse on planning and the city, have been changing. The city, a place that expresses power and urban social structure (Sennett, 2020), is facing a new set of challenges marked by instability and unpredictability combined with accelerating social and ecological change. It has entered what could be described as a phase of permanent intellectual work in progress yet still seeks unifying new models (Peyroux et al. 2016). From the myriad of current doctrines, we have studied some relatively recent concepts for the city (*the adaptable, human-scale, circular, creative, frugal, sober, inclusive, productive, proximity-based, resilient, smart* or *natural* city as well as the *urban bioregion*) and revealed their similarities or incompatibilities with the low-tech definition, thereby seeking to identify how a possible *low-tech city* might look.

Based on a selection of recent works representative of the current debate on city concepts, the research uses a descriptive analysis breaking the different concepts down into generic *conceptual markers* that make comparison easier. Since each concept is rooted in its own specific socio-economic, geographical and historical context, this definition in terms of *markers* is necessary for identifying similarities and differences between the concepts.

This analysis results in the identification of a number of markers. Some markers are shared among most city concepts: *innovation, circular economy, maximized well-being* and *calm* (versus *intensification* and *effervescence*). Other markers are less common and therefore more differentiating: *technological discernment, predictivity, equality* or *inclusivity*, certain aspects of *sobriety/sufficiency* (*asceticism, frugality* and *austerity*), and the allowance made for biodiversity (*coexistence, symbiosis*, etc.) and environmental issues (climate change and *capitalocene*).

Regarding its conceptual foundations, the low-tech approach reflects many of the markers found in the urban concepts studied. It does not provide a substitute but offers alternative mechanisms for understanding urban challenges. Low-tech stands in clear opposition to the smart city and appears to a degree complementary with the bioregion concept, which is also systemic in its approach. But the vocabulary used is different. Its guiding principle, *discernment,* and its resolutely systemic questionings distinguish it from the other concepts, taking multi-scale challenges into account more fully.

This examination of the state of the art was a vital pre-requisite for producing an assessment of a new, low-tech-based urban concept. In the light of the elements it may share with other conceptual approaches (see Figure 1), we can now distinguish what makes it unique: the use of what we have chosen to term *methodological discernment*.

1 LIAT, École Nationale Supérieure d'Architecture Paris-Malaquais (FR).
2 LISST-Cieu (UMR 5193) CNRS, Université Toulouse Jean Jaurès (FR).
3 École Nationale Supérieure d'Architecture Paris Val-de-Seine (FR).
4 AREP, Agence d'architecture pluridisciplinaire, subsidiary of SNCF (FR).
5 Lopez C., Le Bot N., Soulard O., Detavernier P., Heil Selimanovski A., Tedeschi F., Bihouix Ph., Papay A. 2021. *La ville Low Tech : Vers un urbanisme du discernement*. ADEME - Institut Paris Region - AREP. 011641. Paris.

Synoptic diagram of city concepts: Links, intersections and overlaps

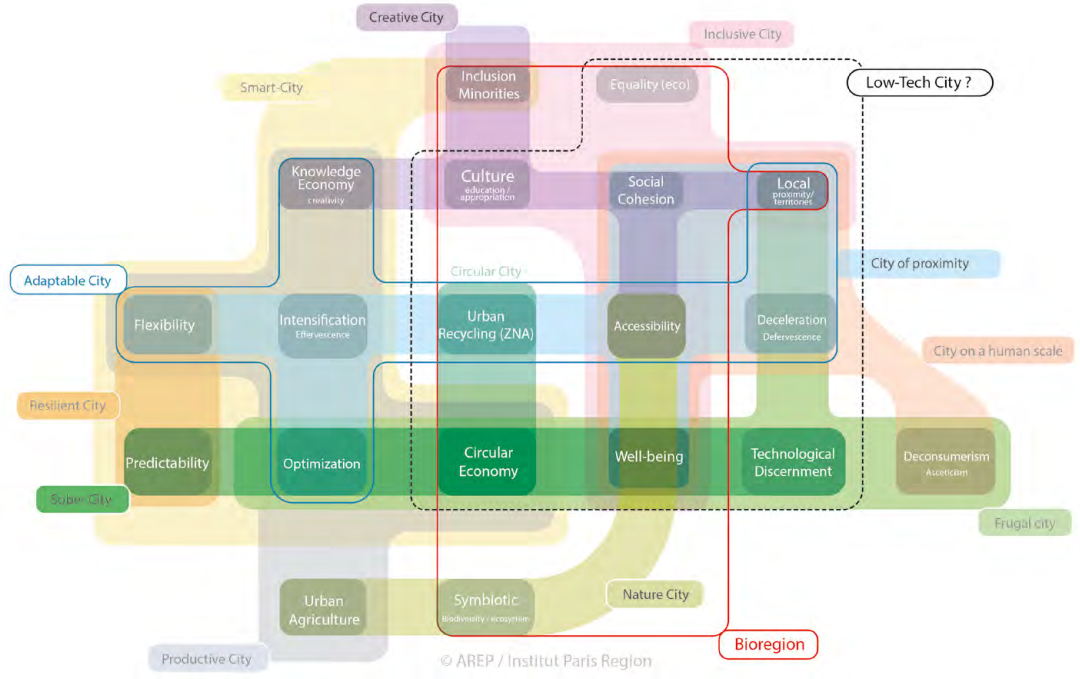


Figure n°1

TOWARD AN *URBANISM OF DISCERNMENT*

With *discernment*, low-tech holds a powerful marker. *Discernment* in this approach must be understood not only as *technical* but also as *spatial, ethical,* and *scalar discernment*. Low-tech provides methods and criteria for arbitrations to make cities more sober, accessible, and convivial. Although these goals feature in many of the city concepts examined, they do not always cover the same dimensions and sometimes create a rebound effect as well as contradictory or incomplete solutions. We consider that the originality of the concept lies in the degree of additional discernment and would, therefore, define low-tech urbanism as follows:

- The low-tech city is a territorial or urban system where social practices, governance, attitudes to the living and the functioning of the economy demonstrate the implementation of an *urbanism of discernment*.
- This systemic, critical, and ethical approach builds on four principles: praise of sufficiency, sustainable management of resources, conviviality (appropriation, accessibility of tools and knowledge, etc.; see. Ivan Illich)[1] and the search for an appropriate scale in terms of political structures and the socio-technical responses provided.

6 We are referring to the concept of conviviality defined by philosopher Ivan Illich. As underlined by Philippe Bihouix in his publication on low-tech, Illich believes that a convivial society is one where "modern tools are at the service of people who are integrated into the collective." Similarly, in its desire to turn to people wherever machines are not absolutely necessary, the low-tech approach restores the inclusive character of certain occupations that require few qualifications.

Figure 2: Basic scheme of the low-tech city

Implementation of the low-tech city could be structured around four areas (see Figure 2).

Questioning need, or the celebration of just sufficiency

A low-tech approach applied to a city would make it possible to understand urban needs and desires with greater discernment. It would offer arbitration processes going far beyond criteria based on profitability or efficiency alone. It would pay attention to the sustainability of chosen solutions, their replicability, potential rebound effects, and so on. It would typically encourage renunciation of the purposeless use of natural resources. Rather than disruptive innovations, it would generally seek to work with what already exists or to try out new organizational forms. Tactical cycle routes, which have seen accelerated rollout since the COVID pandemic, are a typical example. Creating "just sufficient" infrastructure for bicycle use is a good illustration of "a just need" that combines a highly flexible rollout with maximum sobriety in terms of time, effort, and materials.

Seek sobriety in resource use (here and elsewhere)

The scientific literature on the circular economy agrees that the decisive element in operationalising the concept is the deployment of action hierarchies, known as R-Hierarchies (Hultman and Corvellec, 2012). These orders of priorities classify actions to take in terms of the resource retention they enable over a product's lifecycle. In terms of urban planning

and construction, low-tech could adopt an approach of this type, focusing primarily on *renouncing* new builds in favour of urban recycling (Grisot, 2020), optimizing or modularizing how facilities are used. This entails a preference for rehabilitation over reuse, material reuse over recycling, and material recycling over using new materials. If all other solutions are exhausted, all new builds must actively question how the resources required are sourced (biosourced, geosourced, etc.).

Ensure universal accessibility

Low-tech products, services and initiatives generally seek to be inexpensive and *convivial*, in the sense defined by Ivan Illich. This means helping people to act, systematically favouring autonomy, simplicity, ease of repair and accessibility to as many people as possible. At the urban scale, this goes beyond collaboration, entailing an effort at all scales to rekindle the collaborative spirit. In a low-tech city, people gain greater autonomy of thought and action, rediscovering the pleasure to be had from taking part in the collective construction of their territory. It could be rooted in a wide diversity of spaces for cooperation and appropriation of know-how: fab labs, upcycling stores, repair cafés, collective projects, etc. Implementing an *urbanism of discernment* would require residents who are involved, a society open to learning, and faith in collective intelligence.

Find the appropriate scale

The low-tech city, irrespective of its size, be it a village or a metropolis, would embrace the idea of a just proportion between means and ends (Lynch, 1981; Batty, 2008). Such a city would seek solutions for acting on a *human scale* (Gehl, 2010) on all levels, from the local to the territorial, depending on needs and possible arbitrations in terms of social and political organization (governance), daily or occasional travel needs, supply, public spaces, and their surrounding buildings, etc. For instance, when it comes to production chains, the low-tech city would seek to boost its own productive capacities by relocating certain production units and making as much use as possible of the resources and know-how of the bioregion to which it belongs.

CONCLUSION

Given all these factors, is it really a good idea to add yet another new concept: the low-tech city? As pointed out by Philippe Bihouix, cities have far more to think about than becoming low-tech. To name but a few, cities must face various fast-approaching changes (relocation of certain logistics and production functions, new consumer practices and habits, adapting to the climate emergency, etc.) while suffering from certain tragic missteps of the past. They are confronted with issues surrounding densification, metropolization, global competition and regional attractiveness but must simultaneously halt the unsustainable levels of soil-sealing. Then there are the new post-COVID realities and shifts, marked by the population's desire for nature and working from home but also by collapsing tourism. It is not the moment to overload them.

Against this background, the idea is not to make low tech a new *deus ex machina* for urban planning, designed to replace (or include) all other concepts of sustainability. However, we believe that a low-tech approach could, at the territorial level, be fertile ground for new thinking and initiatives that could accelerate the transition and develop resilience in ways that improve the experience of sharing the same space. And that the ideas and evocations engendered by an *urbanism of discernment* would bring immediate, concrete advantages in terms of employment, pace of life, inter-resident collaboration, autonomy, resilience, and repairing the world.

The challenge now is to make sure that cities take up the low-tech approach and succeed in winning over as many people as possible. At the territorial level, there are also the beneficial prospects of creating local employment and social ties, easing tensions and eliciting desires.

The next stage in the joint study by the Institut Paris Région and AREP will be to create inspirational, concrete and visible examples so that low-tech is no longer hampered by the misconception that it is a backward-looking, makeshift approach. The aim is to show that low-tech approach can turn things around and make overnight trains and re-use more desirable than space tourism and colonizing Mars.

ONE HEALTH: AN ECOSYSTEM-BASED ECOLOGY OF HEALTH

Serge Morand
Research director at the CNRS and associate researcher at Cirad

Scientific studies paint an alarming picture of environmental damage and the associated health risks. The challenges are numerous and the ecosystem approach offers a response to interlinked environmental and health challenges, thanks to the One Health concept that provides a systemic understanding of ecological transformation. The concept is used in international governance, by UN agencies, as well as in national governance. France has established a One Health monitoring group within the framework of its 4th National Health & Environment Plan. Concrete implementation of the concept using One Health social ecology methods is illustrated in the form of co-constructed projects in southeast Asia involving scientists, local authorities, economic actors and local administrations. Characterized by a new form of One Health governance that is more environmentally focused, the impacts of these projects will be felt over the medium or even long term to respond to global environmental and health issues.

Serge Morand is a researcher who specializes in the social ecology of health. A field ecologist and parasitologist, he studies relationships between biodiversity and health, the interfaces between people, wild and domestic animals, and the environment. He leads missions and projects looking at impact of land-use changes on the emergence of zoonotic diseases in southeast Asia. He is a CNRS-Cirad research scientist based in southeast Asia and Invited Professor at the Kasetsart University Faculty of Veterinarian Technology and Mahidol University Faculty of Tropical Medicine. He is a member of the One Health (OHHLEP)[1] international expert panel.

INTRODUCTION

The COVID-19 pandemic caused by the SARS-CoV-2 virus has created a global health, social and economic crisis that shines a spotlight on the systemic malfunctioning of our relationships with nature. Although the exact trigger for the epidemic remains little understood, there is no arguing that the origin of the virus lies with an Asiatic bat. We now have to understand how a virus, one of millions found among animals in the wild, was able to emerge and spread across the entire planet. The risks of such a pandemic were all too predictable. Emerging viruses and epidemics of infectious diseases affecting humans, animals and plants have been rising constantly for the past several decades. In report after report, scientists link these health risks to the damage done to how ecosystems operate. The current health crisis has reinforced the need to act by turning to holistic approaches, particularly those based on ecosystems.

1 One Health High Level Expert Panel, launched jointly by WHO-OIE-FAO-UNEP. See the list of members here: https://www.who.int/groups/one-health-high-level-expert-panel/members.

WIDELY ACKNOWLEDGED FACTS

Countless scientific works demonstrate the impacts on human health of global changes such as the climate change, loss of biodiversity, industrialization of agriculture, intensification of livestock rearing, damage to habitats and unchecked urbanization. Globally, close to 25% of all deaths and causes of morbidity can be attributed to environmental factors. The increase in epidemics of infectious diseases observed over the past few years appears directly linked to the uptick in livestock rearing and landuse changes, such as the conversion of forests into commercial plantations. The globalization of international trade favors the spread of epidemics that become increasingly global, resulting in pandemics. The last pandemic H1N1 swine fever emerged at a North American mega-farm in 2009 before spreading across the planet.

The ecosystem approach is an integrated strategy for management of land, water and living resources that promotes the conservation and sustainable use of these natural resources while also contributing to human fulfillment and well-being

The environment's role in health has long been recognized. Back in 1968, the UNESCO conference on the biosphere declared that "*man is an integral part of most ecosystems, not only influencing but being influenced by his environment, that his physical and mental health, now and in the future, are intimately linked with the dynamic system of natural objects, forces and processes that interact within the biosphere and including also those of man's culture.*"

The Millennium Ecosystem Assessment, which ran from 2001 to 2005, again stressed the functional link between the environment, biodiversity, health and the well-being of human populations. This functional link is embodied in the ecosystem approach and the idea of ecosystemic services. The ecosystem approach is defined as an integrated strategy for management of land, water and living resources that seeks to promote the conservation and sustainable use of these natural resources, while also contributing to human fulfillment and well-being. This approach is based on the application of appropriate scientific methodologies at various levels of biological organization, including the essential processes, functions and interactions among organisms, humans, and their environment. As applied to human health, the principles of an ecosystemic approach to health are interdisciplinarity, systemic thinking, participative research, sustainability, social and gender equality, and the shift from knowledge to action.

The effects of globalization of trade and mobility on the risks of emerging infectious diseases and pandemics in relation to land-use changes, increasing infrastructure and rising demand for natural resources

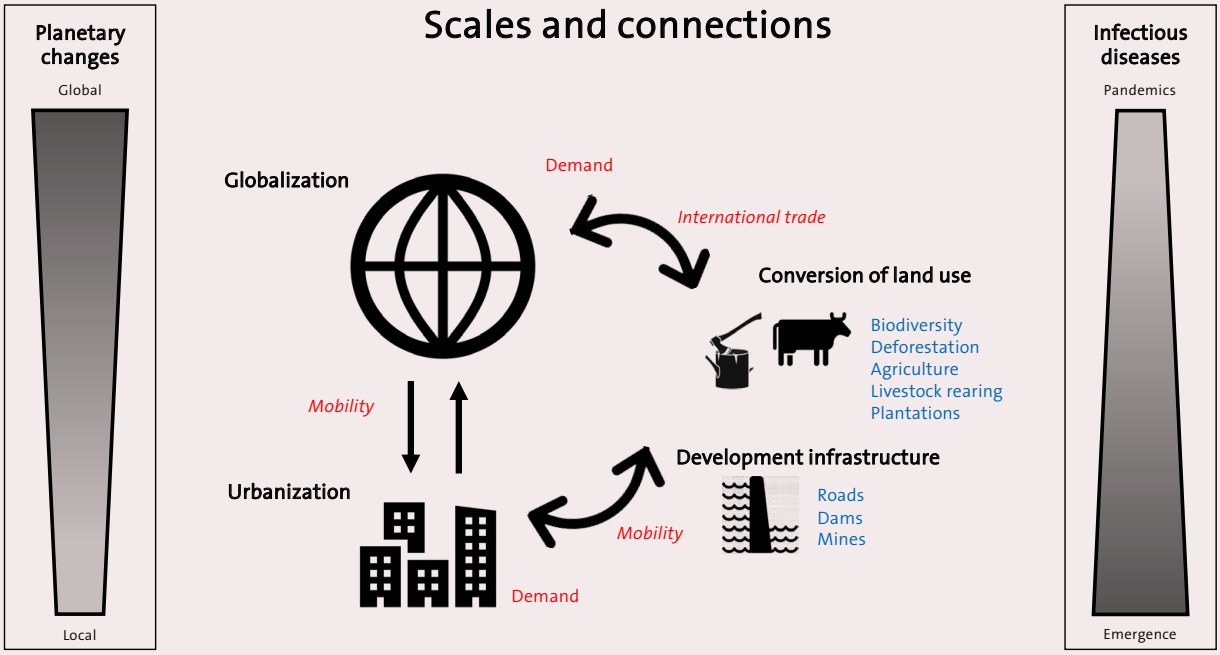


Figure 1

In June 2021, the United Nations Environment Programme (UNEP) joined the tripartite One Health program, encompassing the World Health Organization (WHO), the World Organization for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO), in order to introduce an environmental dimension to the One Health approach. These four intergovernmental bodies appointed a One Health High Level Panel (OHHLEP) of experts tasked with providing an actionable scientific assessment to inform decision-making with a view to preventing the emergence and epidemics of zoonotic diseases caused by modifications to interfaces between humans and wild or domestic animals. Another recently launched body is the Planetary Health Alliance, which aims to promote and unify local initiatives able to achieve a transition to human activities that are aligned with nature.

France is also taking action. In September 2021, it set up a One Health monitoring group within the framework of the 4th National Health & Environment Plan. A white paper was published in November 2021 containing proposals for actions needed to establish a One Health policy for France. The country's national parks have also adopted a wildlife health strategy for the years up to 2027.

CHALLENGES

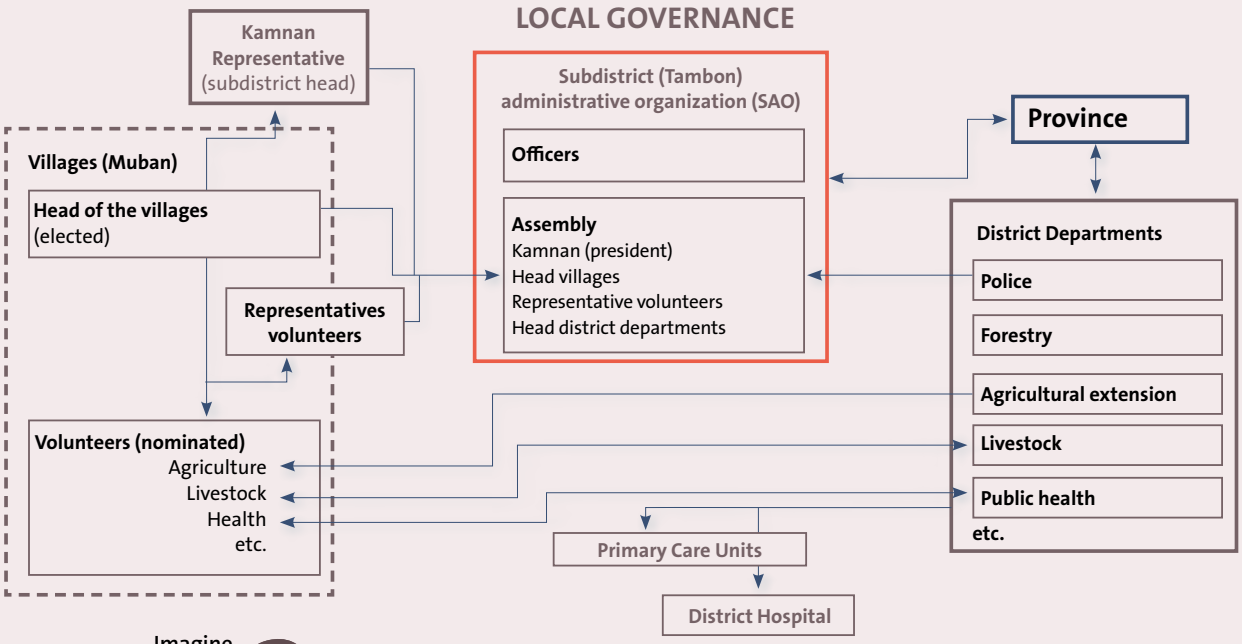
However, there remain many challenges to an ecosystem-based approach to health targets. The ecosystemic approach requires a very different mindset from approaches governed by silos and sectoral thinking, even more so as human health policies increasingly focus on treatment rather than prevention. Environmental health is reduced to being simply a matter of avoiding exposure to chemical or biological substances that are harmful to individual health. In the face of repeated health crises, animal health is reduced to a focus on biosurveillance and biosecurity. This results in an alteration in our relationships with wild and domesticated animals, which are seen as potential dangers and a risk to humans. These sectoral policies encourage the clearance of natural environments and isolate the natural world, despite the fact that the psychological benefits of contacts with biodiversity and nature are increasingly recognized.

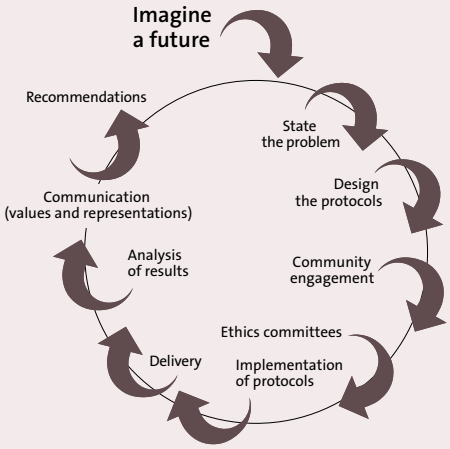
With considerable efforts focused on the ecology of conserving natural environments and wild areas, scientific ecology has failed to interact sufficiently with human and animal health

Scientific ecology, on the other hand, has begun to concern itself with environmental and global health issues only very recently. The ecological sciences struggle to communicate complex notions, particularly when these involve references to systemic thinking, to practitioners seeking to treat health-adjacent problems or to provide emergency responses to health crises. With considerable efforts focused on the ecology of conserving natural environments and wild areas, scientific ecology has failed to interact sufficiently with human and animal health. Yet, following the WHO's "Health in all Policies" recommendations has never been more urgent. We still have a long road to travel, as can be seen in the paucity of dialogue and inter-sectoral actions during health crises. In a similar vein, the idea is to incorporate ecology in all policies, including those that impact the health of humans, animals or plants. The One Health approach offers this opportunity for dialogue and actions that can provide a response to environmental and health challenges.

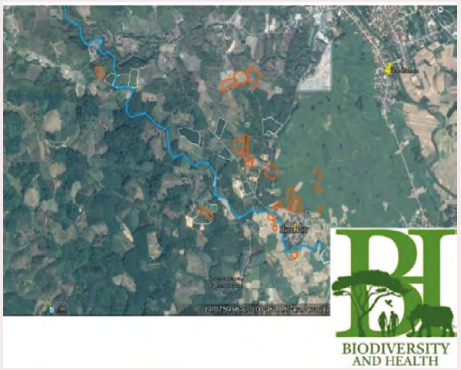
Ecology of health is a recent scientific field that seeks to contribute to our understanding of health problems at the interfaces between humans, wild and domestic animals, and their environments. Ecology of health requires abandoning silos between disciplines and sectors, instead developing collaborative projects constructed jointly by scientists, residents, economic actors and administrations. A One Health social ecology that is truly inter-sectoral in its expertise requires knowledge and representations to be shared between scientists, administrations, civil society communities and economic actors. The goal is to move beyond a traditional vision of educating citizens and other actors, shifting instead to a shared understanding of the knowledge, values and visions espoused by these various actors. This development requires a methodology and some real-life examples for inspiration.

Schematic diagram of a social ecology of health research project, rooted in actors' local governance (leaders and volunteers from village communities, administrations, and clinics), whose involvement is depicted in the form of a dynamic network





ACQUISITION OF SHARED DATA PARTICIPATIVE MAPPING



NETWORK OF ACTORS, COMMUNITIES, ADMINISTRATIONS, AND RESEARCHERS

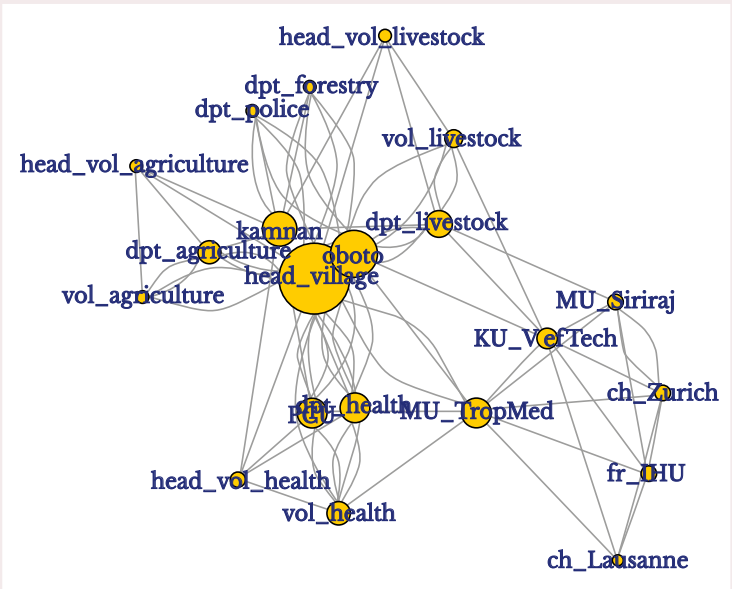


Figure 2

PUTTING IT INTO PRACTICE

In France, a large number of initiatives sponsored by local authorities and non-profits are emerging, or in the process of consolidation. But if we turn our focus to southeast Asia, there is much we can learn from local experiments that bring together communities, administrations and research projects looking into health and biodiversity.[2]

Local governance of health, environment and agriculture in Thailand, and other countries of southeast Asia, centers on village communities. Every Thai village is represented by one or more health volunteers, as well as volunteers focused on agriculture, livestock and fisheries. These volunteers act as the link between their communities, health clinics and authorities responsible for public health, veterinary health and agriculture, all as part of a local administration exercising devolved power. The volunteers' role is to inform their communities of risks to the health of humans, animals and plants, take part in training people to prevent risks, such as by combatting local vectors, and organize activities, together with the relevant administrations, designed to improve agricultural production or encourage a shift to organic farming. This being the case, all research projects have to be guided by an understanding and explicit description of the local governance framework and its administrative actors, representatives and volunteers from village communities, and its forums for deliberation and collective action (see diagram 2).

Many research projects are run by local universities, sometimes in partnership with universities from other countries. But every research project implemented locally inevitably creates a specific network of actors, made up of researchers, different administrations (health, agriculture, conservation areas), the territorial assembly, leaders and volunteers from the villages concerned by the project. This network of actors also contains a wide range of expertise (scientific, technocratic, political and practical) as well as varying visions and perceptions. Every research project has to describe this dynamic network, within which circulate information, economic and political power, individual and collective action. Describing the governance and network of actors engaged in such a project is the first step along the road to systemic thinking.

Implementing a research project centering on human health from a One Health perspective, and including ecosystem health, will involve large segments of local governance, countless local actors and a great volume of outside scientific expertise. Setting up an interdisciplinary and inter-sectoral research project is a sizeable undertaking.

- **The first phase in the life of a project centers on formulating a given One Health problem.** For example, the impact of biocides (pesticides and antibiotics) on the health of humans, animals (domesticated and wild) and ecosystems (soil and water). The project's network of actors must have the capacity to describe and share its knowledge, whether scientific, medical, technical, practical or traditional. This sharing process makes it possible to formulate the problem and design the protocols to follow. The protocols will then be approved via community engagement (local communities and their leaders, administrations, clinics, and scientists) and then by the appropriate ethics committee (human ethics and experimentation on animals) and authorities concerned (national parks, provincial government, universities, etc.).
- **The second phase involves implementing the protocols and deliverables**. The protocols may cover topics such as interviews, questionnaires, participative mapping and group interview sessions. They may require biological samples to be taken from humans or animals, or from the environment, and will in addition require data on the environment, climate and biodiversity. These protocols will generate a large set of qualitative and quantitative data for analysis by scientists from various disciplines (anthropology, sociology, medicine, ecology, molecular genetics, etc.). Rules for saving, sharing and accessing data have to be explicitly defined in the ethical protocols and research license (protection of individuals and communities, protection of traditional knowledge, and safety).
- **The third phase is presenting the scientific results**. This is the most complex phase as it requires, from the outset, researchers to open up to other fields outside their specialty as well as to other forms of non-scientific knowledge. This entails moving beyond a traditional vision of educating citizens, communities, practitioners and decision-makers, shifting instead to a shared understanding of the knowledge, representations, values and visions espoused by the various actors. Conventional scientific expertise needs to be left behind, and we need instead to embrace an integrative, pluralistic expertise based on scientific knowledge and forms of understanding rooted in the lived experience of population groups and administrations. The experience we gained in southeast Asia serves to highlight the great number of practical and cultural (scientific and administrative) difficulties involves in rolling out One Health social ecology projects based on the ecosystem approach.

CONCLUSION

Ecosystem-based One Health social ecology is what can be called an involved science, and only once the barriers between disciplines and sectors are set aside are its findings considered within the larger public debate. Achieving this breakthrough calls for collaborative projects that are co-constructed by scientists, local authorities, local economic actors and administrations, characterized by a new form of One Health governance that is more environmentally focused and whose impacts will be felt over the medium or even long term.

2 See, for example: "*Quels sont les impacts des changements d'usage des terres sur l'émergence de maladies infectieuses en Asie du Sud-Est ?*", [What are the Impacts of Changing Land-Use on the Emergence of Infectious Diseases in southeast Asia?]: Agence Nationale de la Recherche (ANR), 2020.

THE SOUTHEAST ASIAN EXAMPLE

Two scientific articles published in the late 2000s focused attention on southeast Asia. The first examined factors driving the emergence of infectious diseases and identified southeast Asia as one of the regions at high risk of the emergence of new infectious agents related to wildlife. The second article described the distribution of endangered biodiversity and also pointed to southeast Asia as the region where mammal species in the wild face the highest risk of extinction. Some of the most important infectious diseases of the past 20 years have certainly emerged in southeast Asia, or southern China, such as H5N1 bird flu, the Nipah virus, the first SARS-CoV virus, and now the SARS-CoV-2 virus at the origin of the COVID-19 pandemic. Loss of biodiversity and natural habitats are seen as significant factors behind the emergence of these viruses.

As part of the ANR project CERoPath (2008-2012), we[3] analyzed diversity and dynamics in the rodent populations that are agents for infectious diseases at several sites in countries along the Mekong River. Fine spatial resolution made it possible to characterize the reservoirs' environmental niches and the prevalence of infection by different agents infectious to humans. This revealed that the mosaics of landscapes maintained dynamically by local people had the effect of promoting biodiversity while minimizing risks of infection and epidemic when compared to heavily modified habitats.

The CERoPath project highlighted the importance of incorporating social and public policy components into the study of links between biodiversity and health, issues at the heart of a second ANR project, BiodivHealthSEA (2013-2016). Using the results of these projects, we are now studying the impacts that economic corridors have on human health and the environment in a further ANR project, FutureHealthSEA (2018-2022). Rapid changes in land use, integration into regional and international trade, and climate-related pressures illustrate the importance of being able to better anticipate local epidemics of infectious diseases, based on data collection and modelling. These three interdisciplinary projects encouraged the establishment of an international network of researchers into biodiversity and health, and have contributed their expertise to international bodies such as the WHO-FAO-OIE tripartite collaboration, UNEP and UNESCO. They have further underlined the importance of developing collaborative ecology of health projects that are co-constructed with communities and administrations at the local and national levels, and generate results over the medium or long term.

3 Serge Morand and his CNRS colleagues.

TRANSITIONING THE CHEMICAL MARKET

Anna Lennquist
Senior Toxicologist, ChemSec

Anna Lennquist joined ChemSec in 2013 and is Senior Toxicologist and project manager for the SIN List and substitution. ChemSec is a non-profit organization committed to the development of sustainable chemicals use through dissemination of knowledge, collaboration and practical tools. It is a leading advocate of chemicals policy based on current scientific understanding. Anna works to convince policymakers, companies and financial investors of the urgent need to phase out hazardous chemicals. Anna graduated from the University of Gothenburg and has a PhD in zoophysiology.

Chemicals are everywhere in our everyday products. Many of them have proven to be hazardous and threaten our health as well as the environment. Scientists and chemical researchers have led many studies demonstrating the devastating effects from the widespread use of manmade hazardous chemicals (risks of cancers, diabetes, respiratory disorders, disruption of ecosystems, soil contamination, etc.). While awareness among society and consumers is slowly increasing, much remains to be done to set the chemical industry's transition in motion. This shift is not impossible, and is in fact achievable given that many toxic substances are replaceable with safer and more sustainable alternatives. Driving the switch to safer alternatives requires all stakeholders, from govemnments to businesses and investors, to adopt far more proactive policies in this area. Chemicals and their impacts should not be underestimated on our path toward a green transition.

INTRODUCTION

When thinking about chemicals, especially hazardous ones, we often picture pesticide spraying or factory chimneys. And yet, hazardous chemicals are found in many everyday products, from mobile phones, furniture and children' toys to the food we eat. As a result, every one of us is exposed to a cocktail of chemicals that can have harmful effects on us or the environment. And the industry is on an upward trend. The chemical industry is the second largest manufacturing industry in the world with global sales totaling USD 5.68 trillion in 2017. The value of the global chemical industry is projected to double by 2030.[1] At ChemSec, we are convinced that the green transition cannot be achieved without phasing out hazardous chemicals of our products and our daily lives.

1 UNEP, *Global Chemicals Outlook II: From Legacies to Innovative Solutions*, 2019. See also: OECD, *Saving Costs in Chemical Management*, 2019.

WHY SHIFTING AWAY FROM CHEMICALS MATTERS

The global chemical industry is gigantic. Millions of tons of chemicals are produced each year and most of them are hazardous. Indeed, 73% of all the chemicals in Europe are hazardous to human health and/or the environment, representing 220 million tons of chemicals.[2] Moreover, global chemical production almost doubled in the past 20 years: between 2000 and 2017, the global chemical industry's production capacity went from 1.2 to 2.3 billion tons. As the industry and its markets have grown, so has international trade in manmade chemicals. For instance, the value of China's exports of chemicals has increased by 15% since 2013. Chemicals are now found almost everywhere.

Many scientific studies have proven that these chemicals have harmful effects on people's health as well as on the environment.

As regards health, scientists have demonstrated in different studies that the presence of chemicals in the environment, food and consumer goods is directly linked to various illnesses and deaths. Chemical pollution is a major cause of human disease and premature deaths; the burden of disease from selected chemicals was estimated at 1.6 million lives in 2016.[3] Workers are often subject to disproportionally high exposure to hazardous chemicals. In 2015, almost one million workers died because of exposure to hazardous substances.[4] According to another UNEP report, Global Chemicals Outlook published in September 2012, poisoning from industrial and agricultural chemicals contribute to more than a million deaths every year worldwide. This figure is among the top five leading causes of death globally, after HIV/AIDS, tuberculosis, road traffic accidents and malaria. Potential adverse health effects of chemical exposure include acute poisoning, cancers, reproductive and neurodevelopmental disorders, and disruption of the endocrine system.

More and more scientists consider hazardous chemicals as a global threat comparable to climate change

Hazardous chemicals are also a global threat comparable to climate change according to many scientists. The UNEP[5] highlights the fact that chemical pollution threatens ecosystem functions by adversely affecting pollinators, contributing to ocean dead zones, contaminating soils, accelerating antimicrobial resistance, killing biodiversity, and increasing pressure on coral reefs. The global chemical industry is the world's largest industrial energy consumer. It is also the third largest industrial emitter of CO_2.[6] The industry accounts for approximately 10% of global energy demand, or 30% of total industrial energy demand, worldwide. The issue is that chemical production continues to rely on oil, natural gas, and coal. Fossil fuels are the feedstocks for basic petrochemicals and the source of the large amount of energy needed to manufacture most chemical products.

2 Eurostat, *Production and consumption of chemicals by hazard class*, 2020.

3 UNEP, *Global Chemicals Outlook II: From Legacies to Innovative Solutions*, 2019.

4 UNEP, *Global Chemicals Outlook II: From Legacies to Innovative Solutions*, 2019.

5 UNEP, *Global Chemicals Outlook II: From Legacies to Innovative Solutions*, 2019.

6 Levi and Cullen, *Mapping Global Flows of Chemicals: From Fossil Fuel Feedstocks to Chemical Products*, 2018.

HOW CONCRETE CHANGE CAN BE ACHIEVED

To achieve a toxic-free future, we need to ban the most hazardous substances and develop and use sustainable alternatives. The good news is that a lot of the hazardous substances in widespread use are replaceable with safer alternatives. Governments, private sector, investors and consumers all have a role to play in the transitioning of the chemical industry.

The role of regulation: inform, ban and incentivize

Regulation has a key role to play in supporting the chemical industry and all businesses on their path toward sustainable chemicals by (1) banning the most hazardous chemicals on the market, (2) incentivizing business to change their practices and (3) increasing transparency and information on chemicals.

Concerning the ban, substances of high concern should not be used in consumer articles. Long lists of high concern chemicals do exist but unfortunately very few are in the process of being banned at EU/international level. The process needs to be speeded up. We have to acknowledge that countries are not all at the same level of maturity in terms of existing regulations, bans and chemical reduction objectives. It is currently very difficult to know where countries stand in terms of chemical policies. The European Union is the only region that is transparent about chemical production and probably has the strictest chemical regulation. Significant efforts have been made by the EU over the years. Considering this, we can assume that the chemical situation is probably worse in regions like the US or Asia.

While EU regulations are far from being sufficient, a number of legal frameworks are sources of inspiration for other countries and regions. REACH is a significant regulation in terms of chemicals that was enforced in 2006. It places responsibility on industry to manage the risks from chemicals and provide safety information on substances. The REACH Regulation aims to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of chemical substances. This is achieved with the four processes of REACH, namely the registration, evaluation, authorization and restriction of chemicals. REACH also aims to enhance innovation and competitiveness of the EU chemicals industry. The Regulation calls for the progressive substitution of the most dangerous chemicals (referred to as «substances of very high concern») when suitable alternatives have been identified. Revision of the REACH Regulation was announced by the Chemicals Strategy for Sustainability adopted on October 14, 2020[7]. The objective of this revision is to ensure that the provisions of the REACH Regulation reflect the ambitions of the European Commission on innovation and a high level of protection of health and the environment, as provided for in the strategy. Other EU legislation, such as the 2020 Chemical Strategy, has put the circular economy specifically, and sustainability more broadly, on the agenda. It is part of the EU's zero-pollution ambition, which is a key commitment of the European Green Deal.

Regulation also has a role to play in encouraging businesses to be more proactive when it comes to sustainable chemical alternatives. Since private companies are often driven by financial targets, maintaining economic incentives to substitute hazardous chemicals within regulations and other policy measures is a powerful tool. A broad set of economic incentives for switching to safer alternatives is an intrinsic part of the REACH authorization system.

In order to improve transparency, regulation should help companies to understand which chemicals are in the products they sell. Companies themselves are asking for better legal requirements on supply chain communications concerning chemicals. The objective is to have full chemical disclosure. Many companies would like to do the right thing, but they do not have the necessary information since it is impossible to track it along the supply chain.

The biggest driver for companies to phase out hazardous chemicals is to future-proof their business

Beyond adopting regulations, one of the main challenges is to get policymakers to keep their promises. Regulators need to present clear targets for real change. The strategy put in place must include specific commitments as well as deadlines and concrete deliverables.

The role of the private sector: change practices and future-proof your business

The biggest driver for companies to phase out hazardous chemicals is to future-proof their business. It is crucial to be prepared for upcoming regulation and ensure that your business has an alternative before the ban comes into place or a scandal hits a business. There is also an opportunity for proactive companies to improve their brand image and reputation among their own consumers.

A growing number of companies are working actively to reduce the use of hazardous substances in their products and processes. More and more companies have even developed a Restricted Substance List, which go beyond regulation.

A number of them are part of the ChemSec Business Group, made up of companies working together to inspire concrete progress on toxic use reduction. The market-leading companies from a diversity of sectors discuss how to develop effective corporate practices in the substitution of hazardous substances. The initiative also raises public awareness of companies' efforts. For example, Coop is Denmark's largest retail enterprise owned by its members. Coop has always worked to secure the highest level of responsibility for consumers, society and the environment. Coop implements requirements on top of legislation. It has committed to a strong policy to educate consumers about chemicals. When it cannot find an alternative to a product containing chemicals, it stops selling the product.

7 This article was written in June 2022, prior to the postponement of the REACH revision to the end of 2023.

ChemSec also works with H&M and Ikea to learn more about hazardous chemicals in recycled textiles. Both companies want to use recycled textiles but need to ensure that they are compliant with their own standards on chemicals. Testing and gathering information requires a lot of work, so they decided to share costs and knowledge. This alliance illustrates the fact that companies can and do agree to work together and collaborate when it comes to this topic, and are prepared to ask their suppliers to make changes concerning chemicals. Consequently, supply chain pressure is also a driver.

CHEMSEC TOOLS TO DRIVE THE SHIFT TO SUSTAINABLE CHEMICALS

ChemSec has developed various tools to support companies and show policymakers that change can happen.

- **ChemScore:** it ranks the world's 50 largest chemical producers on their work to reduce their chemical footprint. It was developed to provide investors with better information to assess which companies have strong chemicals management strategies, and which do not.
- **Marketplace:** this business-to-business website is a place where buyers and sellers of alternatives to hazardous chemicals can interact. Not only does it provide a unique market opportunity for producers of safer alternatives, but also a one-stop shop for downstream user companies looking to substitute hazardous chemicals in their products. Companies can advertise their alternatives, providing and sharing their own solutions.
- **SIN List:** it consists of hazardous chemicals that are used in a wide variety of products and manufacturing processes around the globe. The SIN abbreviation – Substitute It Now – implies that these chemicals should be removed as soon as possible as they pose a threat to human health and the environment. It is a good way to learn which chemicals every company should avoid.

ChemSec is currently developing a PFASs guide to help companies that want to substitute these so called "forever chemicals". One main challenge for companies is to understand which of their products contain PFASs.

Investors: disinvest from toxic chemicals

Financial investors have a big impact on the strategic decisions taken by companies. From their perspective, the production and use of hazardous chemicals implies financial risks. However, these risks can be avoided by including the chemical perspective in investment analysis, and there are opportunities to grasp in investing in companies producing safer alternatives.

The implementation of the European REACH chemicals' legislation and the Toxic Substances Control Act in the US are seriously affecting chemical manufacturers, as well as downstream companies and retailers. To avoid risks and underperformance, hazardous chemicals must become a rising issue on the investment horizon.

The use of hazardous chemicals implies financial risks. Producers and users of hazardous chemicals facing possible future restrictions, such as the ones listed on the SIN List (which are identified by ChemSec as Substances of Very High Concern according to REACH criteria) face the risk of increased costs associated with reformulating products and modifying processes, which can have significant implications for company performance. This points to vast risks for companies with long production cycles. A product that is made today but put on the market in ten years' time could require the use of a substance which by then will have become restricted by REACH.

Consumers: be aware of toxicity and ask for change

The more consumers know about chemicals and the more questions they ask, the better. Consumers have a crucial role to play. According to a survey by the EU Commission,[8] 85% of European citizens are worried about how chemicals affect their health and 90% are worried about chemicals and the environment. Even though people are increasingly aware of the dangers of chemicals, there is still a lot to do.

ChemSec does not work in the consumer sphere, but there are several good initiatives with apps for scanning products on the shelf and finding out more about their chemical content. They provide a powerful game-changing tool to bring about a shift and empower customers. Consumers should have the right to know what is inside the product they buy.

CONCLUSION

The harmful effects of hazardous chemicals on both health and the environment are a scientific fact. Small changes and progress have been made over the past few years. The European Union has adopted some proactive policies, even though a lot remains to be done, while a number of businesses are taking the lead in shifting their current practices and finding safer alternatives. Nevertheless, this is only the beginning of a long journey toward the transition of the chemical industry. It is key that businesses, States and regulators, investors and consumers themselves understand the risks of hazardous chemicals and push for better practices. The green transition and the emergence of a new sustainable model for people and the planet cannot happen without taking into consideration the chemical perspective.

8 European Union Barometer, *Attitudes of Europeans towards the Environment*, 2019.

3. ACCELERATING OUR ACTIONS

Our societies' reactions to environmental challenges appear ambivalent, characterized as much by a form of resistance and denial, as by proactive movements to embrace change. Reflecting the varying forms and timescales of these changes, green solutions tend to be heterogenous and unevenly taken up from continent to continent. There appear to be several keys to embedding them durably, and to switching from sector-led approaches to the sweeping transformation demanded by the systemic nature of the climate emergency.

BUILDING STRONGER STAKEHOLDERS' RELATIONSHIPS

A business' social and environmental performance now seems to be a condition for it to last. With this in mind, stakeholder inclusion and co-constructed solutions figure among the new must-haves for imagining the conditions for a just transition, echoing the vision of a stakeholder capitalism advocated in the USA by researchers such as Julie Battilana, Ethan Rouen and Georges Serafeim.[1] **Laurent Obadia** looks at the importance of adopting an "expanded vision of businesses", rooted in a deeper dialogue with stakeholders and the adoption of a performance model which is multi-faceted and extra-financial.

RETHINKING ACCOUNTING MODELS

There are growing calls for the adoption of new models for accounting for and valuing resources so that they are managed more sustainably. **Mark Gough** describes the benefits of a multi-capital approach that values natural capital as much as financial and human ones. This diversification of reporting and assessment methods is encouraged by changes to the regulations in Europe, centered on the double materiality concept.[2]

DIVERSIFYING AND REDIRECTING FINANCING METHODS

According to the most recent report from the IPCC, the capital to finance ecological transition exists but the major problem is that it is misdirected, funding fossil fuels instead of decarbonized solutions. It needs to be redirected, and climate financing tools strengthened. **Priscilla Negreiros** presents an overview of the current climate finance landscape and the many obstacles to its take-up: on-going lack of private sector mobilization, and the imbalance between sums spent on adapting to the climate emergency in comparison to the unavoidable imperative to mitigate its consequences, which are already here.

GUARANTEEING SUPPORT FROM POLICYMAKERS

Taking financing as an example, the role public authorities need to play when funds are not redirected spontaneously is clear. Ecological transformation will only happen with proactive support from governments and public administrations. **Stefan Sipka** and **Annika Hedberg** underline the key role played by European regulations in encouraging a total transformation of the transport, energy, and infrastructure sectors as part of the Green New Deal.

LINKING COLLECTIVE EFFORTS AND INDIVIDUAL BEHAVIORS

The question of individual gestures and their contribution to the fight against the climate emergency is coming increasingly to the fore. While collective action is very much the primary lever for cutting emissions, individuals' actions are mentioned in every scenario for carbon neutrality and cannot be overlooked. According to a study carried out by NGO The JUMP, citizens have primary influence over 25-27% of the emissions savings needed by 2030 to avoid ecological meltdown.[3] **Liam Smith** looks at behavioral sciences and the growing support they provide to public environmental policies. Some researchers, however, caution against injunctions focusing on individual actions, fearing that it avoids collective responsibility.[4]

INCREASING TRAINING AND SUPPORT TO MEET ECOLOGICAL TRANSFORMATION CHALLENGES

Providing people with in-depth training on climate-related issues is judged a priority by many actors, who deplore the scant place environmental concerns occupy in educational syllabuses. New actors such as the Sustainability Institute, which approach is presented by **Vanessa von der Heyde** and **Jeremy Doyle**, put teaching people about climate issues at the heart of their educational efforts, which also focus on new ways of learning that promote less top-down forms of education. Outside the educational sphere, initiatives such as the Art Climate Transition project, presented by **Arie Lengkeek** and **Carolina Mano Marques**, use artistic expression to raise public awareness, helping to change people's conceptions and understanding of ecological transformation.

Iris Levy
Mathilde Martin-Moreau
David Ménascé
Archipel&Co,
Issue coordinators

1 H. Joly et al. "Getting Serious About Stakeholder Capitalism", *Harvard Business Review*, 2019.

2 Double materiality involves accounting simultaneously for the impact of the environment on a business, and for the impact of the business on the environment.

3 *The power of people*, The JUMP, with Leeds University, Arup and C40, 2022.

4 See, for instance, the works of French sociologist Sophie Dubuisson Quellier.

GOVERNANCE: TOWARD A BROADER VISION OF BUSINESS

Laurent Obadia
Senior Executive Vice President, Stakeholders and Communications, Veolia

After serving as head of institutional relations for Africa, the Middle East and India at Veolia Water, from 2005 to 2009, then Director of Communications at Veolia, in 2022 Laurent Obadia was appointed Senior Vice President, Stakeholders and Communications for the Veolia Group. As advisor to Antoine Frérot, Chairman and Chief Executive Officer then Chairman of Veolia's Board of Directors, since 2009, Laurent assists the Group in tackling its key strategic challenges and meeting its objective of becoming a model company in the ecological transformation.

Ecological transformation and the corporate changes it requires, must take place through engaging the company's stakeholders beyond mere contractual ties and mutual interests, by identifying new ways of cooperating. Stakeholders' involvement is intrinsic to Veolia's purpose which was adopted in 2019. Veolia is now determined to strengthen and build on dialogue with its stakeholders as it seeks to invent new forms of collaboration. The "+1, the ecology turned into actions" initiative prototyped in 2021, embodies this vision and contributes to spreading a culture of dialogue and engagement that can then be adapted to fit different contexts and scopes within Veolia: contracts, business units, and projects.

INTRODUCTION

Adopted in 2019, France's PACTE law heralded a new paradigm and contributed to the launching of a fresh perspective on businesses in society. It encourages businesses not simply to take a close look at their responsibilities, but to go further and define their purpose, clearly stating their objectives and the contribution they wish to make to society and the planet. Veolia was one of the first major French corporates to define its purpose, which was adopted by the Board of Directors and presented to the shareholders' annual general meeting on April 18, 2019. Veolia's purpose sets a course for the Group to *"contribute to human progress by firmly committing to the Sustainable Development Goals set by the UN to achieve a better and more sustainable future for all."* To achieve this, Veolia is determined to become a model company in the ecological transformation, standard-bearer for an ambitious and far-reaching transformation of our collective modes of production and consumption.

One of the most important aspects of Veolia's purpose is that it must be actionable in operational terms, nurturing every aspect of its business and becoming a reality for all colleagues at different levels. This is quite a challenge for a company that operates on all five continents, employs 220,000 people, and is undergoing a period of rapid transformation. Veolia's purpose is founded on twin pillars that help translate it into action: a multifaceted performance, which places the same emphasis and ambition on all aspects of Veolia's performance (economic, financial, commercial, social, societal and environmental); and a shift in the Group's governance, to include all its stakeholders: employees, shareholders and clients as well as society and the planet.

A LONG TRADITION OF STAKEHOLDER DIALOGUE

Veolia has been working on this purposeful and larger vision of business for many years. In 2013, Veolia set up a committee of Critical Friends. The committee is a forum for collective reflection, giving a platform for external observers to share their viewpoints on strategic issues impacting the Group's social, societal, and environmental responsibilities with Veolia's top managers. This was done to facilitate and strengthen the Group's improvement efforts. Members of the committee include nonprofits, institutions, and representatives of the Group's stakeholders (clients, suppliers, younger generations). Part of the committee's main missions is to convey stakeholders' expectations from the Group, and exchange advice on issues that can sometimes be highly complex. For instance, the Critical Friends committee members were asked to express their views on the Group's methods and timelines for its energy transition based on solutions involving renewable energy, carbon capture, and other greener solutions. Their recommendations were then made to the Board of Directors.

One of the most important aspects of Veolia's purpose is that it must be actionable in operational terms, nurturing every aspect of its business and becoming a reality for all colleagues at different levels

Committees similar to the Critical Friends one were set up first in China in 2015, then in Japan in 2018, to provide inputs on issues specific to these two countries. Veolia has also been commissioning for many years materiality analyses based on extensive consultations with stakeholders. The most recent analysis was conducted in 2020, with nearly 200 internal and external stakeholders consulted on 24 CSR issues.

A NEW AND MORE AMBITIOUS FRAMEWORK FOR STAKEHOLDER DIALOGUE AND ENGAGEMENT

Dialogue and engagement have multiple objectives: establish a process of active listening, engage stakeholders in some of the Group's decision-making processes, make commitments to them, but also help them appreciate the multidimensional impacts of the Group's activities. The design and adoption of Veolia's purpose was itself the product of a unique long-term collaborative process which included the Group's senior decision-making bodies, employees and their representatives, the Critical Friends committee, clients, and citizen panels. It launched the start of a new era for Veolia, one of a strengthened ambition in terms of dialogue and engagement: for the Group, this involves building and creating new interfaces with society and stakeholders, new ways to observe and listen, new methods of relating to others, new ways of contributing in a broader sense.

THE "+1" MECHANISM: AN INNOVATIVE, OPEN-SOURCE METHODOLOGY

The "+1, the ecology turned into actions" mechanism, initiated by Veolia in partnership with Usbek & Rica and La REcyclerie and with support from Comité 21, was born in this context. It is a unique collaborative prototype involving around 50 of Veolia's stakeholders from various backgrounds (employees, clients, shareholder, society, and the planet) which aims to identify a common pathway to the ecological transformation. The mechanism is designed to bring together various stakeholders that do not always have a forum for exchanging, giving them the opportunity to work on rollouts in a cross-cutting way, identifying and finding solutions for ecological transformation. It provides an ecosystem-based approach to inter-stakeholder dialogue, helping to pinpoint the interconnections that exist between them.

The +1 group met at the REcyclerie in Paris for three half-day sessions between September and December 2021, looking at three topics: #1 Listening, #2 Deciding, #3 Training. At each session, members first heard an opening keynote speech providing them inspiration and food for thought on the challenges of that day's topic. Members were then divided into sub-groups to participate in collective intelligence workshops with representatives from each of the five stakeholder categories. They came up with high-impact practical actions to help make ecological transformation a reality. The purpose of this consultation process prototype, shared as an open source, is to suggest actionable responses that can largely be adopted thanks to a methodology which can be applied to different contexts, geographical zones, territories, and issues. Its role is to leverage cooperation to find news ideas, and to be an operational tool for use across Veolia and beyond, which all actors can make their own.

The "+1, the ecology turned into actions" initiative aims to bring together stakeholders that do not usually have a forum to talk to each other, thus giving them the opportunity to work in a cross-cutting way on rolling out an ecology of solutions

The mechanism has delivered worthwhile results. Firstly, the trial proved the necessity, feasibility, and real desire on the part of stakeholders to find cross-cutting ways to think and work together on issues of ecological transformation. The collective intelligence method developed was effective in enabling the co-construction of concrete solutions for ecology in action. The mechanism also created a community of individuals united in their commitment to bringing about the ecological transformation.

Local adaptations of the prototype are now in development to take the process to the next level.

- As part of a contract and the Arianeo project on behalf of Nice Côte d'Azur metropolitan authority, covering issues surrounding recovery of the city's waste with the aim of supporting dialogue between all the contract's stakeholders. A Societal and Environmental Council will be set up, and will gather 6 to 12 members, a third of which will represent the project's partners, while the others will represent the civil society. It will play a consultative and decision-making role in project management and the contract's multifaceted performance.
- At the country level, in Prague, at the headquarters of Veolia's Central and Eastern Europe zone, helping a business unit establish dialogue on the ecological transformation between the Czech Republic's main national and municipal stakeholders.
- And at a Veolia client, Bouygues Immobilier, looking to tailor the +1 mechanism to suit its own business challenges.

MULTIFACETED PERFORMANCE: THE SECOND CENTRAL PILLAR OF VEOLIA'S PURPOSE

Veolia's purpose is expressed through Impact 2023, the Group's four-year strategic program launched in February 2020, guided by a vision of multifaceted performance that places the same emphasis and ambition on all aspects of performance: economic and financial, commercial, social, societal, and environmental. Convinced that performance in these areas is complementary, forming a single virtuous circle, Veolia has made a public commitment to 18 priority goals and progress indicators covering the five dimensions of its performance. Progress toward meeting these goals is audited regularly by an independent third-party body and will set the performance-related benefits paid to Veolia's senior management.

VEOLIA'S PURPOSE...

AN APPROACH OF SHARED PROGRESS WITH AND FOR OUR STAKEHOLDERS

1. Our stakeholders
2. Our performance
3. Our commitments
4. Our goals

LEVERS FOR CONTINUITY

Establishing honest dialogue and true stakeholder engagement must be built over the long term and requires constant adjustments and continuous improvement processes. Different mechanisms have been set up by Veolia at various levels (head office, country, department, etc.), to identify several levers enabling the group to perpetuate its approach over the long term. An overview of these levers is provided below.

A vision shared at the highest level

The impetus for the dialogue and engagement approach central to Veolia's purpose comes from the very top. It was championed by Antoine Frérot, Veolia's CEO from 2009 and Chairman of the Board of Directors since July 1, 2022. It remains a vision shared at the highest levels of the Group's Executive Committee. A coordination and governance mechanism is already in place, to accompany the Group in its approach to deliver meaning, cohesion, and transformation. It includes a Purpose steering committee, comprising members of the Executive Committee and functional departments. Its mission is to coordinate the Group's action towards reaching its purpose.

Several other innovative measures have been adopted to ensure these targets are pursued on the field. Every multifaceted performance target is steered by a two-person team comprising a sponsor from the Executive Committee and a target coordinator from the Group.

- Executive Committee sponsors are appointed to ensure the targets are supported at the very highest levels.
- Target coordinators: define a strategy to ensure the Group meets the targets; suggest how this strategy might be rolled out within the various operational and functional entities concerned; take part in designing and analyzing action plans, monitoring and supporting their implementation, and consolidate the Group's overall multifaceted performance indicators.

Deep commitments build trusting relationships

This purposeful and larger vision of business is not something that can be imposed unilaterally: it is shared and requires a rigorous process, assuming a long-term involvement and a structured approach over time. A commitment that is built on a rigorous process, requiring long-term involvement and a structured approach over time. It is crucial not to underestimate the long-term effort such a large and demanding approach necessitates for it to be truly meaningful.

Mechanisms for appropriating dialogue and engagement so they are embedded at every level

One of the key objectives is to ensure that every individual can take ownership of Veolia's purpose. Several mechanisms have been implemented for our managers as well as our operational teams.

Actionable internal guidance has been shared with managers to help them bring the purpose to life on a daily basis, with their team and as part of their activities. The network of Purpose Officers is also helping to speed up the implementation of Veolia's purpose and multifaceted performance within the Group's operational and functional entities. Purpose Officers represent their entity within a global network and are tasked with a threefold objective:

- sharing best practices;
- tracking progress of the approach within areas under their supervision;
- thinking collectively about ongoing improvements to the approach.

Our Purpose in Motion training workshops have been available since September 2020 to help managers take ownership of the Group's purpose and to help them integrate the Group's multifaceted approach principles to their projects. Members of Veolia's Management Committee were the first to benefit from this training, progressively rolled out in all business units in 2020 and 2021. The process of adapting it to reflect the specific needs of different business units and geographical zones is yet another step on the road to making sure the message is heard on the field.

To boost employees' awareness of and engagement with these issues, for the past two years we have run in-house competitions to reward projects that best reflect the multifaceted performance concept — initially on a zone basis, then at the Group level. Winning projects are selected by a jury comprising members of Veolia's Executive Committee. In 2021, the jury was enlarged to include stakeholders (employees, clients, shareholders, representatives of the civil society and the planet), who evaluate projects in terms of how well they balance the five dimensions of multifaceted performance and on the significance of their positive impact for each of Veolia's five stakeholders categories.

We also work very closely with employee representative bodies to ensure employees monitor and manage the purpose so that they can take ownership of it.

CONCLUSION

Veolia's dedication to working with its stakeholders and delivering its purpose is an ambitious, long-term program. Little by little, it is transforming the business at every level, from designing strategies to rolling them out in the field. The most important challenge for the years ahead is to keep this process alive and make it a reality for as many people as possible, employees and external stakeholders alike. Veolia has recently decided to consult its stakeholders across the world to incorporate their input in its next strategic program.

WHY VALUING NATURE CAN MAKE A DIFFERENCE

Written based on an interview with Mark Gough
CEO of the Capitals Coalition

Mark Gough is CEO of the Capitals Coalition, a global collaboration of business, governments and civil society that advance the capitals approach to decision-making. The Coalition unites the Natural Capital Coalition and the Social and Human Capital Coalition. Mark has worked extensively in the private sector, leading programs and strategy for the Crown Estate and Reed Elsevier (now RELX), as well as advising many other organizations. Among other board and advisory positions, Mark is on the Advisory Board for TEEB (The Economics of Ecosystems and Biodiversity), a member of the Steering Committee of the United Nations CEO Water Mandate, and an advisor on the High-Level Panel for a Sustainable Ocean Economy.

Until now largely neglected in traditional wealth measurement systems due to its "economic invisibility", the value provided by natural capital nevertheless forms the basis of our economies and societies through its multiple ecosystem benefits, whose degradation imposes external costs on society and on future generations. A better understanding of our dependence on these services has thus become an essential challenge for organizations to integrate, in order to address the considerable global challenges we are facing today, such as climate change, biodiversity loss and rising global inequity. In this end, many initiatives have emerged, both from public organizations and from the private sector, with more or less significant efforts and progressing results. Nevertheless, the growing awareness of the interconnectedness of the challenges faced by our societies has added urgency to the need to invest in the various forms of capital – natural, social and human – to ensure their protection and continued value to our societies.

INTRODUCTION

The rising awareness of biodiversity loss in recent years by a growing number of actors – both public and private – has highlighted the role of nature and its various services as an essential foundation for the economy and human activities. According to the OECD,[1] the economic benefits of ecosystem services on the global scale can be estimated at between USD 125,000 and 140,000 billion per year. In the run-up to the 15th Conference of the Parties on Biological Diversity (initially scheduled for May 2020, then postponed several times until 2022), the preservation of biodiversity and its ecosystem services has become a priority issue on the international agenda, together with the fight against climate change. Some stakeholders have started to compile information about their natural capital impacts and dependencies. Yet a wider and more robust integration of natural capital accounting approaches could help to address biodiversity loss and guarantee a greener transition for our economies.

1 OECD, *Biodiversity: Finance and the Economic and Business Case for Action*, May 2019.

NATURAL CAPITAL: A KEY APPROACH IN VALUING NATURE AND ITS BENEFITS FOR SOCIETY

DEFINING NATURAL CAPITAL

Capital has traditionally been thought of only as money, but capital describes any resource or asset that stores or provides value to people.

Natural capital works in much the same way as traditional capital – if we invest in it we can secure a flow of value for current and future generations. But, if we eat into the underlying capital stock, we reduce the ability of nature to provide the goods and services that we depend on for societal and economic prosperity. Recognising the ways in which they depend on natural capital can be a watershed moment for organizations, many of whom realize that issues they had considered to be immaterial in fact directly underpin their success. This new lens can catalyse a clear business case for the protection of and investment in the health and resilience of natural ecosystems which not only provides benefits for business, but also for other stakeholders, and for nature itself.

Natural capital can be defined as the stock of renewable and non-renewable natural resources on earth (e.g., plants, animals, air, water, soils, and minerals) that combine to yield a flow of benefits or "services" to people.[2] The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment – requested by the United Nations Secretary-General Kofi Annan in 2000, launched in 2001 and then published in 2005 – defining ecosystem services as "the benefits people obtain from ecosystems" and grouping them into four categories:

- **Provisioning Services:** product obtained from ecosystems (e.g., food, raw materials, fresh water, and medicinal resources).
- **Regulating Services:** benefits obtained from regulation of ecosystem processes (e.g., mitigation of climate change through carbon sequestration, local climate and air quality, pollination, water filtration by wetlands, erosion control and protection from storm surges by vegetation).
- **Cultural Services:** non-material benefits obtained from ecosystems contributing to our spiritual welfare (e.g., aesthetic appreciation and inspiration for culture, art, and design).
- **Supporting (or Habitat) Services:** services necessary for the production of all other ecosystem services (photosynthesis, habitats for species, nutrient cycling, etc.).

While nature underpins all aspects of our society and economy, traditional measures of progress such as GDP have failed so far to identify and measure the value that those ecosystem services provide to our economic systems. In fact, the destruction of ecosystems often leads to an increase in GDP, while the value that is lost through these activities is economically invisible and externalized. A natural capital approach empowers decision-makers to recognize the value of leaving nature standing, rather than the current paradigm of valuing nature only when we cut it down and process it.

2 Natural Capital Coalition, *Natural Capital Protocol Principles and Framework.*

A GROWING AWARENESS OF THE CONCEPT

Although the concept of natural capital is not yet mainstreamed, the concept has made a lot of progress over the past twelve months in the public debate. 2021 has seen a major acceleration in the recognition of the value of natural capital in decision-making among some of the world's most powerful governments and intergovernmental bodies.

Building on the **G7 Climate & Environment Ministers Communiqué**,[3] the official statement of **G7 Finance Ministers** committed G7 countries to *"embed climate change and biodiversity loss considerations into economic and financial decision-making"*.

Traditional measures of progress such as GDP have failed so far to identify and measure the value of ecosystem services to our economy

In the new Nature Compact, part of the **final 2021 G7 Communiqué**[4], the Group of Seven wrote that: *"Nature, and the biodiversity that underpins it, ultimately sustains our economies, livelihoods and well-being – our decisions must take into account the true value of the goods and services we derive from it"*, as they committed to *"halt and reverse biodiversity loss by 2030"*. This commitment was echoed in the new **Atlantic Charter** signed by the U.S. President and the British Prime Minister, in the UK Treasury's Dasgupta Review on the economics of biodiversity, and is a central milestone in the UN Convention on Biological Diversity's draft for a Post-2020 Global Biodiversity Framework.

While the awareness of the concept is consistently growing, we have to acknowledge that implementation remains slower to achieve. Although 25% of Global 500 companies are now familiar with the concept, less than 5% of them have actually conducted an assessment of their impacts and dependencies on natural capital and even less have actively applied this information to inform their decision-making.

THE NECESSARY STANDARDIZATION OF NATURAL CAPITAL APPROACHES

In the current context of biodiversity loss and the rapid degradation of ecosystems, it has become essential to provide public and private decision-makers with tools that allow them to measure, evaluate, manage, and disclose their impacts and dependencies on natural systems.

PUBLIC VS. PRIVATE SECTOR: DIFFERENT LEVELS OF MATURITY

Over the past few years, the public sector has made significant progress in terms of standardization, notably with the System of Environmental Economic Accounting (SEEA). The SEEA is an international statistical system that brings together environmental and economic information into one common framework. The recent adoption in March 2021 by the United Nations Statistical Commission of the SEEA Ecosystem Accounting (SEEA EA) represents a major step forward in recognizing the value of nature and a new "beyond GDP" tool for countries to incorporate environmental and social aspects. The SEEA EA offers an accounting framework to measure the contribution of ecosystems to our society, their condition (health) and the services they provide to our economies. According to the 2020 Global Assessment of Environmental-Economic Accounting and Supporting Statistics 2020 (UN-CEEA), this accounting framework has already been applied by 89 countries worldwide to guide their policies. For instance, Australia has used natural capital accounts to tackle the impacts of drought as well as better manage the Great Barrier Reef. Nevertheless, despite the fact that ecosystem accounting has taken off over recent years, too few countries are currently applying these approaches, leaving room for progress on implementation.

The situation is very different when it comes to the private sector: while implementation of natural capital approaches is more developed, organizations are using a large variety of methodologies and tools.

There are different ways to illuminate the value we receive from natural capital, and this value can be provided in quantitative, qualitative or monetary metrics depending on the needs of the organization and the decisions they want to inform.

Developed by the IUCN, Birdlife International, Conservation International and the UNEP-WCMC, the **Integrated Biodiversity Assessment Tool (IBAT)** can be used to map the areas of ecological concern around the places where companies operate. Used by several companies such as Allianz and General Motors, the interactive map integrated into the tool makes it possible to visualize the perimeter of protected areas or areas of high ecological interest in relation to the geographical limits of companies' sites or future projects.

There are also environmental performance measurement tools such as the **Environmental Profit & Loss account (EP&L)**, developed by French luxury group Kering, which consists of evaluating and publishing an organization's environmental externalities throughout its value chain. Several criteria are taken into account: air pollution, GHG emissions, land use changes, waste generation, and water consumption and pollution. These impacts are then converted into monetary values in order to quantify the value provided to the organization by nature. In particular, it shows that 66% of Kering's impacts are related to the supply of raw materials. It constitutes an effective communication tool to make a company's impacts easy to understand. Stakeholders such as investors and customers, who are increasingly demanding information and transparency, are given access to the tool.

3 G7 Climate and Environment: Ministers' Communique, London, May 2021.

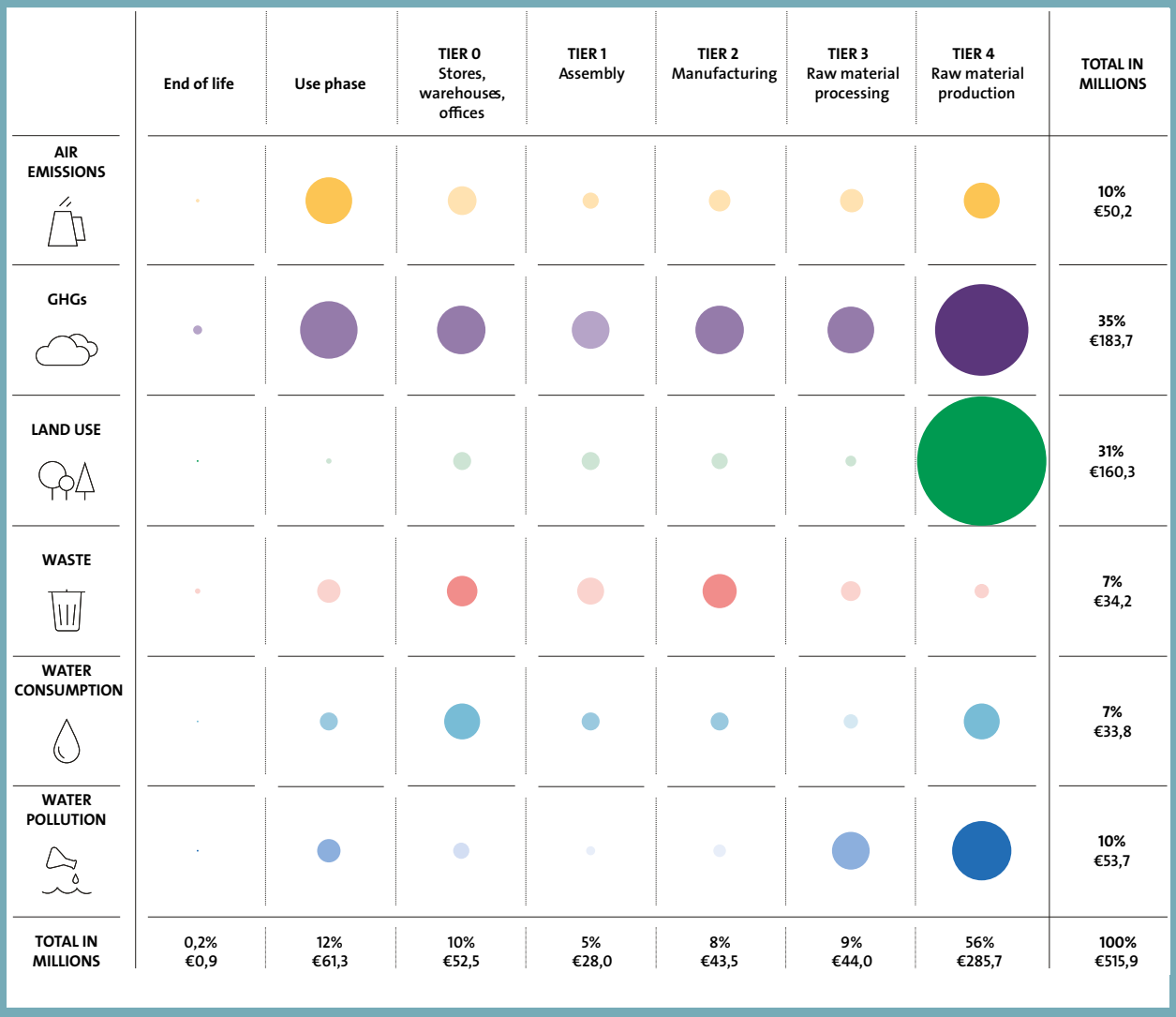
4 G7 2030 Nature Compact, June 2021.

ZOOM ON KERING'S ENVIRONMENTAL PROFIT & LOSS (2020)[5]

Kering's 2020 Group environmental Profit and Loss (EP&L) is estimated to be €516M. It quantifies the value of impact resulting from six impact driver categories: air emissions, greenhouse gases, land use, waste, water consumption and water pollution, across all the tiers of Kering's supply chain, from raw material production to the product's use and end of life.

Different valuation techniques are used to assess the value of impacts. For example, in the case of greenhouse gases, the Social Cost of Carbon approach is used, which reflects the full global cost of the damages caused by GHG emissions over their lifetime in the atmosphere.

The EP&L account helps Kering designing their responsible sourcing policies and industrial processes and management. Besides, it allows them to tracking progress towards their sustainability targets. As for 2020, most of the impact (56%) are concentrated on the raw material production tier. Land use (31%) and GHGs (35%) are the first impact areas.



5 Kering, Environmental Profit & Loss (EP&L). 2020 Group Results.

ZOOM ON OLAM'S LEADERSHIP ON TAKING NATURE INTO ACCOUNT TO ITS BUSINESS

Olam International Ltd. is a leading Singaporean food and agri-business company specialized in trading agricultural raw materials and food ingredients. The company delivers 47 different products (such as cocoa, coffee, cotton, nuts, or spices) to more than 16,200 customers in 70 destination markets and employs around 81,000 people worldwide.

Recognizing that the food and agri-sector is among the biggest contributors to GHG emissions and one of the biggest drivers of terrestrial biodiversity loss, in 2017 Olam launched a new purpose-driven strategy, Re-imagine Global Agriculture and Food Systems, and began to report on six different non-financial capitals (social, human, manufactured, natural, intangible, and intellectual) to help demonstrate how they contribute to the creation of long-term value for the group as well as create value for its stakeholders. The company then developed different initiatives, such as the Olam Living Landscapes Policy (OLLP), which supports a Net-Positive approach to agricultural supply chains and landscape management, and tools such as the Integrated Impact Statement (IIS), a decision-making tool covering three Capitals (natural, social, and human) and made up of three elements: Profit and Loss, Balance Sheet, and Risk and Opportunity Statement.

Today recognized as one of the leading companies on linking sustainability and finance, Olam was recently awarded the BusinessGreen Leaders Award in the Nature Based Project of the Year category for the work carried out by its subsidiary Olam Food Ingredients with smallholders to tackle deforestation in the cocoa supply chain.

The **Taskforce on Nature-related Financial Disclosures (TNFD)** – in the same spirit as the Taskforce on Climate-related Financial Disclosures – launched in June 2021 by a dozen financial institutions including AXA, BNP Paribas and the World Bank alongside the British and Swiss governments is another noteworthy framework dedicated to financial stakeholders. Coordinated by Global Canopy, the UNDP and the WWF, the initiative aims to build an international benchmark of analysis and reporting by 2023 for financial institutions on their impacts and risks related to biodiversity loss.

THE NEED FOR STANDARDIZATION

However, the different approaches developed by those actors have resulted in an increasing number of procedures and individual accounts, leading to a lack of comparability and standardization of different methods. The Capitals Coalition has thus tried to harmonize existing best practices and produce a standardized and generally accepted global approach with the Natural Capital Protocol, a decision-making framework that enables organizations – mostly businesses – to identify, measure and value their direct and indirect impacts and dependencies on natural capital.[6] The Natural Capital Protocol methodology is divided into four phases, then subdivided into nine sub-steps that address more specific issues.

This co-built framework enables actors to choose the right tool depending on their objectives and can be applied to all sectors of activity and companies of all sizes and is suitable for use at multiple levels in the organization (for example, at the product, project, or whole organization level) and in all geographical regions where they operate.

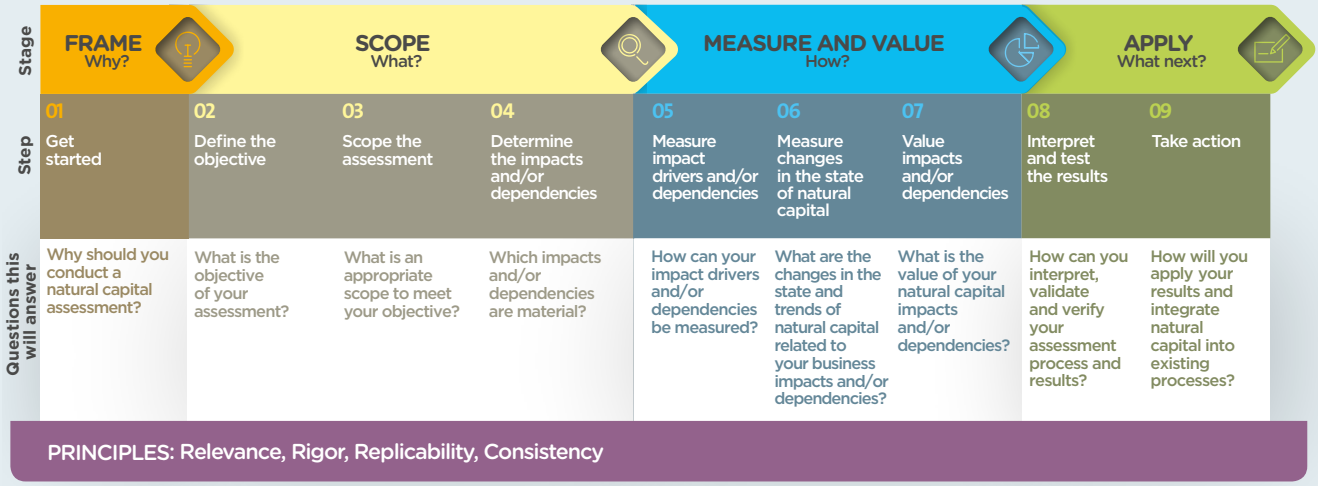
FROM SINGLE TO INTEGRATED CAPITAL ASSESSMENTS: TOWARD A MORE HOLISTIC APPROACH

The growing popularity of the natural capital concept and availability of numerous tools for businesses, financial institutions and governments represent an encouraging signal for nature conservation. Nevertheless, many areas for progress remain: a skills and knowledge gap on the topic, the difficulty of convincing company boards or CEOs internally, gaps in the understanding of the concrete benefits for the organization in terms of business model, etc. Moving this voluntary approach to a mandatory approach by 2030 thus constitutes a key milestone.

In order to address the three interconnected global crises of climate change, nature loss, and rising global inequity, the next major challenge for businesses, financial institutions and governments is to move from single capital assessments to integrated capitals assessments (the Capitals Coalition recognizes four main categories of capital: natural capital, social capital, human capital, and produced capital) to improve their decision-making by overcoming their silo mentality with a more holistic understanding of the system in which they operate. By considering all capitals at once, all environmental, social, and economic externalities become visible in an inter-connected planet: for instance, marine pollution by a business can affect the quality of natural capital, which can then affect the human and social capital of

6 Natural Capital Coalition, *Natural Capital Protocol Principles and Framework.*

The Natural Capital Protocol methodology [7]



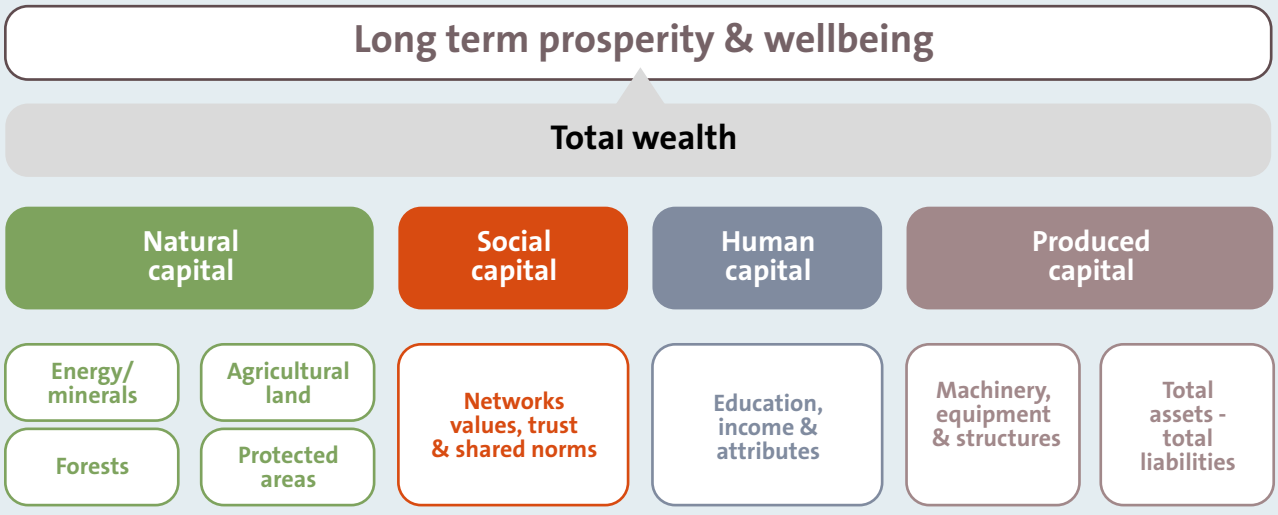
7 Natural Capital Coalition, *Natural Capital Protocol Principles and Framework.*

Figure 1

communities that rely on the fish for their food supply or fishing business. To tackle the challenge of understanding the interconnections, trade-offs and synergies between all forms of capital, the Capitals Coalition has drawn up the Principles of Integrated Capitals Assessments[8] to provide guidance on how to apply a consistent capitals approach through integrated thinking. This holistic approach to the concept of capitals could be a game-changer to ensure a green and fair transition in the upcoming years.

8 Capitals Coalition, *Principles of Integrated Capitals Assessments*, January 2021.

Beyond GDP: a framework of comprehensive wealth accounting [9]

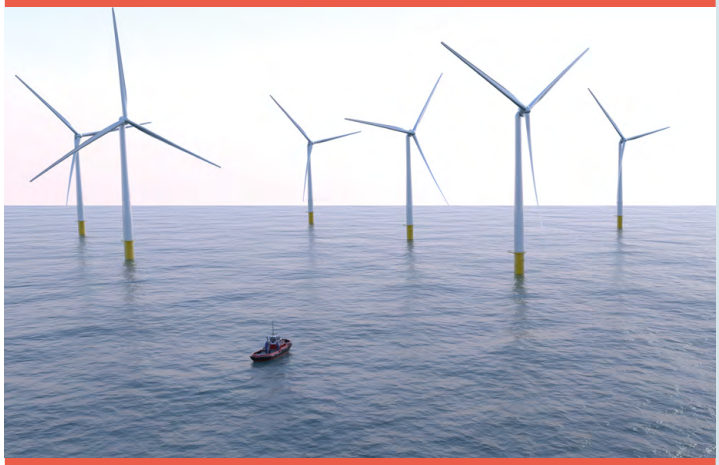


9 Capitals Coalition, "Beyond GDP – United Nations Adopts New SEEA Ecosystem Accounting Standard", June 2021.

Figure 2

CATALYZING CLIMATE FINANCE TO SUPPORT A LOW-CARBON TRANSITION

Priscilla Negreiros
Manager of the Cities Climate Finance Alliance at Climate Policy Initiative



Financing climate action is a key condition to achieve the transition towards a low-carbon world, and climate finance stands as a key pillar of the Paris Agreement. It raises multiple debates, involving not only private and public actors but civil society organizations as well. Despite some progress, today's climate finance landscape is mostly directed at financing mitigation projects, and largely insufficient to meet our climate objectives. Cities face specific barriers when trying to access climate finance funds. Several innovative finance tools, enhanced by CPI's Global Innovation Lab for Climate Finance, aim at lifting those obstacles.

Priscilla Negreiros is a Manager at Climate Policy Initiative (CPI), based in London. At CPI, she leads the Cities Climate Finance Alliance (the Alliance), which is a coalition of leaders committed to deploying finance for city level climate action at scale by 2030.[1] Before CPI, Priscilla worked for the Brazilian government at Apex-Brasil as the Head of the Market Access Unit. She has also served as a consultant to the UK Foreign and Commonwealth Office, and World Trade Organization, among others. Priscilla holds a Master's Degree from SciencesPo Paris in International Public Management and a double B.A. degree from Pontifícia Universidade Católica de São Paulo and SciencesPo Paris in International Affairs and Political Science.

1 The Alliance works to ensure that finance will be deployed at scale for city-level climate action by 2030, by focusing on establishing a bridge between demand and supply for city-level climate-related finance with cities, national governments, DFIs, and private investors.

Financing climate action is a key condition to achieve the transition towards a low-carbon world. When did the issue of climate finance become such a priority?

Priscilla Negreiros: First let me introduce what we mean by climate finance. The most agreed-upon definition, which is based on the Paris Agreement, defines climate finance as local, national, or transnational financial resources – drawn from public, private and/or alternative sources of financing – seeking to support activities limiting GHG emissions or aiming to address climate-related risks and to contribute to resilience and low-carbon development.[2]

The issue of financing climate action can be traced back to the "Earth Summit" held in Rio de Janeiro in 1992, which marked a turning point regarding international action on environmental issues. The Summit had many achievements, and contributed to divide environmental issues into several sub-topics: climate – through the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) –; biodiversity – Convention on Biological Diversity –; forest management – Declaration on the principles of forest management – ; etc.

From this landmark, the question of financing climate action really gained visibility, and became the topic of specific international negotiations and forums, with particular interest within the Climate COPs. The principle of "common but differentiated responsibility and respective capabilities" lay down by the Convention tried to answer the question that lies at the roots of climate finance debates: Who should pay for all the changes required in infrastructure, energy, transport, to move towards a sustainable low-carbon world?

Based on the CPI's estimation, climate finance should increase by at least 590% to meet our climate objectives

Indeed, developing economies early argued that their responsibility should not equal those of developed countries. Although this principle remains relevant, the Paris Agreement, which is the main international framework regarding climate finance, grants both developed and developing countries legally binding commitments related to climate finance. The 193 countries which ratified the agreement committed to make finance flows consistent with a low-emissions and climate-resilient pathway, in order to limit global temperature increase in this century to 1.5 degrees. Developed countries committed to providing USD 100 billion annually for supporting mitigation and adaptation needs of developing countries – a promise which has been vividly discussed during the most recent COP's negotiations. Indeed, there is no doubt that long term finance is a key pillar of the Paris Agreement.

Yet, one should bear in mind that nowadays, climate finance is a much larger debate, which no longer only concerns national bodies and governments, but rather flows through all levels of society, beyond national public actors. Cities, NGOs, private actors and even citizens themselves are increasingly involved in discussing and, more importantly, financing climate-related issues. Since climate action is now considered as requiring systemic changes, consequently, a lot more actors start tackling the issue of financing.

What are the main features of the climate finance landscape today and how have they evolved over the years?

P. N.: For a decade, Climate Policy Initiative has been providing one of the most comprehensive overviews of global climate-related primary investment. Indeed, we believe it is crucial to map precisely the reality and sources of climate finance. The 2021 edition,[3] based on two-year averages data (2019 and 2020), shows that total climate finance steadily increased over the last decade, reaching USD 632 billion in 2019/2020 (+10% compared to previous periods), even though flows have slowed in the last few years.

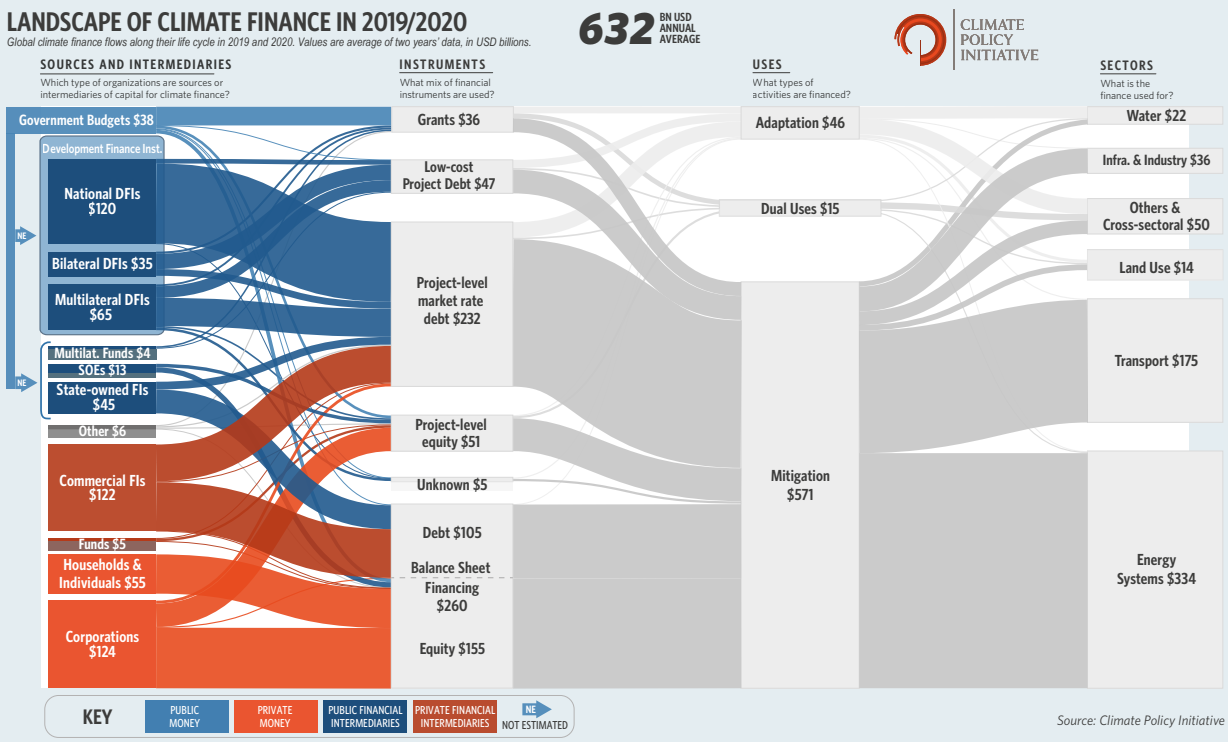
Several key findings deserve to be highlighted in terms of sources of financing, instruments and uses and sectors.

- **Financial sources.** Public climate finance increased by 7% from 2017/2018, remaining largely stable at 51% (USD 321 billion) of the total. Development finance institutions (multilateral banks, international development banks, etc.) continued to deliver the majority of public finance (68%). In regards, private climate investments increased by 13% from 2017/2018, to USD 310 billion. Interestingly, while corporations accounted for the largest share (40%) of private climate finance, commercial financial institutions made the biggest stride in growth, increasing their share from 18% to 39% (USD 122 billion). Clearly, those figures show that both public and private financing are needed. Indeed, to achieve the transition to a sustainable, net zero emissions and resilient world this decade, climate investment must increase drastically (to USD 4.5 – 5 trillion annually): reaching this goal without the private sector won't be nearly as possible. Public actors can play a key role to help catalyse the money, but most of the investment will need to come from the private sector.
- **Financial instruments.** The majority of climate finance was raised through traditional financial instruments – debt (61%) and equity investments (33%).
- **Uses and sectors.** Most climate finance keeps being directed towards mitigation projects. As highlighted widely during the last COP, adaptation finance continues to lag, while the cost of climate warning's consequences keeps rising sharply. Renewable energy finance continues to be the main recipient of mitigation finance (58%) – partly because they require higher early-stage capital investment.

2 UNFCC, "Introduction to Climate Finance" *("Climate finance refers to local, national or transnational financing – drawn from public, private and alternative sources of financing – that seeks to support mitigation and adaptation actions that will address climate change.").*

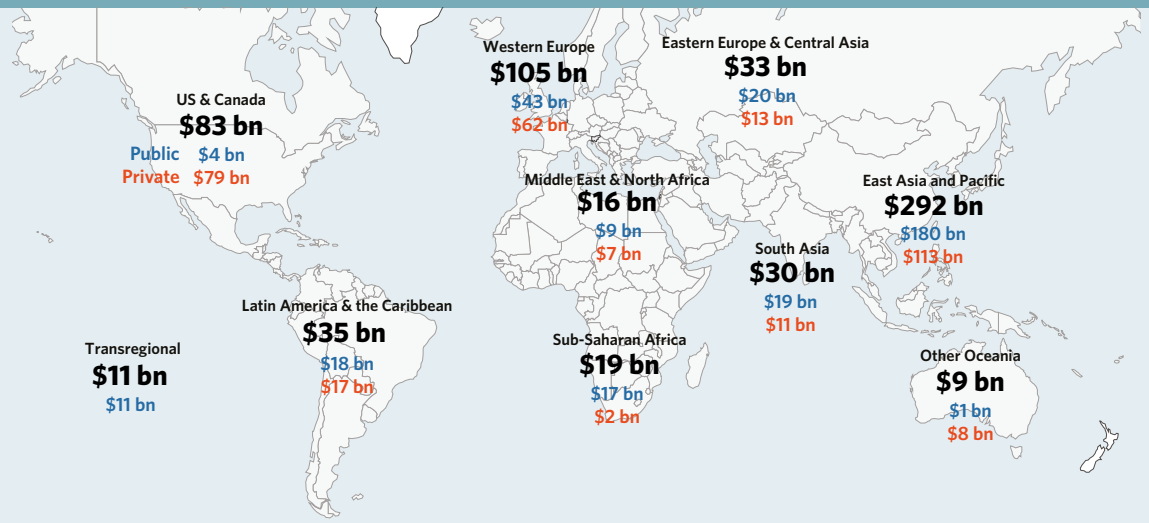
3 CPI, *Global Landscape of Climate Finance 2021.*

Landscape of climate finance in 2019/2020[4]



4 CPI, *Global Landscape of Climate Finance 2021.*

Destination region of climate finance, by public/private (USD billion, 2019/2020 annual average)



Even though some progresses have been made, based on the CPI's estimation, climate finance should increase by at least 590% to meet our climate objectives. At least three elements could help bridge this gap. First, huge finance streams keep flowing towards high-emissions investments – investments directed at fossil fuels exceed USD 850 billion annually. Second, public and private actors need to work on aligning their investment goals, to fill the adaptation gap mentioned earlier. Public and private actors can complement each other, for instance regarding some specific industries where it is less viable for private actors to invest and where public actors could help de-risk the investment. Finally, definitions, methodologies and data access need to be improved and standardized. Currently available disclosure initiatives fall short of providing standardized information on climate investments – even though some recent initiatives move in the right direction, such as the EU taxonomy.

Do cities face specific barriers when trying to access climate finance funds?

P. N.: Absolutely. If national governments and public actors face challenges to access those funds, cities inevitably face an additional layer of challenges, regardless of their specificities. When looking to access and attract climate finance funds, I can mention two specific challenges municipality authorities face:

The first one is to turn ideas into actual bankable and investable projects. In many cases, cities lack the human, financial and technical resources to take this step – and face difficulties when trying to identify and even more develop financially viable low-carbon and climate resilient infrastructure for instance. This requires strong technical knowledge and financial engineering capabilities, which cities do not necessarily have – particularly small and intermediary cities. Supporting early-stage project preparation is a key priority – if not the main one.

Another difficulty is that cities vary a lot on their enabling environment – to mobilize urban climate finance, there is no 'one size fits all'. For instance, many cities cannot raise money in private markets, because they are not allowed to by national regulations. Institutional and inter-governmental cycles, such as political cycles, do not necessarily align with cities planning and budgeting cycles – e.g. a climate-smart waste management facility might need more than a 4-5 year political cycle to be planned, executed and finalized. Additionally, municipalities sometimes have limited authority to plan and regulate urban spaces – some cities have autonomy on the water management, some don't for instance. And needless to say that tackling an issue you are not responsible for is quite difficult. The issue of cities' creditworthiness is also central – even tough cities have their own financial resources, they are usually insufficient to cover the risks.

Removing the barriers preventing cities from accessing climate finance funds is an urgent issue as they are responsible for most GHG emissions, are home to most of the world's population, and, fortunately, are increasingly willing to act

Removing the barriers preventing cities from accessing climate finance funds is an urgent issue as they are responsible for most GHG emissions, are home to most of the world's population, and, fortunately, are increasingly willing to act.

Which innovations do you find particularly promising in the field of climate finance?

P. N.: Fortunately, there are a lot of interesting ideas and initiatives. At CPI, we encompass a broad definition of innovation – beyond purely technical innovation. Bringing a solution to a market which has a failure is innovative. Using this definition, it is fair to say that more and more innovative financial instruments appear.

To foster these initiatives, at CPI, we lead the Global Innovation Lab for Climate Finance, an incubator conceived to help identify, develop and support transformative sustainable finance ideas and cutting-edge climate finance instruments. Since it started, the Lab launched 55 instruments, which mobilize $3.2 billion.

I can mention two of them which are particularly interesting and promising. The first one, quite known already, is the Climate Resilience and Adaptation Finance & Technology Transfer Facility (CRAFT),[5] an answer to the huge adaptation finance gap mentioned before, and that CPI helped develop. Investing in adaptation is a harsh challenge for private actors, as it does not necessarily raise sufficient returns. CRAFT, which is one of the first commercial investment vehicle focusing on expanding the viability of technology and solutions for climate adaptation, has invested in 20 companies, located mostly in developing countries already experiencing substantial economic losses from climate change, which have proven technologies and solutions for climate resilience and have demonstrated market demand and revenue. The goal is to prove that viable investments in adaption do exist.

More recently, the Lab developed the Sub-National Climate Finance Initiative (SCF), expected to be the first equity fund to feature a Technical Assistance Facility that provides local government capacity building and certifies all projects for SDG impact prior to investment.[6] Some specific tools dedicated to removing the barriers encountered by cities are needed. In this perspective, SCF seeks to remove barriers to the sourcing, financing and sustainability certification of mid-sized sub-national infrastructure projects by de-risking projects through concessional finance and technical assistance.

Two additional elements, among many others, are worth highlighting. The first is the role of national development banks (NDBs). With more than USD 5 trillion in assets, and several comparative advantages relative to other financiers – they have a strong knowledge of investment opportunities, have access to international public funding, are backed by national governments, etc. –, NBDs are very well-positioned to support the acceleration of climate-smart urban infrastructure investment. At CPI, we believe enhancing their role is a key priority.[7]

As mentioned before, helping cities preparing and designing viable projects is crucial. Today, a lot of different actors offer this kind of support: multilateral development banks, major donors, NGOs... To go beyond and increase the impact, we need to scale those kinds of supporting initiatives. The City Climate Finance Gap Fund, jointly established in 2020 by the World Bank and the European Investment Bank in partnership with GIZ and several other partners, works to this objective. It seeks to address those shortfalls by providing the technical assistance needed to turn climate-focused ideas into concrete urban project proposals. Networks of cities such as C40, ICLEI, and GCOM also play an important role to enhance capabilities and knowledge sharing within local actors themselves.

5 See further detail: https://www.climatefinancelab.org/project/climate-resilience-adaptation-financetransfer-facility-craft/.

6 See further detail: https://www.climatefinancelab.org/project/sub-national-climate-finance-initiative/.

7 To go further, see Sarah Conway, Priscilla Negreiros, Bella Tonkonogy, Kristilla Yang, *Enhancing the Role of National Development Banks in Supporting Climate-Smart Urban Infrastructure. A Policy Brief for the Cities Climate Finance Leadership Alliance,* August 2020.

THE ROLE OF EUROPEAN UNION POLICIES IN ACCELERATING THE GREEN TRANSITION

Annika Hedberg
Senior Policy Analyst, European Policy Centre
& Stefan Šipka
Policy Analyst, European Policy Centre

The EU can and should play a major role in addressing the planetary crisis, in enabling and accelerating the transition to a more sustainable world. It can do this by acting as a rule-maker and enforcer; as a major producer and consumer; as a source of significant funding within the EU and beyond; as a convening power; as an innovator and as a standard-setter. As the planetary crises know no boundaries, it is in the EU member states' interest to work together and agree on common rules for action. As the role of the government is to safeguard public interest, it is in the EU's interest to use the power of legislation (directives, regulations), economic instruments (public funds) and soft law (guidelines, stakeholder platforms, voluntary commitments) to ensure sustainable prosperity for Europeans today and tomorrow. The European Green Deal provides a valuable updated framework for action and a basis for a new growth strategy for Europe. While the pandemic and now the Russian war on Ukraine are testing EU leaders' commitment to the goals of the Green Deal, it provides the needed guiding light for the way forward.

Annika Hedberg is the Head of Sustainable Prosperity for Europe Programme at European Policy Centre (EPC), an independent think tank based in Brussels, Belgium. She joined the EPC in 2010 and over the years has worked on a wide range of policy areas, including climate, energy, environment, health, and industrial transformation. In her role as the Head of Programme, she aims to promote discussion on the foundations and drivers for a more sustainable and competitive European economy.

Stefan Sipka is a Policy Analyst at European Policy Centre (EPC). He works in EPC's Sustainable Prosperity for Europe Programme on environmental policies and smarter use of resources. His immediate focus revolves, in particular, around the circular economy, EU common agricultural policy, and interlinkages between these and other relevant policies at the EU and global level.

THE EU AND THE POWER OF POLICIES

The urgency to address the planetary crises from climate change to ecological destruction is growing by the day. Challenges with greenhouse gas (GHG) emissions, pollution, the unsustainable use of natural resources, inefficient energy use, biodiversity loss and waste are growing and show no sign of dissipating. In addition to their immediate impacts, the ongoing climate and environmental crises cast a long shadow over humanity's future.[1] Addressing these challenges requires support from the private and public sector. It requires mobilisation of people and societies. It requires the EU to use the tools available – including the power of policies – to accelerate the green transition.

The EU is a global frontrunner in building the power of policies to address climate and environmental challenges, and promote sustainable development of the economy and society. Since the end of the last century, the EU has been introducing rules on nature protection, air quality, water protection and waste management. It has also become known for its ambitious framework for climate action, well-reflected by its Emission Trading Scheme, a central tool to curb GHG emissions. Moreover, these considerations are reflected in the use of its overall toolbox (including Multiannual Financial Framework, Common Agricultural and Fisheries Policies, single market and public procurement, financing, digital as well as skills agenda, innovation policy, trade and diplomacy).

The EU is a global frontrunner in building the power of policies to address climate and environmental challenges

The European Green Deal provides now a valuable updated framework for action. It aims to encourage a more systemic approach to addressing the challenges of today. It acknowledges that changes are needed across sectors, and that this will only succeed if the measures taken also enhance competitiveness and 'leave no one behind'. At the heart of it is the EU's goal to become climate neutral by 2050, which became a binding target with the adoption of the Climate Law (2021).[2]

In align with the vision for the Green Deal, the European Commission has already put forward numerous policy proposals and initiatives for improving energy, mobility and food systems, for enhancing circular economy as well as supporting ecosystems and biodiversity. Some examples include the 'Fit for 55' package and the recent REPowerEU proposal that calls for further enhancing the ambition on energy savings and efficiency as well as renewables, as an effort to enhance EU's energy security in the wake of Russia's invasion. Under its circular economy agenda, the Commission has proposed new rules to make our products more durable, reparable and recyclable. EU's sustainable finance agenda aims to help direct private investments towards green economic activities. Moreover, the Commission's proposals for the 'Farm to Fork' strategy, the EU Biodiversity Strategy for 2030, and the Zero Pollution Action Plan are guiding design of follow-up policies and legislation.

However, this is only a start and many challenges remain to be addressed. As Europeans consume more and more resources and goods from outside the EU, this comes with a significant embedded climate and environmental footprint. Most of waste is not recycled.[3] Annually, hundreds of thousands Europeans still die prematurely due to air pollution.[4] Nature conservation is inadequate while water management is sub-optimal.

1 See e.g. Intergovernmental Panel on Climate Change (2018), "Global Warming of 1.5 °C".; Brondizio, Eduardo; Josef Settele; Sandra Díaz et al. (2019), "Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; United Nations Environmental Programme (2021),"Making Peace With Nature".; Milman, Oliver, ""Global heating pushes tropical regions towards limits of human livability" ", *The Guardian*, 8 March 2021.; UNICEF (2021), "One billion children at 'extremely high risk' of the impacts of the climate crisis" GOV.UK, "Final Report - The Economics of Biodiversity: The Dasgupta Review".

2 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').

3 As a result of e.g. product design and difficulties to repair products.

4 Website of the European Environment Agency (last accessed on 4 July 2022): https://www.eea.europa.eu/publications/air-quality-in-europe-2021/health-impacts-of-air-pollution/.

European Green Deal with examples of specific targets per sector

GREEN DEAL:

A sustainable, climate-neutral, resilient and competitive europe

Sustainable energy system

Proposal:
'Fit for 55' package and updates via REPowerEU

Some goals:

- Increasing the share of renewable energy in the European mix to 40% by 2030
- Increasing energy efficiency to achieve an overall reduction of 36-39% for final and primary energy consumption by 2030

Sustainable agriculture and food system

Proposal:
'Farm to Fork' strategy

Some goals:

- At least 40% of the Common Agricultural Policy budget to be climate-relevant

Circular economy

Proposal:
Circular Economy Action Plan

Some goals:

- All plastics reusable or recyclable by 2030
- Moving towards circular products and functional market for waste
- 65% of municipal waste recycled or reused by 2035

Green ICT

Proposal:
Digital Strategy

Some goals:

- Climate neutral data centers by 2030

Proposal:
Renovation Wave for Europe

Some goals:

- Encouraging the renovation of 35 million buildings by 2030
- Creating additional 160,000 green jobs in the construction sector by 2030

Sustainable built environment

Proposal:
Sustainable and smart mobility strategy

Some goals:

- 55% reduction of emissions from cars by 2030
- 50% reduction of emissions from vans by 2030
- Zero emissions from new cars and vans by 2035

Sustainable mobility

Climate neutrality by 2050

Reduction of emissions by 55% by 2030

Zero pollution

Proposal:
Zero Pollution Action Plan

Some goals:

- Air, water and soil pollution no longer considered harmful by 2050
- Reducing by more than 55% the health impacts (premature deaths) of air pollution by 2030

Preserving and restoring ecosystems and biodiversity

Proposal:
EU Biodiversity Strategy for 2030

Some goals:

- Protection of 30% of both EU's land and sea by 2030

BUILDING ON THE POWER OF POLICIES: CHALLENGES TO BE ADDRESSED

While the EU and its member states tend to be good at agreeing on visions and setting targets, they continuously fall behind when it comes to implementing the agreed climate, energy and environmental goals.

Member states and businesses often assess new policy initiatives from the perspective of relative gains and losses for them. Time after time, the Commission puts forward carefully thought-through, relatively balanced proposals that the member states first water down on paper, and after they have agreed to the diluted new rules, they may or may not implement them depending on their interests. However as long as national political victories are judged on the basis of short-sighted criteria, such as the ability to protect national industry or maintain the status quo (e.g. subsidies for agriculture with no conditions attached), the EU will never become more than the sum of its parts.

Especially at times of crises, there is a huge risk that leaders react to the pressures with short-sighted decisions, policies and investments. This risk is especially acute now as the EU and its member states are taking swift decisions to manage the impacts of the pandemic as well as those of the Russian war on its economies and societies. As is the case with managing the ongoing energy and food crises, short-sighted decisions now could lead to devastating longer-term costs for people, business and the planet.[5]

Another great challenge is that **policies impact people, regions, member states and businesses differently.** Significant efforts will be needed to ensure a broad buy-in for the measures to be taken with the help of social dialogue about the benefits and transitional costs of the measures taken. It also requires managing the impacts, and providing people with the tools to engage in the transition.[6]

Moreover, the **monitoring and enforcement of agreed rules remains a challenge.** The EU and national leaders' speeches and political declarations mean little if not actually implemented and enforced.

Finally, **in the absence of a global playing field, there is a risk that European businesses' competitiveness can be affected by EU's ambitious climate and environmental policies.** For example, higher sustainability standards in the EU can increase the costs for the European industry if they need to meet new regulatory requirements, which are not expected of their counterparts operating in third countries. Thus, the EU must become more effective in leveraging its strengths and bringing about a system change also beyond its borders.

PROSPECTS FOR THE WAY FORWARD

As the EU is looking to turn the ambition and the goals of the Green Deal into policies and initiatives to be implemented, there are five strands of action, in which the EU with its member states must up their game: leadership, implementation of agreed rules, bringing business and people along, as well as global action.[7]

The EU needs:

1. Leadership that communicates the urgency for action to member states, companies and citizens, and ensures that the policies developed, agreed and implemented reflect this urgency.

European leaders must advocate for and ensure a coherent approach to addressing the multiple challenges the EU faces. This is especially important now as the EU and its member states are managing the impacts of the Russian aggression and there is an enormous risk that short-sighted decisions could lead to accelerating rather than slowing down the energy and food crises as well as climate emergency and environmental degradation. This must be avoided at all costs.

2. To align member state action with the agreed goals. Compliance and implementation of agreed measures, with the speed needed, requires political will. Moreover, member states need to take ownership of the necessary measures.

At the same time, it is critical to address the existing incoherencies in the policy and investment framework. The EU must also ensure better enforcement of existing rules and more readily penalise member states when they are breaking them. The European Commission should be more willing to take infringements of the climate and environmental law to the European Court of Justice, while the Court should consider maximal penalties to incentivise member states to apply the EU law.

3. To bring business along. The EU needs to help create the right framework conditions for European businesses – big and small - to succeed in the transition, and to become a leader in those solutions that are increasingly demanded in- and outside of the EU. The EU should enhance the use of both its internal tools (e.g. Multiannual Financial Framework, Common Agricultural and Fisheries Policies, single market and public procurement, ETS, environmental regulation and standards, sustainable financing, eco-design, labels, digital as well as skills agenda, innovation policy, taxation) as well as external tools (e.g. trade, diplomacy, funding, border measures like carbon border adjustment) to create these enabling conditions.[8]

5 Hedberg, Annika, "Managing the energy and food crises: Exceptional times call for exceptional measures", European Policy Centre, 20 July 2022.

6 See e.g. the project on 'the Fair Energy Transition for All': https://fair-energy-transition.eu/.

7 Hedberg, Annika, "The European Green Deal: How to turn ambition into action", European Policy Centre, 4 November 2021.

8 See e.g. Giuli, Marco; Claire Dhéret, Johan Bjerkem, Marta Pilati and Stefan Sipka (2019), "An Industry Action Plan for a more competitive, sustainable and strategic European Union", European Policy Centre.

The overall toolbox must signal the direction of travel, provide predictability for investors and businesses, and thus contribute to making greater sustainability profitable. Removing existing incoherencies, such as support for fossil fuels, from the policy and investment framework is the starting point. Moreover, the toolbox should enhance the sustainable production and consumption of energy, food, textiles, packaging, electronic devices and all other consumer goods. It should help change how homes are built, deconstructed, kept warm or cooled down. It should incentivise change in how people and goods move on land, sea and in air. The toolbox should help direct the power of digitalisation, including how data and digital solutions are used, to enabling and accelerating the green transition.[9]

4. To bring people along. Reaching the agreed goals starts with communicating and showing the benefits that the measures will bring to people. Greater public awareness and readiness for action can reinforce EU's policy efforts on the green agenda, and can be further supported by state-of-the art communications strategies and behavioural science to ensure that the message is actionable.

Second, it requires managing the social impact on the most vulnerable in particular. When trade-offs occur (price surges, layoffs) the EU, its member states and regions should use socio-economic tools to support the ones most affected.

Lastly, people must be provided with the tools to engage in the transition. Creating space and tools for social dialogue has already proven their value for exchanging about the rationale for the transition and enabling people to express their hopes and concerns, thus contributing to fairness and transparency. Such platforms can also be used to co-create solutions and manage the transition.

5. Global action. The EU should lead by example but also collaborate with other major players in addressing the climate and the wider sustainability crises. When the EU speaks and acts as one, it can be more powerful and impactful globally than the sum of its parts. The EU must become stronger at advocating for global rules on climate and environment and insist on their implementation worldwide. The EU should use its financial resources to aid lower income countries achieve the green transition; conversely tools such as foreign trade agreements and tariffs for unsustainable products should be used to discourage the free riders.

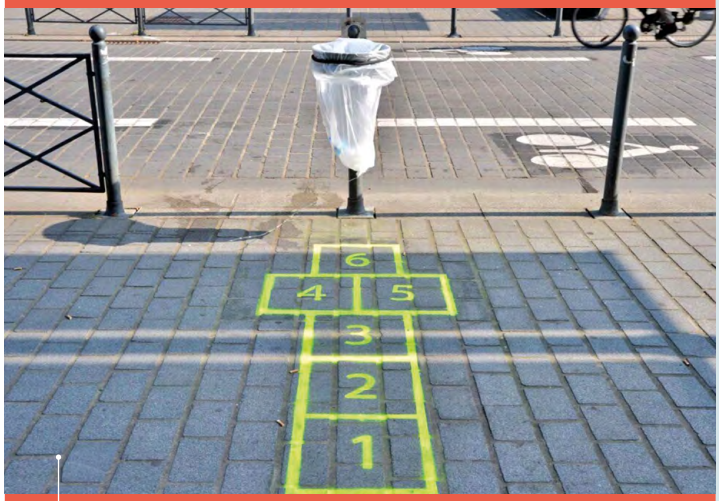
Creating a sustainable, resilient and competitive climate-neutral economy requires improving our energy, mobility and food systems, our overall production and consumption patterns as well as ecosystems and biodiversity – all at the same time. This requires ensuring that climate and environmental goals are reflected across relevant policies and in their implementation. This requires building on the potential that circular economy policies and initiatives can bring for making European economy more competitive and resilient.

The EU is a global leader when it comes to climate action, implementing environmental standards and promoting circular economy. It is a regulatory superpower that can use its toolbox to bring about positive changes to the European economy and society, and promote change beyond its borders. Given the scale of the planetary crisis and the urgency to act, there is no time to waste in getting on the right track. The EU must increase efforts to turn the ambition of the Green Deal into policies and action.

9 Hedberg Annika, Šipka Stefan, (2020), "Towards a green, competitive and resilient EU economy: How can digitalisation help?", European Policy Centre.

STRENGTHS AND LIMITS OF BEHAVIOUR CHANGE TO FOSTER THE GREEN TRANSITION

Liam Smith
Director and co-founder, BehaviourWorks Australia (BWA)



Example of nudge to encourage people to throw their waste (Lille, France).

Liam is Director and co-founder of BehaviourWorks Australia (BWA) and one of Australia's leading authorities on behaviour change. Liam holds a Bachelor of Science (Resource and Environmental Management) from the Australian National University, a Master of Ecotourism from James Cook University, a Master of Philosophy and PhD from Monash University. With a brief to bring behavioural experts together with government and industry to find solutions to real-world sustainability problems, Liam's research initially focused on the areas of water, energy, waste, litter, pollution, climate change adaptation and wildlife conservation. Since then, Liam has been directly or indirectly involved in conducting over 500 behaviour change research projects across a wide range of industries and sectors. Liam is on the executive of the Monash Sustainable Development Institute. He has published numerous research reports, research papers and public discussion pieces.

Behavioural approaches increasingly tend to be seen as one of the "go-to" approaches when it comes to solving environmental issues: to address energy and water consumptions, improve agriculture practices, preserve biodiversity, reduce GHG's emissions, etc. Behavioural interventions are more efficient when people get messages at multiple levels, as highlighted by the example of the "Millennium Drought". However, behavioural approaches should be paired with other instruments, such as regulatory or structural reform, and collaboration between behaviour change scientists, institutions and governments should be encouraged. Additionally, behavioural sciences could be used to diagnose systems, and focus on encouraging behaviour spillover, to reach a lasting impact.

Aerial view of Sydney suburb. Residents are asked to paint roofs white and plant a tree in each garden to fight climate warming *(EPA-EFE)*.

Over the last decade, an increasing focus has been put on the importance of human behaviours to achieve the green transition. Consequently, more and more behavioural experimentations aim at addressing sustainability issues. How do you account for this increasing popularity of behavioural sciences and the role they can play to accelerate the green transition?

Liam Smith: The increasing focus on behavioural sciences to tackle sustainability issues should be understood as part of the broader history of behavioural sciences' role in public policy. In this regard, a few milestones can be highlighted. The publication of the book *Nudge* in 2008, written by economist and Nobel Laureate Richard H. Thaler, and Law Professor Cass Sunstein,[1] certainly contributed to reinforce the interest and appetite for behavioural sciences within public opinion and public actors. However, it is not until the creation of the Behavioural Insights Team (BIT) in 2010, within the UK Cabinet office, that behavioural sciences and approaches began to directly influence and inspire public policies. One of BIT's first behavioural sciences-based intervention aimed at increasing tax payments by using "descriptive norms" – e.g., making people aware that most people do pay their taxes on time –, and proved to be quite effective. Those initial convincing results gave BIT a stronger license and ability to apply this perspective to more and more areas. Furthermore, the realisation that behaviour change is, *per se*, at the core of governments' missions meant that behavioural sciences have gained traction within public bodies, and this paved the way for the birth of multiple "nudge units" around the world.[2]

Regarding the use of behavioural sciences to address sustainability-related challenges, even though the last couple of years have seen an acceleration, this originated a decade ago as well. For instance, one of the BIT's first experimentations aimed at increasing loft insulation installation, by designing specific incentives – in this case, offering people a low-cost labour to clear their lofts prior to insulate them.

In this context, behavioural approaches increasingly tend to be seen as one of the "go-to" approaches when it comes to narrowing down complex challenges, including environmental issues and we've seen a significant rise in the use of behavioural science in this area. Among many, behaviour change tools are being used to encourage reductions in household energy and switching to green energy choices, water consumption, donations to green charities, environmental volunteering and lobbying for policy changes.

1 Richard H. Thaler and Cass R. Sunstein, *Nudge. Improving Decisions about Health, Wealth and Happiness*, Yale University Press, 2008.

2 For a more comprehensive view of nudge units, see OECD, *Behavioural Insights and Public Policy. Lessons from around the world*, 2018.

One of the concerns with this approach is that for governments, behavioural experimentation can bring a lot of added value because they do not require significant financial, social, or political capital investment, and offer quick solutions to complicated challenges. In this sense, green behavioural change programs have been criticised because of the short-term thinking that can accompany them.

Which are the areas in which behavioural sciences have achieved significant results so far? Could you present us with a concrete example?

L.S.: To begin with, marketing is a fairly good example of successful behavioural interventions! In a way, we, as individuals, have been nudged forever even if we do not always notice it.

If we focus rather on public goods behavioural interventions, an obvious example is the ongoing management of the pandemic. Since the beginning of the surge, behaviour change "toolkits" have been at the core of the responses implemented by governments around the world – from floor markings to encourage social distancing in subways or stores to incentives-based vaccination campaigns in some countries.

Regarding sustainability issues, one of the examples I find the most interesting and insightful occurred in Townsville, a city located in Queensland, a State in the northern part of Australia where the weather is subtropical and thus very warm. As part of the Community Energy Efficiency Program (CEEP), the city initiated a reflection to identify which behaviours could be implemented to reduce households' energy consumption and greenhouse gases' emissions. Ultimately, the team came up with a list of 240 behaviours, divided in various sub-sections – equipment (double glazing, solar panels, etc.), maintenance, habits behaviours (lowering heating temperatures, spending less time in the shower, etc.). The remaining question therefore was: where should we focus our attention? Which behaviour should we prioritize? To answer it, two assessment criteria were considered: the impact of the behaviour, in terms of energy savings, and the likelihood that the target audience would perform the behaviour. Based on this, the behaviour of "having the roof painted white" turned out to be selected – as it offered many advantages: well-recognised way to reduce energy demand in the home, not technically onerous, "one-off" behaviour, etc. The whole city therefore rallied around this "cool roofs" objective: people could buy roof paint in the hardware store next door, small businesses supported by the government offered support to promote services to paint roofs white. The result was that most roofs got painted in white.

This initiative provides us with a clear example of how behaviour change approaches and interventions can be applied as part of a thought-through strategy, with significant and lasting impact. In this case, two elements proved to be key: making the behaviour the easiest and cheapest possible for people.

Have you identified other key success factors for behavioural interventions to succeed?

L.S.: The most successful behaviour changes to address significant issues are, actually, not the product of "single-interventions" (which academics like to study), but rather suites of interventions where people are able to get messages at multiple levels. Of note, if the public discourse highlights a particular issues and this is aligned to interventions targeting specific related behaviours, they have a much higher chance of success.

For instance, in the context of the pandemic, nudges aiming at encouraging people to wash their hands, or to flash their QR code after being in a certain place, have a stronger chance of being effective in the context of a global pandemic than in 2019, prior to COVID – as they coexist with large-scale social marketing campaigns, financed by public institutions, insisting on COVID-related measures.

The appetite for behaviour change grows continuously, throughout the whole environment spectrum: to address energy and water consumptions, improve agriculture practices, preserve biodiversity, reduce GHGs' emissions...

Another great example is provided by the "Millennium Drought" (1996-2010), a water crisis which touched large parts of Australia and lasted over a decade, placing extreme pressure on agriculture production and urban water supply. During these years, wide-scale campaigns were regularly run to highlight water shortages – from helicopters flying over empty dams to newspapers' frontlines publishing water levels, "naming and shaming" the worst suburbs regarding water consumption. There was a clear discourse on water consumption and the importance of water savings. In this context, targeted behaviour change campaigns were more effective at encouraging Australians to adopt particular water saving behaviours such as only watering gardens at certain times, taking shorter showers and buying water-efficient appliances.

If you are able to influence both individual and macro-level scales, interventions are more likely to succeed. Similarly, a campaign that promotes public discourse but doesn't include single-behaviour interventions is less likely to achieve lasting impact.

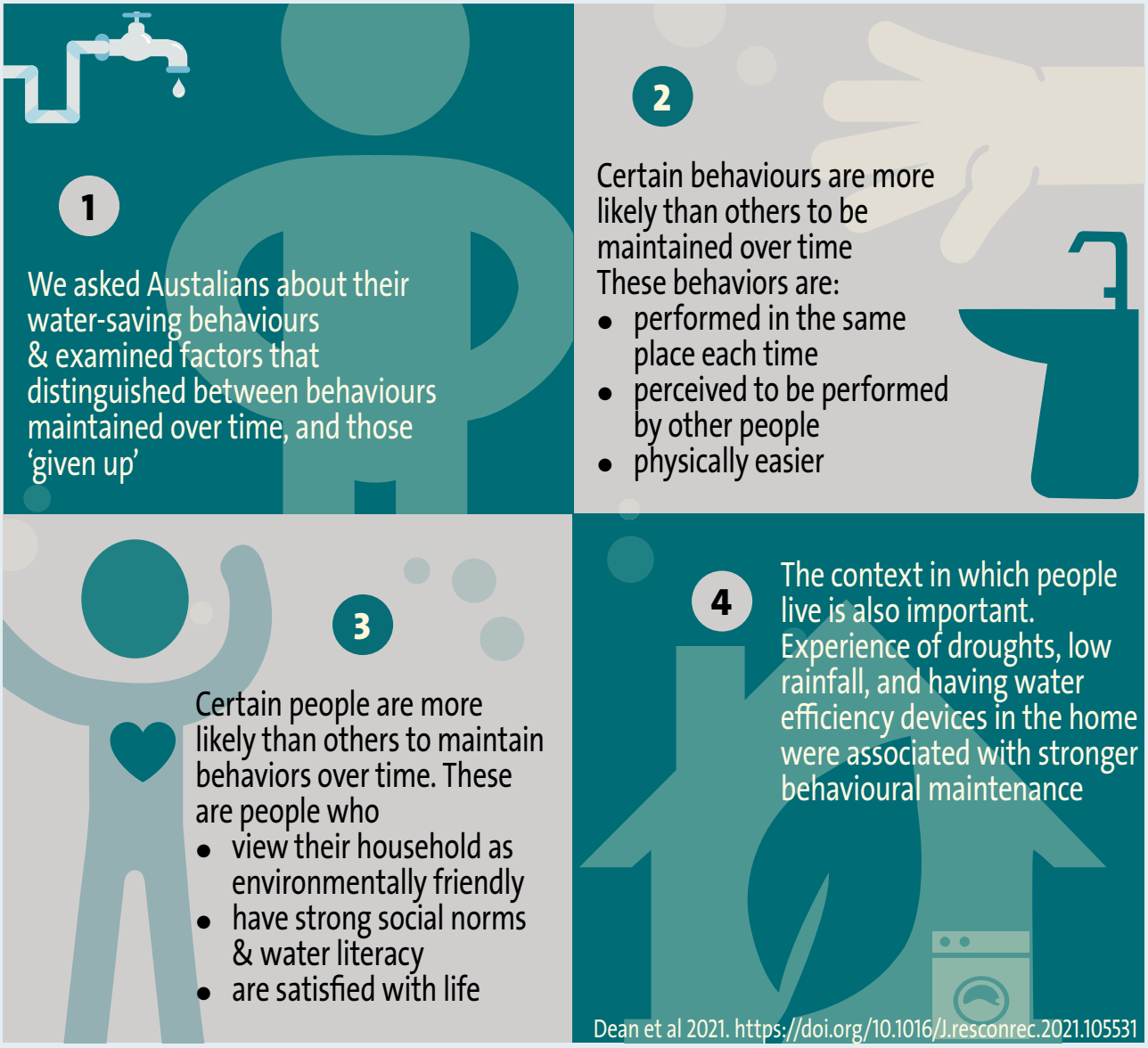
Of course, there are many behaviour change tools that have been successfully used to change behaviour. The two that readily spring to mind are the use of descriptive norms (telling people that numerous others are doing desirable behaviours) which has been shown to work in multiple contexts and the use of defaults which, where implemented, have repeatedly been shown to work.

When considering 'success', one additional key element worth discussing is the appetite for experimentation. In general, the behavioural science movement has been at least partially responsible for encouraging the use of experimental designs to test whether particular interventions are effective at changing behaviour. Experimental approaches to public policy are, as much as the introduction to behavioural science, a key contribution to changes in how governments, in particular, operate.

However, there isn't always the opportunity for these approaches. For instance, coming back to the Millennium Drought, the lessons for behavioural science from the drought weren't captured. Two elements account for this. First, as the country was undergoing a major crisis, solutions needed to be designed and implemented quickly, which didn't leave much time for testing. Second, besides this context of crisis, the appetite for experimentations

What drives maintenance of water-saving behaviours?

Results from a national survey of 4,872 Australians.



Source: Angela J. Dean, Sarah Kneebone, Fraser Tull, Nita Lauren, Liam D. G. Smith, "'Stickiness' of water-saving behaviours: What factors influence whether behaviours are maintained or given up?", in *Resources, Conservation and Recycling*, n°169, June 2021.

– like randomized controlled trial – was much lower. Behavioural sciences weren't on governments' agenda yet. Consequently, a lot of interventions got implemented without building in experimental designs. Looking back at the drought and the response, we can say that collective water consumption reduced significantly across much of Australia, but it is not possible to attribute this drop to specific behaviours.

That said, some interesting insights were identified after the crisis. In a recent paper, some colleagues and I tried to identify which factors influence whether water-saving behaviours are maintained or given up.[3] It appears that different behavioural, individual, and contextual characteristics influence behavioural maintenance. For instance, people who view their household as environmentally friendly, and have strong social norms and water literacy, are more likely than others to maintain behaviours over time.

Fortunately, it is therefore feasible to learn valuable insights after the episode of crisis. Nonetheless, it is essential to support the interest and appetite for experimentations, which is equally important than strengthening behavioural sciences' role in public institutions.

Regarding the ongoing transition, in which areas do you believe behavioural sciences could offer the most promising results in the years to come?

L.S.: The appetite for behaviour change grows continuously, throughout the whole environment spectrum: to address energy and water consumptions, improve agriculture practices, preserve biodiversity, reduce GHGs' emissions... Behavioural sciences can contribute to all these challenges. At BehaviourWorks Australia, most of our current research focuses on one of these issues.

But as suggested earlier, there's some caution to this approach. In a way, it is sometimes concerning to witness stakeholders turning "too easily" towards behaviour change, to address challenges which would be better solved through other instruments such as regulatory or structural reform. In certain cases, notably regarding climate change-related issues, we shouldn't necessarily ask individual citizens to be the solution without governments and institutions also playing a strong role.

As fighting climate change is to be one of the dominant issues of the public discourse in the upcoming years – if not decades –, even though COVID strongly disrupted this trend, one key success factor will therefore be to foster collaboration between institutions, governments and behaviour change scientists. How do we make sure different stakeholders work together to be more efficient?

This is going to be one of the most important challenge to tackle in the upcoming years. Behavioural sciences have a role to play, but it is important to ensure that actors from all levels come together if we want to achieve the required changes.

In which direction should behavioural-focussed approaches evolve to tackle sustainability challenges more efficiently?

L.S.: Sociology traditionally describes human behaviour as shaped by two dimensions: **structure** – the recurrent patterned arrangements which influence or limit the choices and opportunities available: physical structures, laws, policies, institutions etc. – and **agency** – the capacity of individuals to act independently and to make their own free choices.

By focusing primarily on the agency of individuals, many behaviour change experiments may achieve small changes... but let's take an example of an intervention that successfully changed 20% of the audience regarding a specific behaviour, which in most circles would be seen as a success. However, at least some of the reasons why the remaining 80% did not change may be attributable to structural barriers. For example, imagine a program aimed at encouraging carpooling as a solution to carbon emissions and congestion. This program might increase the occupancy rates in cars which would be seen as a success. But by doing so, the program inadvertently keeps supporting the infrastructure of roads, and ultimately

3 Angela J. Dean, Sarah Kneebone, Fraser Tull, Nita Lauren, Liam D. G. Smith, "'Stickiness' of water-saving behaviours: what factors influence whether behaviours are maintained or given up?", in *Resources, Conservation and Recycling*, n°169, June 2021.

delays the problem of cars' carbon emissions. In a way, by celebrating the change, we avoid changing the more complex issues – laws, policies, institutions, etc. This is one of the early criticisms addressed at behaviour change as the sole focus of policy responses, depicted as an alternative solution to more important, structural changes.

I believe three points could help behavioural sciences to cope with these criticisms.

- First, behavioural sciences could be used to **diagnose systems**. This would mean shifting our attention on understanding why the 80% did not change, and identifying where the structures have the most influence, and prevent people to act as free agents.
- Second, behaviour change interventions should focus on the behaviours which are the most **sensitive to systems** and / or can be used to leverage systemic change and we ought to put a lot of energy into identifying behaviours to foster. Using the example above on carpooling, a better behaviour would be to encourage people to work from home. While carpooling sustains the system, working from home takes permanent pressure off it. This preliminary reflection is crucial.
- Finally, behavioural interventions should consider how to encourage **behaviour spillover** (how engaging in one positive behaviour affects the probability of engagement or disengagement in a second related behaviour). Indeed, individual changes, through spillover, can lead to more broader policy change and increased pressure on decision makers to do things differently. For instance, if I work from home, I might want to make my house more energy efficient, and eventually support political parties backing those measures. While there's an emerging literature on spillover, early research shows that identity increases the likelihood of spillover to occur, meaning we should think about how to foster environmental identities alongside choosing impactful, system sensitive behaviours.[4]

At BehaviourWorks Australia, we gather researchers from different academic backgrounds, and work on advancing those different ideas. There is no doubt that behaviour change approaches raise legitimate hope and expectations. However, it should be seen as one element belonging to a larger set of solutions needed to achieve the green transformation.

As fighting climate change is to be one of the dominant issues of the public discourse in the upcoming years, one key success factor will therefore be to foster collaboration between institutions, governments and behaviour change scientists

Some observers argue that an equal focus should be placed on individual and organizational change, as organizations have a greater impact in terms of carbon emissions. How do behavioural insights apply to organizations? How different are individual and organizational incentives?

L.S.: Most of BehaviourWorks Australiaresearch focuses on individuals. However, several of our PhD students also study organizational behaviour, and specifically look at the nexus between individuals and organizations' behaviours.

One of our key learnings is that organizations often have similar motives to individuals. The theory of planned behaviour,[5] one of the models most commonly used in behaviour change, sometimes proves to be even more relevant and predictive for organizations than individuals. According to this theory, a human behaviour is the product of:

- **Attitude** – the degree to which the person has a favourable or unfavourable evaluation of the behaviour –: organizations, like individuals, tend to adopt the behaviours they judge positively.
- **Perceived Norm** – the perception about whether most people approve or disapprove of the behaviour, and about the customary codes of behaviour within the group –: organizations, like individuals, adopt certain behaviours because they feel pressured to do so, from consumers, stakeholders, governments, etc.
- **Perceived Behavioural Control** – individuals' beliefs about their capacity – the skills and knowledge to adopt the behaviour – as well as their beliefs about opportunities to perform the behaviour: organizations, like individuals, adopt certain behaviours because they have the resources to do so and opportunities are available.

Organizational change is with no doubt a topic worth studying in more depth, even more so as discrepancies between how organizations behave and how individuals do tend to widen, resulting in negative outcomes such as burnout and frustration for individuals who work within them.

4 See also: Lauren, N., Smith, L.D.G., Louis, W.R. and Dean, A.J. (2019) "Promoting spillover: How past behaviors increase environmental intentions by cueing self-perceptions.", *Environment and Behavior*. 51(3): 235-258. https://doi.org/10.1177%2F0013916517740408. Lauren, N., Fielding, K.S., Smith, L.D.G. and Louis, W. (2016). "You did, so you can and you will: Self-efficacy as a facilitator of spillover from easy to more difficult environmental behaviour.", *Journal of Environmental Psychology*. 48:191-199. https://doi.org/10.1016/j.jenvp.2016.10.004.

5 I. Azjen, "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, vol. 50, n°2, 1991. See also: the "COM-B" model (Capacity, Opportunity, Motivation Behavior) in Michie, Stralen, West, *The behavior change wheel*, 2011.

ACCELERATING TRANSFORMATION THROUGH PLACED-BASED LEARNING

Vanessa von der Heyde
Managing Director of Institute Programmes at the Sustainability Institute

Jeremy Doyle
Independent researcher and MPhil candidate at Stellenbosch University Centre for Sustainability Transitions

©Sustainability Institute

Founded in 1999, the Sustainability Institute is an international living and learning centre, registered as a non-profit trust. It designs and runs learning experiences for transformative education, including a preschool, primary school, youth centre, learning farm, and short courses. The Sustainability Institute offers knowledge, skills and a physical space for educational experiences anchored in sustainability. Its expertise is in designing transformative learning experiences for all ages, and advisory and consulting services under themes of sustainable food systems, sustainable organisations, sustainable communities, and transformative learning for sustainability. Vanessa von der Heyde is the Managing Director of the Sustainability Institute's programmes, and Jeremy Doyle is an independent researcher and MPhil candidate at Stellenbosch University Centre for Sustainability Transitions.

Today, society faces arguably its greatest challenge: tackling the sustainability crisis in the face of worsening social and racial inequalities. We need new ways of thinking, new ways of understanding the challenge and how we might approach it; even unlearning what we already know. At the Sustainability Institute, we see our role as helping to accelerate this response. Situated just outside Stellenbosch in the Western Cape, South Africa, our vision led to the establishment of a mixed-income and mixed-race ecovillage in which people from different walks of life could choose to live and work together as a community, and practice development in which both people and the natural environment would flourish. With over two decades of lived experience, we explore fundamentally different ways of living, learning, and working, often in collaboration with universities, NGOs, development agencies, farms, corporates, and others. In this article, we reflect on the challenge for higher education in the twenty-first century, explore the role of place-based learning, and outline three examples to illustrate our recent work, demonstrating how learning that happens in a physical environment can bridge the gap between theory and practice.

INTRODUCTION

Higher education institutions have the responsibility of preparing a generation of capable, skilled people who can contribute to society. Today, society faces arguably its greatest challenge: tackling the sustainability crisis in the face of worsening social and racial inequalities. At the Sustainability Institute, we see our role as helping to accelerate this response by restoring broken connections. We integrate abstract concepts with practice, theories with action, learners with communities. We aim to restore education of mind, body and soul, through whole-being learning experiences. We bring together disparate disciplines that often struggle to engage with each other. And we aim to restore connections between people and the living world we are part of. Indeed, we believe that separation is a fundamental part of the problem, and that seeing the world as an interconnected web of life – an understanding long held by many indigenous knowledge communities and practices – is central to the work of restoring healthy relationships between people and this planet we call home.

HIGHER EDUCATION IN THE 21ST CENTURY

Twenty-two years ago, when the Sustainability Institute Trust was established, the notion of sustainability was often associated with what could be done: reducing waste, switching to cleaner forms of energy, or recycling. Today, it is increasingly clear that these actions, while critical, are not enough. As David Orr writes, *"the crisis we face is first and foremost one of mind, perception, and values – hence, it is a challenge to those institutions presuming to shape minds, perceptions, and values. It is an educational challenge."*[1]

A crisis of mind calls for new ways of thinking, new ways of knowing, new ways of understanding the challenge we face and how we might approach it; even unlearning what we already know. Teaching sustainability can no longer be an add-on, an afterthought, a module in a programme. We believe it must be embedded; endeavouring to shift the way we think, how we perceive the world, and how we approach problems.

Teaching sustainability can no longer be an add-on, an afterthought, a module in a programme

In the global South, there is an added dimension for educators: many of the dominant learning paradigms shaping today's higher education programmes emerged in the industrialising nations of the global North. That is, they were shaped by a certain context. But knowledge exists in many places and takes many forms, and the developmental context of the global South is quite different. We must account for deep cultural, geographical, and historical differences, and move forward in the face of resource scarcity and rising costs, in sharp contrast with the era of resource abundance and cheap energy of the past two hundred years.

In principle, many higher learning institutions are already deeply committed to transformative learning. Universities, for example, are home to many creative and radical thinkers who are at the forefront of innovation in education.

Yet the challenge for universities – as it is with any large institution – is a structural inertia that makes it difficult to achieve innovation at both scale and pace. Arguably, the scale of the challenges that we face as a global society now require just that: wide-scale innovation at pace.

Here, we believe the Sustainability Institute has a critical role to play. As a small organisation independent of the constraints faced by many higher learning institutions, we act as a catalyst for higher learning institutions, development agencies, and others who are embedding sustainability into their learning programmes.

1 David Orr, *Earth in Mind: On Education, Environment, and the Human Prospect*, 1994.

OUR ROLE: A CATALYST FOR SUSTAINABILITY EDUCATION

Our story began in Lynedoch, a small village in the Western Cape, South Africa. Our vision was to establish a mixed-income and mixed-race ecovillage in which people from different walks of life could choose to live and work together as a community. We asked ourselves how we could practice development in which both people and the natural environment would flourish, accounting for South Africa's specific context and challenges. We started by rehabilitating the degraded land around the village school with indigenous species, experimenting with ecologically intelligent and low carbon buildings, implementing a sustainable wastewater treatment system, and planting a community vegetable garden.

Over time, our work led to a collaboration with Stellenbosch University, through which we support their undergraduate and postgraduate diploma in sustainable development. We facilitate a variety of transformative non-degree short courses, including immersive learning journeys in other countries. Collaboration with learners and researchers led to the launch of several projects, such as a community-owned solar energy project.

Today, the Sustainability Institute helps a broad range of institutions embed sustainability into their learning programmes. We collaborate with universities, NGOs, development agencies, farms, corporates, and others to explore and implement fundamentally different ways of living, learning, and working that bring forth more equitable and generative futures.

Our work is rooted in principles of co-design, experimentation, and process over form. A central component of the Sustainability Institute's approach is an emphasis on the interconnectedness of all things. Our work is deeply influenced by complexity and systems thinking, and thus we incorporate elements of these concepts in the design of our programs.

OUR APPROACH: PLACE-BASED LEARNING

What sets the Sustainability Institute apart is that learning takes place in a physical environment that bridges the gap between theory and practice. This approach to learning through being embedded in a real-life environment – often referred to as place-based learning – allows us to create and facilitate learning experiences that are fundamentally different to traditional, class-based environments. Place-based learning has several important aspects.

First, ideas can be radical, experimental, yet grounded. We can, for example, theorise about what a socially and

©Sustainability Institute

environmentally just transition might look like for South Africa's food system. In practice, local, ethically sourced, organic food and coffee for our on-site café is unaffordable for many of our learners and most of the staff. Navigating these contradictions with honesty and humility, while attempting to reconcile them, is a core part of learning for both us and learners.

Second, learning is tangible. Embedded in the broader community of Lynedoch and built over time to integrate with the natural environment around it, the ecovillage aims to be a microcosm of sustainable living in practice. Continuing with the example of the food system, learners might spend time planting and harvesting vegetables from our garden, preparing meals in our kitchen, and sorting and recycling waste. This 'whole body' experience connects abstract concepts with practical actions, often triggering entirely novel ideas.

Third, there is space for reconnection between specialised schools of thought, between conventional and other forms of knowledge. Contextual, indigenous knowledge, rooted in place, comes into its own. One cannot understand a place fully without considering its geography, its history, its social dynamics, its ecology, how its economy is structured, how it is governed, what technologies it benefits from, and so on. All these aspects create opportunities for sharing across disciplines, as each programme comes with a unique group of learners with diverse backgrounds, learning objectives, questions, and constraints.

Sustainability education remains difficult work. It involves trial and error. It is far easier to speak about than to achieve in practice. In our role as an independent non-profit trust, we can be nimble, experimental, even radical, but being grounded in a physical place and community holds us to account in terms of rigour and purpose.

OUR LEARNING PHILOSOPHY IN PRACTICE

The following three examples illustrate our recent work and help bring elements of our learning philosophy to life:

FOSTERING A RELATIONAL WORLDVIEW WITH THE AGENCE FRANÇAISE DE DÉVELOPEMENT (AFD)

As Daniel Christian Wahl[2] writes, *"sustainability is not a destination, it is a journey"*. We agree, and for this reason we believe dwelling on questions is important. Jumping too quickly to find the answers takes the unnecessary risk that we continue to perpetuate the behaviours and mindsets that have created the world we want to leave behind.

This idea is central to the Biodiversity Partners Programme, a coordinated effort between the Agence Française de Dévelopement Campus (AFD Campus) and the Sustainability Institute. The programme is aimed at pro-nature entrepreneurs and intrapreneurs in Southern Africa. Participants are encouraged to integrate a deeper understanding of complexity and biodiversity into their innovations, business models, and theories of change, using their own project or business venture as a focal point for learning. Topics include deep ecology, indigenous knowledge, and systems thinking.

Many participants describe how they come to view their project not as an isolated effort, but as part of a network of relationships embedded in a greater system. For example, one participant shared how they realised that by-products from maize processing could be used as an input in the production process rather than going to waste. We encourage entrepreneurs to consider the potential impact of their project on a wider range of stakeholders and on the natural world. As another participant describes it, *"the programme gave me a different lens on how I view biodiversity and my own role in nurturing it"*. For many, it is about *"giving a new language"* to what is often taken for granted: our dependence on nature, and the complexity of our relationship with it.

2 Daniel Christian Wahl is a biologist, notably on the advisory councils of Ecosystems Restoration Camps, Commonland and Future Planet Europe.

ANIMATING DEGREE PROGRAMMES WITH THE UNIVERSITY OF STELLENBOSCH[3]

The Sustainability Institute collaborates with the University of Stellenbosch on two of their degree programmes: the postgraduate diploma in Sustainable Development (since 2003) and the undergraduate Diploma in Sustainable Development (since 2018). Both blend influences from environmental and social sciences to help learners understand the complexity of the significant societal challenges we face and provide them with a variety of tools and skills to address these.

Through our involvement in these degree programmes, we aim to facilitate experiences that stimulate not just the mind, but connect to heart, body, and soul. We do this by creating space for reflection and deep connection with others, with shared pasts, and with desired futures. In parallel with academic writing, these programmes encourage learners to express themselves via multiple creative forms and styles including poetry, artwork, podcasts, storytelling, drama, and dance. As the Dalai Lama reflected on modern education *"we seem to be very good at educating the mind but not the heart."* Every day starts with *ilima*[4], a practical activity such as working in the food gardens, preparing meals or cleaning, a way for learners to give back to the community in which their learning is taking place. A core component of each assignment is a journal, building critical reflexivity into learners' academic work and helping draw out inner assumptions and values.

Being physically present within the practice hub offered by the Sustainability Institute is a core part of the learning experience that makes these degree programmes so unique and transformative. Theoretical concepts are linked to practical examples and experiences. For example, learners studying the dangers of alien vegetation will spend time in our woodland, observing the way the alien grass encroaches on indigenous tree and shrubs, and seeing how we are trying to combat this (at the moment we are trying to do so with the help of six friendly pigs). We think this type of collaboration between universities and NGOs can create sustainability education programmes that are cutting-edge at the global level.

3 Undergraduate and postgraduate diplomas in Sustainable Development are administered and owned by Stellenbosch University. For more information see: http://www.sun.ac.za/english/faculty/economy/spl/degree-programmes/undergraduate-degrees/diploma-in-sustainable-development [Undergraduate Diploma] and http://www.sun.ac.za/english/faculty/economy/spl/degree-programmes/postgraduate-degrees/post-graduate-diploma-in-stustainable-development [Postgraduate Diploma].

4 *Ilima* is an isiXhosa term for collective action to tackle common challenges and build social capital.

PROMOTING INDIGENOUS KNOWLEDGE AND REGENERATIVE AGRICULTURE WITH SPIER WINE FARM

In 2019, we started the Living Soils Community Learning Farm in collaboration with Spier Wine Farm, a project that aims to increase food security in the Lynedoch Valley while simultaneously training young farmers in ecologically regenerative agriculture. Interns learn practical farming methods as well as farming management, administration, and entrepreneurial skills. A youth programme aims to rebuild a sense of cultural heritage and ownership when it comes to food growing that has been lost over generations of association with low paid work and poor treatment in the commercial farming industry.

Here, we ensure other voices are present in learning beyond conventional, codified knowledge. Facilitators include those with a deep understanding of indigenous vegetation and food, and who can help bring to life 'ways of knowing' in parallel with conventional farming techniques. As one facilitator describes, *"traditional knowledge is not something from the past, but rather something that is a living part of our present and future."* Living Soils is a practical effort not only to restore food security, but in recognition that new patterns of thinking and acting are urgently needed to address a crisis rooted in old patterns. The food industry is one such system where the need for new alternatives is clear, and where there is still so much work to be done.

Transformative learning is a lifelong process. And sustainability education doesn't offer neat solutions. Instead, learners probably leave with more questions than they had when they arrived, which can be disorienting. A one-week immersion might give you a glimpse into another way of seeing the world, but it is easy to return to the world from which you came. The importance of a 'tribe' to support learners beyond their experience cannot be overstated.

Our work must therefore catalyse sustained action in a diverse group of people so that their knowledge is applied in new ways, in their unique contexts, in ways that help solve the crisis as opposed to reinforcing it. Whilst theoretical insights deepen and inform our practice, we believe that it is critical for learners to additionally have real agency, valuable skills, and the right attitude to activate change for a more sustainable world. Learning that is place based, action oriented, embedded in nature, reflective, of mind, body, and soul, and community-led is central to this work. It is a daunting and exciting challenge for higher education in the twenty-first century.

ECOLOGIES OF CHANGE
HOW ART EXPLORES THE PATHWAYS FOR A JUST TRANSITION

Arie Lengkeek & Carolina Mano Marques, Art Climate Transition

Arie Lengkeek is an independent programmer, editor, curator and researcher, based in Rotterdam. Carolina Mano Marques is an international cooperation project manager, currently collaborating with Culturgest, based in Lisbon. Both of them are part of Art Climate Transition, a European cooperation project on ecology, climate change and social transition, initiated by 10 cultural operators from 10 European countries, working in the field of performing and visual arts. ACT is a project with the support of the Creative Europe Programme of the European Union.

Paris, June 2015: the whole world is watching as the "conference of the parties" unfolds, commonly referred to as: COP21. While the parties meet, eat and negotiate, the clock is ticking. At the Place du Pantheon, twelve giant chunks of glacial ice are placed in a circle. The artist Ólafur Elíasson took them from Greenland's Nuuk Fjord, and shipped them to Paris. There, they are slowly melting in the summer sun, as the world turns, and the time is ticking away. People are attracted, touching the ice, tasting its water. *"I hope this work of art can actually bridge the gap between the data, the scientists, the politicians and heads of state and how normal people feel"*, as Elíasson stated.

And yes, this is exactly what art can do. It provides a direct access to complexity, without reducing it. It makes slow, creeping processes visible and audible. It brings urgency and activism. It is able to connect the individual experience to "hyperobjects" like climate change, extinction of species, and growing global inequality. It provokes debate, and it's itself subject to it as well. Ólafur Elíasson was heavily criticized for the carbon impact of his artwork, shipping glacial ice in air-conditioned circumstances all the way from Greenland to Paris, only to melt away there.[1]

Nevertheless, we're 7 years later now, and "Paris" and "1.5°C" have become keystones, leading up to many policy initiatives.

1 Julie's Bicycle produced a report on the Carbon Footprint of the "Ice Watch" installation by Ólafur Elíasson, which is available in the press section of the icewatch.london website.

ART, CLIMATE, TRANSITION: ACT

In this transition towards a sustainable future, art and artists have many different roles, positions, entanglements. Globally operating artists like Elíasson are able to bring urgency and invite a wide audience to engage in the artwork and the issues it addresses. But it is also locally, in smaller scales and peripheral territories that we witness the everyday contribution of artists and cultural organisations to a just transition. We operate under the name ACT, Art Climate Transition, as a network of 10 European cultural organisations, venues, NGO's and festivals. A diversity of contexts and perspectives brings us together in critically engaging on a reflection of what it means to program artivists and to produce artworks that are committed to ecology and to a fairer social transition. Co-financed by the Creative Europe programme of the EU we have been working on the cutting edge of performing and visual arts that relate to the issues of climate change and ecology. Under the name *Imagine2020*, the previous collaboration projects focused on exploring the future under new ecological conditions. ACT started as a project in 2019, maintaining a focus on arts, ecology and climate change, and we connect this to the interlinked issues of inequality, climate justice and urban ecologies.

Finding ourselves in the Anthropocene era, we seek to include the agency and voicing of the non-human and other voices. Recent uprisings and protests in our cities support our agenda to address via the arts the networks of dependency, inequality and power that define our (in)ability for collective action. It is not just transition, it is a just transition which is urgently needed: a transition that is based on our ethical awareness and ecological understanding of interaction between species, humans and their political and natural environments. This understanding of ecology is not just "the issue", it also shapes the way we see the world and our own contribution to it. In this article we will highlight some of our works and projects to illustrate this idea of ecology.

Fikos' Marseille Mural unveiled at IUCN congress, September 5th 2021.

CONNECTING CONTEXTS

September 2021 was finally the moment when Marseille hosted the IUCN World Conservation Congress – the global summit on biodiversity, after being postponed several times due to COVID-19 constrictions. Participants who descended the stairs from Saint-Charles train station couldn't miss a huge mural with birds, painted by the Greek artist Fikos. The birds depicted are migratory species, which find a habitat in the surroundings of Marseille during a part of the season. The depicted birds are under threat: their habitats are reduced, either by climate change or by man-induced developments. The mural was commissioned by ACT-partner COAL, bringing the American "Audubon Mural Project" to Europe. But the project didn't stop there. As a sequel, the other ACT partners are organising a reverberation of the initiative in their local territories by commissioning a bird mural locally. The murals are following the same principle: a beautiful depiction of migratory birds from the region that are under threat of extinction. Not only rare species, also mundane birds are disappearing. These projects include the engagement of local communities, be it schools, a workers union or an elderly home, and inviting the knowledge of local ecologists. The conversations that emerge around each mural deepen the understanding and sense of responsibility. It also connects across Europe each of these murals, and each of these communities. A "Roodborstje" (Robin)

at the Roodborststraat in Rotterdam, a Grey Vulture (at the primary school Goce Dolchev) in Skopje, North Macedonia - and soon more bird murals will follow.

AN ECOLOGY OF RELATIONS

Now let's dig a little deeper. Because we are convinced that this "contextualizing" approach to ecology and arts allows also a deep connection with the issue of a just transition. Many of the artists we work with are convinced that ecological and climate justice cannot be imagined without social justice. Perceiving the world as an interconnected web of things and people - and also sharply aware of the institutionally embedded inequalities and dependencies. As a cooperation project, we foster this approach and we invite artists to explore it and to learn from each other's artistic trajectories in summer labs and residencies. This artistic orientation is not aiming for the global stage, but rather seeks its impact in the roots and rhizomes of everyday life in urban and rural communities.

To create and disseminate an ecology of relations is the underlying statement of the Collection Europe project, developed within ACT. Here, an ensemble of four artists and collectives were selected to develop artistic trajectories across European territories. The Portuguese collective Berru created an unprecedented installation on the energetic issues of the Ocean, which will be performed in Clermont-Ferrand and Lisbon. Their works tend to combine living and non-living structures and speculate about their potential collaborations in creating sustainable systems.

With The Apocalypse Reading Room, Ama Josephine Budge creates an on-site library in the face of environmental and social transformation. In this installation, the London-based artist gathers all the books that we might need to change the end of the world. The installation is also activated by other artists who are invited to develop a residency programme around it, and requires the holding of a community space. It opens conversations and connections, on loss and grief, but also on resistance and strategies for solidarity.

As such, both projects invite the voices of others that are not heard or understood, or are not given the stage to be listened to. For the Belgian artist Sarah Vanhee, this is the heart of her cultural practice. As Sarah says about her project BOK - Bodies of Knowledge: *"What develops, is an ecology of relations, also very literally. Something happens beyond the blindness of the white middleclass to which I also belong. We wonder why the ecological movement remains so white?! Of course it's because the topics that are at the table are completely out of reach for people from more precarious classes. But at the same time, a lot of ecological solutions come already from them! For instance we had someone in the tent who spoke about 'how to get by with very little money?'- and then you realize a lot of these solutions are deeply ecological, but she just doesn't call them that way."*

EMBODIED KNOWLEDGE

So, the end of the Theatre with a capital T? The work that ACT is producing and presenting redefines the position of the theatre and the art institutions. But this doesn't equal with a departure from the theatres and formal stages. These are used intensely and in innovative ways as well. The intricate and delicate unwritten contract between audience and performers, limited in time and space, remains of great value in exploring the new ecological condition. In post-pandemic times also the means to develop such implicit protocols have been widened. The triad nature – audience – performers becomes a source of inspiration for many artists. They activate the audience as a "collective body", which can be an ecological awareness per excellence.

We see this in diverse forms: some very fragile and intimate, others resulting in mass-choreographies where the audience transforms into a swarm. Very intimate is *Immersion*, by Selina Thompson (UK), which explored the sacredness of breath by inviting an intergerational mix of women to record their breath. These recordings became part of a soundscape, shared as a form of activism, which signals our inability to breathe freely, whether due to Covid, racism or air pollution. The Chilean choreographer Jose Vidal creates mass choreographies such as *Emergenz*, a dance performance that explored the process in which a collective, a social body emerges from the movement of single bodies. Swarms of birds and fishes, the wind through the leaves of the forest, fractal patterns that repeat and sustain themselves. Vidal offers a structure, a framework, in which the dancers play and improvise.

Jose Vidal, *Emergenz* (Hamburg, 2019).

Emergenz brings 100 performers on stage. Professional dancers, but an equal amount of citizens from all walks of life. Architects, designers, teachers, bank-employees: they rehearse with Vidal and his team. No words, just movements and invitations to interact. As a result, 100 performers act as one ecosystem in itself. The result is mesmerizing to see - and an unforgettable experience for those who participate in the process of creating it.

AN ARTISTIC COMPASS FOR UNKNOWN TERRITORIES

What is the role and contribution of art and creation in the vast and urgent transition towards a just and sustainable society? With ACT we work from an ecological understanding of this question - not a mechanic or a linear one. We are assured that artistic work has impact - but that this impact is organized in ways that require an ecological understanding. The merging of art and activism can be found in many of the projects we connect with and support. And they're desperately needed in our collective attempts to find new ways to inhabit Earth together with all other lifeforms. Or to be more precise, to inhabit a Critical Zone, as the French philosopher Bruno Latour calls it, a thin shell of only a few kilometres thick, where everything happens. *"Is it inhabitable? 'Depends on your chosen science'. Will I survive down there? 'Depends on your politics'"*. It's time to land, and learn to navigate.

Editor-in-Chief: Nicolas Renard, Executive Director, Veolia Institute

Publication Director: Dinah Louda, President, Veolia Institute

Issuing Body:
Field Actions Science Reports (FACTS) is published by the Veolia Institute. EISSN: 1867-8521

Contact:
institut.ve@veolia.com

Designed and produced by: Increa by Printvallée
Cover: Veolia Graphic Studio

Printed in France
with vegetable-based inks by an environmental printer (a member of Imprim'vert) on chlorine-free paper from well-managed forests and other controlled sources, certified in accordance with the standards of the Forest Stewardship Council.

Photo credits:
Veolia Picture Library, Adobe Stock, GettyImages, Shutterstock and other credits as noted in the figure legends.

"If there is hope, it rests on the human capacity to choose to invent a better future and on leadership at every level that shows the way."

Harvey V. Fineberg
President of the Gordon and Betty Moore Foundation
Member of the Veolia Institute Foresight Committee

Veolia Institute
30, rue Madeleine Vionnet • 93300 Aubervilliers, France
www.institut.veolia.org