

John Elkington



THE ZERONAUTS

Breaking the Sustainability Barrier

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The Zeronauts

A world of nine billion people by mid-century will demand fundamental changes in our mindsets, behaviors, cultures, and overarching paradigm. Just as our species broke the Sound Barrier during the 1940s and 1950s, a new breed of innovator, entrepreneur, and investor is lining up to break the Sustainability Barrier.

In this book, John Elkington introduces the Zeronauts – a new breed of innovator, determined to drive problems such as carbon, waste, toxics, and poverty to zero – as well as creating the first Zeronaut Roll of Honor, spotlighting 50 pioneers in the field of zero. Zeronauts are innovating in an astonishing range of areas, tackling hugely diverse economic, social, environmental, and governance challenges. To give a sense of progress to date, we zero in on five key challenges (the 5Ps): population growth, pandemics, poverty, pollution, and proliferation.

The power of zero has been trumpeted, notably in relation to zero defects. This book spotlights key lessons learned in the field of total quality management – and introduces a five-stage “Pathways to Zero” model, running through from the Eureka! discovery moment to the point where a new way of doing things becomes endemic in the economy.

In order to move from incremental to transformative change, we must embrace wider framings, deeper insights, higher targets, and longer time scales. This book investigates some ways in which leading Zeronauts are pushing change in relevant directions, with cases drawn from a spectrum of human activity – from water profligacy to human genital mutilation. If we learn from these pioneers, the twenty-first century could be our best yet.

John Elkington has been a leader in the environmental and sustainability movements since the early 1970s. He has cofounded three companies: Environmental Data Services (ENDS) in 1978, SustainAbility in 1987, and Volans in 2008. All three still push the boundaries. He has published 17 previous books, including the number one bestseller *The Green Consumer Guide*.

"*The Zeronauts* demonstrates once again how John Elkington has become our most accurate and prescient oracle with respect to sustainability, restorative commerce, and environmental innovation. In his judicious and respectful writings, he uncovers vistas of opportunity for start-ups, corporations and governments, panoramas of brilliant ideas that will transform our lives."

Paul Hawken, *author of The Ecology of Commerce, Natural Capitalism and Blessed Unrest, and the visionary entrepreneur who ignited Interface founder Ray Anderson's interest in zero, USA*

"A pioneer within the sustainability movement, John Elkington continues to inspire us, shifting the spotlight from change-as-usual to breakthrough innovation."

David Blood, *Senior Partner and Co-founder, with Al Gore, of Generation Investment Management, UK and USA*

"*The Zeronauts* is a must read for the business minds of today and tomorrow."

Jochen Zeitz, *Chairman of PUMA and Chief Sustainability Officer of PPR, Germany*

"John Elkington is a one-man Tipping Point creator: what Malcolm Gladwell calls a maven, connector and salesman all rolled into one! The inventor of the triple bottom line and *Cannibals with Forks* has surpassed himself with *The Zeronauts*!"

David Grayson, *Chair and Director of the Doughty Centre for Corporate Responsibility, Cranfield University, UK*

The Zeronauts

Breaking the Sustainability Barrier

John Elkington

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In memory of Ray Anderson (01934–02011)¹
Radical Industrialist, Early Zeronaut

Also by John Elkington:

- The Ecology of Tomorrow's World*, Associated Business Press, 01980
Sun Traps, Pelican Books, 01984
The Poisoned Womb, Pelican Books, 01985
The Gene Factory, Century Hutchinson, 01985
The Green Capitalists, Victor Gollancz, 01987
Green Pages, Victor Gollancz, 01988 (with Julia Hailes and Tom Burke)
The Green Consumer Guide, Victor Gollancz, 01988 (with Julia Hailes)
The Green Consumer's Supermarket Shopping Guide, Victor Gollancz, 01989
(with Julia Hailes)
The Young Green Consumer's Guide, Victor Gollancz, 01990 (with Julia Hailes)
A Year in the Greenhouse, Victor Gollancz, 01990
The Green Business Guide, Victor Gollancz, 01991 (with Julia Hailes and Peter Knight)
Holidays that Don't Cost the Earth, Victor Gollancz, 01992 (with Julia Hailes)
Cannibals with Forks, Capstone/John Wiley, 01997
Manual 2000, Hodder & Stoughton, 01998 (with Julia Hailes)
The New Foods Guide, Victor Gollancz, 02001 (with Julia Hailes)
The Chrysalis Economy, Capstone/John Wiley, 02001
The Power of Unreasonable People, Harvard Business School Press, 02008
(with Pamela Hartigan)



In the end, beginnings

An old order is ending, new ones beginning. What follows is a thought experiment. In arguing that zero is our future, Zeronauts act in the same way as the Zen masters who use a koan to jolt other people into a different state of awareness, to open their minds to new possibilities. A case in point: the Long Now Foundation sticks a zero in front of the year - e.g. 02012 - to help us expand our time horizons.

"If you look at zero you see nothing", Robert Kaplan wrote in The Nothing that Is, subtitled "A natural history of zero". "But look through it", he continued, "and you see the world".²

And the Chinese character above? LING. Another mind expander. Its meaning is context specific, evolving over time; but it stands for "zero". Serendipitously, other possible meanings include "an end" and "a beginning", "starting from scratch" and "new horizons".

Link this with the immense potential impact of China upon our common future, for good or ill, and Ling looks like a useful starting point for a global conversation on how we can radically shrink our environmental footprints - and help a better future take flight.³

To track - and support - our work, please visit www.zeronauts.com.



LING

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Executive Summary

Foreword

The genesis of the book.

Introduction: Helping the Future Take Flight

The Zeronauts are a new breed of innovator, determined to drive problems such as carbon, waste, toxics, and poverty to zero. On the climate front, leading sustainability champions argue the need to cut the carbon intensity of every dollar or euro earned by at least 130 times, suggesting that our economic and business models need to be turned upside down, inside out.

I ZERO: THE NEW BLACK

1 Breaking the Sustainability Barrier

The evidence suggests that most CEOs and other members of the global C-suite so far fail to grasp the nature and scale of what's coming at them. A world of 9 billion people by mid-century will demand fundamental changes in our mindsets, behaviors, cultures, and paradigms. Happily, just as our species broke the Sound Barrier in the 01940s and 01950s, a new breed of innovator, entrepreneur, and investor is lining up to break the Sustainability Barrier.

2 Houston, We Have A(nother) Problem

It may not have been designed that way, but conventional capitalism increasingly looks like a giant Ponzi scheme – where the interests of (at least some) people alive today are wildly favored over those of future generations. The example of soil is used to demonstrate that, without intending to do so, we are in the process of crashing the biosphere.

3 Enter the Zeronauts

Transformational, systemic change is generally driven by unreasonable people – who refuse to take the world as it is as any guide to how it might be in

the future. We introduce the first Zeronaut Roll of Honor, spotlighting 50 pioneers – referring out to coverage elsewhere in the book.

II CRACKING THE 1-EARTH CODE

4 Turbulent Teens: Our Detox Decade

The decade to 2020 is set to be our Detox Decade, in which we are forced to abandon unsustainable mindsets, behaviors, and valuation models. Three scenarios are presented: breakdown, change as usual, and breakthrough. We dig into five key domains (the 5Cs) where innovation is taking place: citizens, corporations, cities, countries, and, ultimately, our civilization.

III BREAKING THROUGH

5 The Race to Zero

The power of zero has been trumpeted in various areas of business, notably in relation to zero defects. Here we look at lessons learned in the field of total quality management – and introduce a five-stage “Pathways to Zero” model, running through from the Eureka! discovery moment to the point where a new way of doing things becomes endemic in the economy.

6 Zeronautics 101

Five stepping-stones take transformative change agents from their breakthrough insight to the point where their impact is so evident that it is increasingly taken for granted. Introducing the emerging discipline of Zeronautics, we move through the five stages (the 5Es): Eureka!, experimentation, enterprise, ecosystems, and economy.

7 It’s the System that’s Stupid

Zeronauts are innovating in an astonishing range of areas, tackling hugely diverse economic, social, environmental, and governance challenges. To give a sense of progress to date, we zero in on five key challenges (the 5Ps): population growth, pandemics, poverty, pollution, and WMD proliferation.

IV BEYOND ZERO

8 Ambassadors from the Future

In order to move from incremental to transformative change, we must embrace wider framings, deeper insights, higher targets, and longer time scales. We

investigate some ways in which leading Zeronauts are pushing change in relevant directions, with cases drawn from a spectrum of human activity – from water profligacy to human genital mutilation. If we learn from these pioneers, the twenty-first century could be our best yet.

9 The Zero Countdown – and Beyond

So, to cut to the chase, what should your board, C-suite, or senior management group do to manage risks – and seize opportunities – created by the Zeronaut agenda? Here are some starter questions that you can pose to your team or wider organization.

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ZERONAUT, *n.* 1. An inventor, innovator, entrepreneur, intrapreneur, investor, manager, or educator who promotes wealth creation while driving adverse environmental, social, and economic impacts toward zero. 2. Someone who finds, investigates, and develops breakthrough, footprint-shrinking solutions for the growing tensions between demography, consumerist lifestyles, and sustainability. 3. Political leader or policy-maker who helps to create the regulatory frameworks and incentives needed to drive related “1-Earth” solutions to scale. 4. For some current examples, see Box 3.1 (pp.44–6) for the first “Zeronaut 50” Roll of Honor.

Foreword

The genesis of the book

It's not every day that a genius, in the shape of your country's poet laureate, writes a poem based on your latest book⁴ – and then publishes said poem in one of the nation's main newspapers. But that's what happened to me in 01987, when Ted Hughes wrote a poem for *The Times* called "Lobby from Under the Carpet". His muse, he said, had just read my book *The Poisoned Womb*, republished as a Pelican paperback the previous year – "I thought her heart would break", he reported. So the man of letters had swung into action: "I sent a copy to Maggie: 'O Maggie, Read Elkington, and awake!'"

God only knows what Margaret Thatcher made of it all, particularly the poet laureate's deliberate dropping of a full stop and a comma at one point in the poem to symbolize the threatened extinction of human egg and sperm.

I only met Mrs. T once – she was having one of those days where she was in Louis XIV ("Sun King") mode. Her perfume clung around for so long on the hand with which I had shaken hers that I wondered if that handshake alone had cost the natural world several pods of spermaceti-rich whales.

But while the encounter underscored the perpetual challenge of engaging our leaders on issues they see as marginal to the task of winning the next election, or keeping shareholders happy, this exchange between poet laureate and prime minister spotlights some of the unlikely channels through which culture change can sometimes flow.

And the basic point had been made. Politicians, governments, and what used to be called the "captains of industry" ignore what we would now call the sustainability agenda at their peril, and ours. To be honest, even at the time I didn't think that this was one of Hughes's great poems. But it had a certain muscular, edgy energy. Its last verse ended:

Outside the door of Number Ten,
While the whole building's a-quake,
With every bankrupt Industry
Bawling: "Awake! Awake!"

Looking back, my own awakening, my personal road to zero, has been long, winding, and often instinctively followed rather than planned. It began when I found myself in a pitch-dark field in Northern Ireland in the mid-01950s, as a child of six or seven, with no moon, as a vast, invisible sheet of elvers – young eels – squirmed every which way around my ankles. After a moment of panic, I experienced a sense of intense connection (I knew about the distant Sargasso Sea where these creatures were eventually headed) that has never left me.

The process continued in fits and starts as the family uprooted to Cyprus. Then when I was 11, and away at prep school in England, I found myself one day standing in front of all the boys and asking for – and getting – their pocket money for two weeks as a contribution to the infant World Wide Fund for Nature (WWF), founded that year.

For years, I had no idea of what had come over me, a shy child with no appetite whatever for public speaking. Then one day, in the late 01970s, I was driving down to WWF's Godalming headquarters with one of the organization's founders, the late, great Max Nicholson, with whom I had recently cofounded Environmental Data Services (ENDS). He asked me how I had got started in the field and I told him the story, commenting that I had no idea how it had happened. He promptly said he did know.

How could he possibly, I wondered? He recalled WWF had got a major splash in a major newspaper to announce their launch – and as soon as he said that I recalled walking into the school library, devouring the newspaper on a reading stand, and impetuously deciding I had to do something.

Later, over many decades, I have somehow found myself repeatedly in more or less the right place at more or less the right time as the environmental and sustainability movements evolved. As an entrepreneur, for example, I have been immensely privileged to be involved in cofounding three companies, all still advancing the cause at the time of writing.

The first two were ENDS, which we launched with the late David Layton in 01978, which helped to open up business to wider discussions around safety, health, environment, and, later, sustainability, and then SustainAbility itself, launched in 01987, which has helped to open up corporate boards and C-suites worldwide to the sustainable development agenda. In 02008, I went on to cofound Volans Ventures, to help disruptive innovators and entrepreneurs to do more, better, faster.

As to where zero first came in, I had been aware of the world of people like Ray Anderson and Gunter Pauli for a long time. Next, in 02000, a good friend and colleague, Andrea Spencer-Cooke, wrote a profile of Paul Tebo, then at DuPont, for the now defunct *Tomorrow* magazine, entitled "Hero of Zero".⁵ And in 02004, I had been involved in the Zero Waste initiative (see p.248) launched by the Royal Society of Arts (RSA) as part of its 250th anniversary celebrations.⁶

But the first time that zero really seized control of my mind was when the newly formed Volans team was brainstorming for a proposal to an embryonic global foundation, which in the end lost its ability to fund as the Great Recession bit into the finances of its Dubai-based backers. At a fairly late stage in the day, working onto enormous blank panels under the direction of David Christie of the Value Web and Innovation Arts, I wrote – graffiti style and tongue in cheek – **I ♥ ZERO**.

These days, that ♥ symbol is wildly over-commercialized; but I knew that the symbolism of the other component – zero – has also been extremely powerful through history. In Mayan culture, for example, the symbol for zero was a spiral. And that resonated: for many years I had been besotted with spirals, even integrating one into a long-running SustainAbility logo, which counterpointed a trigram (representing balance across multiple dimensions of value) with a spiral (creativity, imagination, innovation, and evolution).

Definitions

ZER0/'zi(ə)rō/

Verb: Adjust or drive to ZERO.

Number: No quantity or number; naught/nought; the figure 0.

Targets: These can be expressed as “zero carbon”, “zero waste”, or “zero whatever”, but may also appear in different forms – for example, “100 percent” renewables (means zero fossil fuels, zero nuclear) or “nuclear free”. In some cases, zero may be misleading, as in “zero emissions” for an electric vehicle, which ignores the emissions produced in generating the electricity used by the vehicle. At worst, this can involve “zero-washing”, in which zero-based targets are used to mask poor performance in other areas.

Zeronauts: See pp.249-51 for definitions – and Box 3.1, pp.44-6, for a listing of 50 pioneers in the field.

If you want to get a sense of the history of the evolution of zero, track down a copy of Charles Seife’s wonderful book *Zero: The Biography of a Dangerous Idea*.⁷ Zero and infinity turn out to be intimately linked. It is fascinating to learn, too, that the West fought hard to deny zero for two millennia – even burning people at the stake for daring to promote its use.

These days there is no need to take your life in your hands to argue the case for zero, though there are those who energetically argue that it is a fool's errand. Several years back, I co-authored *The Power of Unreasonable People*, with Pamela Hartigan,⁸ and it strikes me that the Zeronauts introduced in the following pages are about as unreasonable as innovators and entrepreneurs come. They are calling for a new economic order that is virtually inconceivable for today's business leaders, even those who have publicly embraced the sustainability agenda.

My growing interest in what my Zero Hub colleague Ralph Thurm has dubbed "zero impact growth" does not reflect a desire to bring the global economy to a halt, though it sometimes seems that it will achieve that trick on its own (for more on the Zero Hub, see pp.12–13). Instead, it flows from a deeply felt need to help spur the sort of breakthrough innovation now needed to help us break what I have dubbed the Sustainability Barrier.

There has been much discussion of the possibility of decoupling our economies from their adverse environmental impacts; but there has also been a growing sense that the prospects for decoupling are overrated. As we will see in the Introduction, some respected analysts argue that we will need an almost inconceivable 130-fold reduction in our environmental footprints to achieve anything like sustainability during this century.

When I trailed this message in Singapore, at events organized by the Singapore International Foundation, the Family Business Network and the National University of Singapore, I used a slide I had been given a week or so earlier by Peter Boyd, COO of the Carbon War Room. This spotlighted the need, if we are to stabilize our climate, to go in the coming decades from 768 grams of carbon per dollar of economic output to just six grams. There were gasps of astonishment from the audiences.

But, some argue, and I will come back to this in Chapter 9, written on the same trip to Hong Kong and Singapore, that we need to go beyond zero, to technologies and business models that are regenerative – that, for example, actively suck carbon out of the atmosphere.

And my role in all of this? Routinely, I am asked to explain what exactly it is that I do? I find the question almost impossible to answer. Sometimes I deflect the interrogator by saying that I am the modern version of the Fool, whose job it was to speak truth to power in medieval courts. In the Tarot deck, I now discover, the Fool was the only unnumbered card. Indeed, it was sometimes numbered as "0" (zero, nought) and could play high or low. Also known as the Jester, this character displayed "crazy wisdom" – and could get away with saying things others could not.

The appearance of the Fool, standing on the lip of the precipice, seemingly unconcerned about stepping out into the void, was taken as a signal that significant change was coming. And that is often where I seem to operate – as

recently when I helped facilitate a three-day session in which a number of international sportswear brands and Greenpeace came together to discuss the potential for driving toxics in supply chains, particularly in China, to zero (see pp.227–8).

Some people got zero – but a fair few didn't.

The aim of what follows is to grow the size of the first group (which in the sportswear case began to talk of launching a “Race to Zero”) and shrink the size of the second. That's what we set up Volans to do – and I warmly thank my colleagues both there and at SustainAbility for their support during the genesis and development of *The Zeronauts*. As the book has evolved, it has shown every sign of switching from a project to a program. For details, please visit www.zeronauts.com.

Soon, I believe, the skeptics will have little choice in the matter. A new reality is pressing in. We are moving into a new geological era, the so-called Anthropocene, increasingly defined by what we do as a species. True, most geologists still think that we are living in the Holocene era; but in 2000 Paul Crutzen, an eminent atmospheric chemist, realized he no longer believed that. As *The Economist* has put it: “He was living in some other age, one shaped primarily by people. From their trawlers scraping the floors of the seas to their dams impounding sediment by the gigatonne, from their stripping of forests to their irrigation of farms, from their mile-deep mines to their melting of glaciers, humans were bringing about an age of planetary change. With a colleague, Eugene Stoermer, Dr Crutzen suggested this age be called the Anthropocene – ‘the recent age of man’.”⁹

In the midst of all of this, I – and the many organizations with which I am associated – have worked with a fair number of the companies mentioned in the following pages, in one way or another. Rather than calling out the associations in each case, except where it fits in with the story, I encourage anyone interested in testing for potential conflicts of interest to visit our websites. See also the Acknowledgements section, which spotlights some of my debts to those who have helped in this stage of my journey – notable among them the Rockefeller Foundation, for the Bellagio Fellowship that enabled me to write a couple of key sections of the book.

That said, both SustainAbility and Volans have been unusually transparent in this area – and, on occasion, we have publicly resigned clients when we judged progress too slow. In future, one key criterion I aim to apply to companies I work with is whether they are at least prepared to play with the idea of zero impact (or zero footprint) growth. Any of us who recalls being a child knows that we can learn a lot from play. Over time, however, that criterion must harden, increasingly requiring the business and public-sector leaders with whom we work to embrace – and then effectively deliver against – the Zeronaut agenda.

Acknowledgements

When was I infected by the Zero Meme? To be honest, I can't remember – but I do recall that in 02002 *Godert van Hardenbroek* – cofounder of Formula Zero in 02003 – handed me an image he had developed of a hydrogen-fueled Formula 1 racing car, dressed up in Greenpeace colors and emblazoned with “Formula Zero”. It was imaginary, but I used it for several years afterwards in slide presentations. Godert's subsequent adventures are described on pp.135–41.

Even earlier, a 02000 article by my friend and colleague *Andrea Spencer-Cooke* was also definitely part of the process. She wrote about *Paul Tebo* of DuPont as a “Hero of Zero”. But while I can't pin down when the idea took root, I do know when it started to blossom, or at least bud: during a Volans brainstorming session facilitated by Innovation Arts and the Value Web, in August 02009.¹⁰ And for that I thank *David Christie*, together with *Patrick Frick*, who first introduced me to him.

The zero line of thought was further nurtured during an extended brunch with *Paul Hawken* early in 02011. His work has long been a beacon for those of us lost in thick fog and ferocious counter-currents. The thought train was clearly accelerated decades earlier by the work of some early Zeronauts whom I was lucky enough to meet, among them *Buckminster Fuller* and *Ray Anderson*, both now sadly gone – but both of whom had a considerable influence on my thinking.

Science fiction author *Frank Herbert*, whom I met several years before he died, also had an important impact, through his *Dune* series of novels and his environmentalism. But zero shot to the surface again when *Nick Bellorini*, then with Earthscan, asked me in 02010 whether I had any ideas for a new book? *The Zeronauts* started to gel – and I thank Nick, *Gudrun Freese* and *Veruschka Selbach* of Earthscan, and *Louisa Earls*, *Emma Hudson*, *Charlotte Russell*, *Christine James*, and *Andrea Service* of Taylor & Francis for taking on the book.

Thanks, too, to my agents in New York, *Doris Michaels* and *Delia Berrigan Fakis*, and to my long-standing friend and colleague *Rupert Bassett* – who helped me to think through the design side of the book and linked website (www.zeronauts.com) as well as producing the book's illustrations.

At Volans, founded as what some would call a Serendipity Engine,¹¹ I simply cannot say how much I have appreciated the company and support of our

growing band of Volanders, notably *Tim Barrow-Williams, Amy Birchall, Amanda Feldman, Pamela Hartigan, Elliot Jackson, Sam Lakha, Jacqueline Lim, Alejandro Litovsky* (who played a critical role in evolving the “Pathways to Scale” model while at Volans; then went on to found the Earth Security Initiative), *Charmian Love, Geoff Lye, Nadine Mendelbaum, Jonny Mallinson, Rafael Morais Chiaravalloti* (and *Claudio Padua* who sent Rafael our way), *Rosie Reeve, Astrid Sandoval, Smita Sircar, Allen Tan, Kevin Teo, Soushiant Zanganehpour* (who helped substantially with the research for the 5Ps sections), and *Zheng Jieying*. Particular thanks here go to Sam and Geoff (who facilitated the latest phase of my learning journey) and to Charmian, as CEO, for helping Volans hold its course through the turbulent early stages of our evolution.

At our sister company, SustainAbility, which I cofounded in 01987, I spotlight and thank my “Zero Scouts”: *Jennifer Biringer, Kyra Choucroun, Jeff Erikson, Aaron Jaffe, Geoff Kendall, Geoff Lye* (again), *Michael Sadowski, Mo al-Shawaf* and *Patrin Watanatada*. I also offer my heartfelt thanks to my cofounder, and friend, *Julia Hailes*, and everyone else who has worked with the organization over its first 25 years.

Having written for *The Guardian* since 01978, I particularly appreciate the ongoing partnership with their Sustainable Business team, where I thank *Jo Confino, Caroline Holtum, and Jenny Purt*. I have drawn on some of the weekly blogs there in *The Zeronauts* – though the flow often went the other way, too.

In retrospect, an absolutely critical stage in the evolution of my own thinking was the award of a three-year grant in 02006 by the Skoll Foundation – and I am eternally grateful to *Sally Osberg* and *Jeff Skoll* for their support, and more broadly for what they have done to drive the development of the crucial fields of social innovation and entrepreneurship.

A key stepping-stone in that direction was the seven-year period I spent working alongside the Schwab Foundation and World Economic Forum, for which I warmly thank *Klaus Schwab* and *Pamela Hartigan*. And I would also like to thank *Jonathan Kua* and his team at Singapore’s Economic Development Board (EDB) for their invaluable support in the early days of Volans.

A further huge surprise came in the form of a Bellagio Fellowship from the Rockefeller Foundation, which provided an unbelievably timely opportunity to write a key section of the book during April and May of 02011 at the sublime Bellagio Centre on Lake Como, Italy. I thank *Jane Nelson* hugely for the nomination, *Robert Garris* (managing director, Bellagio Programs) for his support, and *Pilar Palaciá* (managing director, Bellagio Center) and her team for their extraordinary hospitality in Bellagio.

It was also an immense privilege in 02008 to find myself alongside pioneers such as Herman Miller, Seventh Generation and Shorebank (a pioneer now sadly no longer with us) when receiving a Social Capitalist Award from one of my favorite magazines: *Fast Company*.¹² This award, however, underscored the fact

that all of the organizations I have cofounded have been for-profit, social mission businesses, which has made the support from foundations such as Skoll, Rockefeller and Tellus Mater (where I thank *James Arbib*, *Kelly Clark*, and *Jessica Brown*) so remarkable.

Once the book was under way, I heard that I had been awarded the American Society for Quality's Spencer Hutchens Medal in 2010, for social responsibility and innovation, which spurred the development of Chapters 4 and 5. At ASQ, I thank *Dorothy Bowers* for the original nomination, together with *Paul Borawski*, *Ron Kingen*, *John Knappenberger*, and *Michelle Mason*. Someone whom I met during the ASQ event in San Francisco early in 2011 was *Daniel Aronson* of Deloitte Innovation, whom I thank (alongside *Ron Kingen*) for very helpful inputs on drafts of Chapters 4 and 5.

Various projects were cranking through at the same time that I was writing *The Zeronauts*, with sometimes fairly intense feedback between the parallel and braiding streams of thinking and work. In this area I thank *Ralph Thurm* and his colleagues at Deloitte Innovation in The Netherlands for their partnership in developing the Zero Hub initiative; *Alastair Morton* of JWT; *Elspeth Finch* and *Nick Roberts* of Atkins; *Neil Hawkins* and *Mark Weick* of The Dow Chemical Company; *Chris West* and *Clare Woodcraft* of the Shell Foundation; and *John Furey* of MindTime Technologies for their support on our latest report, *The Future Quotient*; and, at Nike, *John Frazier*, *Santiago Gowland*, *Sarah Severn*, and *Hannah Jones* for our evolving partnership around the Race to Zero/Zero Discharge of Toxic Chemicals Initiative.

In addition to those already mentioned, I have drawn in infinitely various ways on an immense network of colleagues and friends. I am particularly grateful here to: *David Blood*, *Colin Le Duc*, and *Al Gore*, Generation Investment Management; *Peter Boyd*, Carbon War Room; *Robert C. (Bob) Buck*, DuPont; *Ron Dembo*, Zerofootprint; *Stephanie Draper*, Forum for the Future; *Maria Eitel*, Nike Foundation; *Karin Ekberg*, adidas; *Linda Fisher*, DuPont; *Gil Friend*, Natural Logic; *Claude Fussler*; *Paul Gilding*; *Tony Gourlay*, Global Initiatives; *David Grayson*, Doughty Centre for Social Responsibility, Cranfield University; *Ellen Gustafson*, 30 Project; *Felicity Hartnett*, London Olympic & Paralympics Games; *Peter Head*, Arup and Ecological Sequestration Trust; *David Hodgson*, IdeaHive; *Alex Johnson*, Clownfish; *Georg Kell* and *Gavin Power*, United Nations Global Compact; *Kevin Kelly*; *John Kim*, Herman Miller; *Hugh Knowles*, Forum for the Future; *Roland Kupers*; *Francis Kyle*; *Julia Lalla-Maharajh*, Orchid Project; *Shawn Lester*, Sustainable World Capital; *Hunter Lovins*, Natural Capital Solutions; *Joel Makower*, GreenBiz; *Erin Meezan*, Interface; *Doug Miller* and *Chris Coulter*, GlobeScan; *Keith Miller*, 3M; *Ian Morris*, Stanford University; *Kumi Naidoo*, Greenpeace International; *Yasunori Naito*, *Zhanna Serdyukova*, and *Olivier Vriesendorp* of Ricoh-Europe; *Jean Oelwang*, Virgin Unite; *Nick Parker*, formerly of the Cleantech Group; *Tom Rand*, MaRS; *Jørgen Randers*, BI and Club of

Rome; *Sue Riddlestone* and *Pooran Desai*, BioRegional; *Dawn Rittenhouse*, DuPont; *Karl-Henrik Robèrt*, The Natural Step; *William Rosenzweig*, Physic Ventures; *Heerad Sabeti*, Fourth Sector; *Samer Salty*, zouk ventures; *Allan Savory*, Savory Institute; *Professor Friedrich Schmidt-Bleek*, Factor 10 Institute; *Robyn Scott*, One Leap; *Nick Sharp*, Beyond Zero Emissions; *Andrea Spencer-Cooke/Henman*, One Stone; *David Stubbs*, London Olympic & Paralympic Games; *Pavan Sukhdev*, The Economics of Ecosystems and Biodiversity (TEEB); *James Swanston*, Carbon Voyage; *Nigel Topping*, Carbon Disclosure Project; *Francesca van Dijk*, One Stone; *Mathis Wackernagel* and *Susan Burns*, Global Footprint Network; *Jan-Olaf Willums*, Inspire Invest; *Matthew Wright*, Beyond Zero Emissions; and *Jochen Zeitz*, Puma – the last of whom made some enormously helpful suggestions.

Most of the quotations and facts in the book were cross-checked with sources, but inevitably there will be errors. I would enormously appreciate comments – any unwitting errors can be changed both in later editions and, where appropriate, on our websites.

Finally, there are debts you can never repay, such as those I owe to people who helped me in the early stages of my career, among them *John Roberts* of TEST and *Max Nicholson* and *David Layton* of Environmental Data Services (ENDS), all three sadly now long gone.

But still very much here, despite my lamentable failure over decades to achieve any sort of work–life balance, are my nuclear family of *Elaine*, *Gaia* and *Hania*, plus the extended family that has swirled around Hill House, Little Rissington, since 01959, and particularly around my parents, *Pat* and *Tim*. I'm not sure that one more damned book will make any difference to their assessments of me as father, husband, son, sibling, cousin, or in-law; but it is offered as a token of respect and love, and as an illustration of the wider allegiances I have formed since my epiphany, where it really all started, in a field of eels in Northern Ireland, in the mid-01950s.

It has been a long journey, but the truly weird thing is that it feels as if it is only just beginning. Find out more at www.volans.com or at www.zeronauts.com.

List of Acronyms and Abbreviations

AIDS	acquired immune deficiency syndrome
ASEAN	Association of Southeast Asian Nations
ASQ	American Society for Quality
BCE	before common era
BEAFI	Better Environment Awards for Industry
BoP	base (or bottom) of the pyramid
BPA	bisphenol A
BRICS	Brazil, Russia, India, China, and South Africa
BZE	Beyond Zero Emissions
°C	degrees Celsius
5Cs	citizens, corporations, cities, countries, civilizations
C2C	Cradle to Cradle approach
CCI	Clinton Climate Initiative
CCS	carbon capture and storage
CDC	US Centers for Disease Control
CE	common era
CEO	chief executive officer
CFC	chlorofluorocarbon
CIA	Central Intelligence Agency
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COO	chief operating officer
COP	Conference of the Parties
CSR	corporate social responsibility
CTBT	Comprehensive Nuclear Test Ban Treaty
CZO	chief zero officer
DCF	discounted cash flow
DDT	dichlorodiphenyltrichloroethane
DI	Confederation of Danish Industries
DNA	deoxyribonucleic acid

5Es	Eureka!, experimentation, enterprise, ecosystem, economy
EBC	Environment Business Center
Eco-Q	ecological quotient
EDB	Economic Development Board (Singapore)
ENDS	Environmental Data Services
EPA	US Environmental Protection Agency
EPI	Environmental Performance Index
EQ	emotional quotient
EU	European Union
EV	electric vehicle
FGC	female genital cutting
FIA	Federation Internationale Automobile
FQ	future quotient
FTSE	Financial Times Stock Exchange
FZ	Formula Zero
G20	Group of Twenty
GDP	gross domestic product
GEMI	Global Environmental Management Initiative
GFN	Global Footprint Network
GHG	greenhouse gas
GPEI	Global Polio Eradication Initiative
GSA	US General Services Administration
HFC	hydrofluorocarbon
HIV	human immunodeficiency virus
ICLEI	Local Governments for Sustainability (formerly International Council for Local Environmental Initiatives)
IED	improvised explosive device
IIED	International Institute for Environment and Development
IMF	International Monetary Fund
IMO	International Maritime Organization
IOC	International Olympic Committee
InVEST	Integrated Valuation of Ecosystem Services and Trade-Offs
IQ	intelligence quotient
ISO	International Organization for Standardization
LEED	Leadership in Energy and Environmental Design
LNG	liquefied natural gas
LOCOG	London Organising Committee of the Olympic and Paralympic Games
LOHAS	lifestyles of health and sustainability
MAD	Mutually Assured Destruction strategy
MDG	Millennium Development Goal
MoD	UK Ministry of Defence
MP	member of parliament (UK)

MSW	municipal solid waste
NAFTA	North American Free Trade Agreement
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NGO	non-governmental organization
NPT	Nuclear Non-Proliferation Treaty
NPV	net present value
NREL	National Renewable Energy Laboratory (USA)
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
3P	Pollution Prevention Pays program
5Ps	population growth, pandemics, poverty, pollution, proliferation
PBB	polybrominated biphenyl
PC	personal computer
PCB	polychlorinated biphenyl
PDA	Population and Community Development Association
PFOA	perfluorooctanoic acid
PR	public relations
PVC	polyvinyl chloride
4Rs	waste reduction, reuse, recycling, and recovery
R&D	research and development
RAF	Royal Air Force
ROIC	return on invested capital
RSA	Royal Society of Arts
SARS	severe acute respiratory syndrome
SERI	Solar Energy Research Institute
SETI	Search for Extraterrestrial Intelligence
SO ₂	sulfur dioxide
SUV	sport utility vehicle
TB	tuberculosis
TBL	triple bottom line
TED	Technology Entertainment and Design conferences
TEEB	The Economics of Ecosystems and Biodiversity
Tepco	Tokyo Electric Power Company
TQEM	total quality environmental management
TQM	total quality management
UCL	University College London
UN	United Nations
VOC	volatile organic compound
WEC	World Environment Center
WEF	World Economic Forum
WHA	World Health Assembly

WHO	World Health Organization
WMD	weapons of mass destruction
WTE	waste to energy
WTO	World Trade Organization
WWF	World Wide Fund for Nature (<i>formerly</i> World Wildlife Fund)
ZD	zero defects
ZEF	Zero Environmental Footprint initiative
ZERI	Zero Emissions Research Initiative
ZPG	zero population growth

Introduction

Helping the Future Take Flight

The Zeronauts are a new breed of innovator, determined to drive problems such as carbon, waste, toxics, and poverty to zero. On the climate front, leading sustainability champions argue the need to cut the carbon intensity of every dollar or euro earned by at least 130 times, suggesting that our economic and business models must be turned upside down, inside out.

Zero is a huge subject – and it’s growing all the time. So where to begin? Here’s as good a place as any. Paul Tebo didn’t just take it as a sign, he took the sign. Around 01995,¹ he was looking for ways to move the giant chemical company DuPont toward a zero waste mindset. Then he stumbled upon a sign at a nearby manufacturing site that stated that **The Goal is “0”**. He took it with him when he left.²

Dubbed a “Hero of Zero” in 02000, as previously mentioned, he told me: “I started carrying the sign around the company to talk about the need and business value in moving toward zero injuries, illnesses, incidents (fire, explosions, accidental releases to the environment), waste and emissions, and eventually we added zero new net energy while the company grew.” Tebo was an early corporate version of an extraordinary new breed of innovators, entrepreneurs, intrapreneurs, investors, and policy-makers: the Zeronauts. Later, I list him among the 50 pioneers in the first Zeronaut Roll of Honor³ and interview him on that stage of his career.

Like the Argonauts of legend, and the Astronauts and Cosmonauts of more recent times, these people push the boundaries of the possible. In this case, they see their mission as one of driving the negative environmental and social footprints of our species toward, to, or – in a few telling cases – beyond zero. This is their story, told against the backdrop of epoch-making shifts in demography, resources, economics, and, inevitably (but not always productively), politics.

And speaking of politics, Obama, the embattled president, finally got Osama, the walled-in fugitive, literally as I was drafting this page. Then, a few days after the teetering-on-the-edge-of-chaos raid that sealed the fate of the al-Qaeda leader, a former commando commented starkly on the nature of such missions: “There’s only two ways to go in these operations – zero or hero.”⁴

As you might suspect by now, the message of *The Zeronauts* is exactly the opposite. The people portrayed here are heroes precisely because they pursue zero – in areas as diverse as population control, poverty alleviation, pollution, and the proliferation of weapons of mass destruction. As they teeter on the edge of a different sort of chaos, they hold zero in their minds as a compass point, guiding light, North Star. They are at the cutting, and often bleeding, edge of the global sustainability movement.

We will dig into the question of who these zero-chasing pioneers are and why they do what they do in Chapter 3. They are market revolutionaries who aim to create wealth while driving adverse environmental, social, and economic impacts toward zero.

Whether or not this is what they intend, they are developing and spreading new *memes*: the psychological, social, and cultural equivalents of genes. The idea behind the “Zero Meme” (see Box 0.1) is that it potentially triggers a cascade of new thinking in those exposed to it – helping them see possibilities (and risks) to which they would otherwise have been blind.

Typically these pioneers admit early on in the conversation that they have made mistakes along the way. This essentially is a process of trial and error. In that spirit, one of the worst professional mistakes I ever made involved getting Bill Ford to admit in an interview we did more than a decade ago that the gas-guzzling sport utility vehicles from which the Ford Motor Company then made a huge slice of its profits were unsustainable.

True, but sometimes you can be too honest too early. It was a candid – and extremely brave – admission from an extraordinary man, illustrating his personal commitment to protecting the environment. But when the interview appeared in Ford’s first sustainability report it didn’t play at all well in some parts of the business press, particularly the *Wall Street Journal*.

Box 0.1

The Zero Meme

NOUN /mēm

memes, plural

An element of a culture or system of behavior that may be passed from one individual to another by non-genetic means, especially imitation.

Wikipedia (11 August 02011, edited)

See page 57 for some examples