

In Conversation

Ellen MacArthur: From Linear to Circular



Figure 1 Dame Ellen MacArthur.
Photo courtesy of Ellen MacArthur
Foundation.

Dame Ellen MacArthur (Figure 1) made yachting history in 2005, when she became the fastest solo sailor to circumnavigate the globe. She remains the UK's most successful offshore racer ever, having won the Ostar, the Route du Rhum, and finished second in the Vendée Globe. She was appointed a Knight (Chevalier) of the French Legion of Honour by President Nicolas Sarkozy in 2008, three years after being knighted by HM Queen Elizabeth II.

Having become acutely aware of the finite nature of the resources on which our linear economy relies, she retired from professional sailing to launch the Ellen MacArthur Foundation in 2010. The Foundation

works to accelerate the transition to a circular economy, and has helped establish the subject on the agenda of decision makers around the world. Since the publication of its first economic report in 2012, the Foundation has launched global initiatives on plastics and textiles; developed innovation networks with educators, businesses, and governments; and released almost 20 further reports and books. Dame Ellen is a World Economic Forum Global Agenda Trustee for Environment and Natural Resource Security and member of its Platform for Accelerating the Circular Economy. She sat on the European Commission's Resource Efficiency Platform between 2012 and 2014.

Yubei Gong (YG): There are many economic models for sustainability – “the green economy,” “the Blue Economy,” “Doughnut Economics,” “Cradle to Cradle,” and more. How does the idea of the circular economy differ?

Ellen MacArthur (EM): I’ll start by answering this question from a personal perspective: my realization was that resources are finite. Fossil fuels, metals, phosphorus for farming – we have this whole range of materials only once in the history of humanity. It struck me early on that the way our current economy uses those materials uses them up. We try to use less every year, because we know those resources are finite, but ultimately they will be utterly depleted. And in a world with a growing population that has a greater and greater demand for resources, that [linear] system doesn’t make sense. It can’t add up.

So, though there were many ideas out there, the circular economy question at the beginning was, “If linear doesn’t work in the long term” – which seems like common sense – “then what *does*?” And that question implies “the economy” in its broadest sense, not just bolting a fix on to one element of something that is happening already – increasing energy efficiency by a few percentage points, for example, or reducing emissions of harmful substances by a few percentage points – which has often been the approach to sustainability in the past. Incremental change is not bad in itself, but tinkering at the edges of the current system runs the real risk that we will not meet the acute resource and environmental challenges we face. I wanted to know what an economy that could run long term would look like.

It was through beginning to understand many of those principles that you mentioned – Cradle to Cradle design, industrial symbiosis, biomimicry, the performance economy, the sharing economy, and more – and saying that if we can take *many* of these ideas and understand what the *system* change would look like, that I started to see things differently. The question then became, “How could we shift from the extractive and consumptive economy to a restorative and regenerative one?” This implies a fundamental economic shift in the way humans use all kinds of materials. If we could do that, would we end up with an economy that can run in the long term?

Most importantly, if we *can* keep materials in biological and technological cycles, then we *can* build an economy which is restorative and regenerative by design.

YG: In light of the Paris Agreement goals for 2020 and beyond, and given current global warming statistics,¹

what practical short- or mid-term impact can public and private organizations really have on climate change mitigation and adaptation?

EM: One of the biggest challenges we face over the next 30 years is providing prosperity to an expanding global population, while at the same time making very deep cuts to greenhouse gas emissions caused by the linear economy and adapting to the impacts of the climate crisis.

Most efforts to reduce emissions focus on renewable energy and energy efficiency, but these are only half the story. Equally important is applying circular economy principles (Figure 2) to transform how we design and use products and also how we oversee land management. Applying circular principles does more than substantially reduce emissions – it increases industrial and agricultural resilience to the effects of climate change by making supply chains more distributed and soils healthier. For example, two effects of regenerative farming² are greater water retention and greater water absorption. Retention is good for times of drought, and absorption is good for times of heavy rain.

A more circular economy can actually make deep cuts to emissions from heavy industry: in an ambitious scenario, as much as 296 million tons of CO₂ per year in the EU by 2050, out of 530 million tons in total – and some 3.6 billion tons per year globally. Making better use of the materials that already exist in the economy thus can take EU industry halfway towards net-zero emissions.³

YG: So the basic principle of circularity is this: keep materials in biological and technological cycles to build a restorative, regenerative economy. Is that right?

EM: Yes. At the Foundation we’ve really tried to understand the economic rationale for circularity since the very beginning. Does it mean more growth? Does it mean we are able to decouple growth from resource constraints? What does that look like economically?

The year after we launched the Foundation in 2010, we did a study with McKinsey. As a starting point, we looked at the application of circular economy principles for Europe and for medium-lived complex products like phones, commercial vehicles, and washing machines. Suddenly, we saw that there was a strong economic rationale. That’s been one of the biggest drivers of the circular economy. From the beginning, the economic benefits of the circular economy have been well understood. Then we tried to understand the change for industries like plastics,



DESIGN OUT WASTE AND POLLUTION

A circular economy reveals and designs out the negative impacts of economic activity that cause damage to human health and natural systems. These costs include: the release of greenhouse gases and hazardous substances; the pollution of air, land, and water; and structural waste, such as underutilised buildings and cars.



KEEP PRODUCTS AND MATERIALS IN USE

A circular economy favours activities that preserve value in the form of energy, labour, and materials. This means designing for durability, reuse, remanufacturing, and recycling to keep products, components, and materials circulating in the economy. Circular systems make effective use of biologically based materials by encouraging many different economic uses before nutrients are returned to natural systems.



REGENERATE NATURAL SYSTEMS

A circular economy avoids the use of non-renewable resources where possible and preserves or enhances renewable ones, for example by returning valuable nutrients to the soil to support natural regeneration.



Figure 2 Principles of a circular economy. Image from Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (Cowes: The Ellen MacArthur Foundation, 2019), 23, available at <https://www.ellenmacarthurfoundation.org/publications/cities-and-circular-economy-for-food>. © 2019 by Ellen MacArthur Foundation.

fashion, and food, and what it means for cities. We've tried to understand how restorative and regenerative things could be, and the economics behind that.

YG: What do you think is the reason behind the growth and success of your Foundation and the idea of the circular economy?

EM: I think the idea is the reason. The idea itself is powerful. It paints an economically positive picture. It paints a restorative and regenerative picture. When we talk about the circular economy at the Foundation, we talk about an opportunity. There is a massive amount of opportunity – for the economy, but also for society and the environment – to build a regenerative and restorative economy. It's about innovation, design, material science, different business models, new businesses, and emerging innovators.

That in itself is very powerful. But this field of opportunity isn't just theoretical. It's backed up by economics, it's backed up by numbers. It's not just the education side saying, "everything needs re-designing. What an opportunity." The business communities are also fascinated, and so are the cities, the regions, the governments – because they see that we can build a better system, a restorative and regenerative system.

This Foundation's Systemic Initiatives⁴ program brings players from across value chains together – so far in plastics and fashion, but also food – and enables meaningful collaboration around a shared future vision of these material streams.

When we look at the numbers, in the vast majority of cases a new, circular system delivers greater economic value than the old system. In this day and age, that is what everyone is looking for.

YG: There must have been many challenges over the past decade. Could you tell us one or two stories about challenges that you have encountered? How did you turn them into opportunities?

EM: This may sound a bit presumptuous, but we haven't really faced that many obstacles. The circular economy concept quickly took root among businesses, academics, and policymakers. We have expanded quickly, and after 9 years, we have built a large, global network of businesses, governments, academic institutions, and a community of people working on creating a more circular economy.

Beyond the Foundation, the biggest challenge is that the linear economy doesn't work, but you can turn that challenge into an opportunity. Business as usual today is linear, and no matter how efficient we

make it, it can't run it in the long term. Then what can we do? The challenge can be turned into an opportunity, and we have to understand this opportunity in the best way possible.

From that perspective, I think that one of the challenges of circular economy is that you can distill it down into basic principles quite easily: it's about designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. People can understand those quite well. But we are looking at the *whole economy* – from farming, to industrial systems, to jet engines, to a pen, to packaging that food comes in. It's very broad. One of the challenges is to paint the circular economy picture in the broadest way possible without focusing too much on one area. We are trying to paint the biggest picture we can, but this might be a challenge.

We enjoy that challenge at the Foundation. It's very much a part of what we do. We want to explore the circular economy, and there are a lot of things we don't understand. We are in the very early days – but that's an opportunity to find out more. If we woke up tomorrow and knew everything, life would be fairly boring!

YG: How do you find this resonates with people from various backgrounds? How do you involve different stakeholders?

EM: There are a variety of stakeholders who are key for the circular economy.

The first group is educators. Our mission is to stimulate pioneering circular economy teaching, learning, and research across a network of world leading universities, and to inspire the necessary creativity and thinking in young people to support the transition to the circular economy.

We believe education is a powerful catalyst for change – it helps students to view the world differently and provides them with the skills necessary to thrive in and shape our modern economy. Our Schools and Colleges Program⁵ works closely with educators worldwide to support them in embedding a systems approach to how an economy can work using the circular economy framework.

These are two relationships in two different areas of education. With the Schools and Colleges Program, for example, we work together with the International Baccalaureate Organization and United World Colleges to develop curriculum materials for secondary students. The Foundation also works with higher education institutions worldwide to develop, share, and scale circular economy learning and aims to develop a strong relationship with both universities

and university students. These are very different ways of collaborating – one revolves around creating education materials, the other revolves around innovation. But the whole idea is to spread the circular economy and help multiple organization understand it.

From a business perspective, we have the CE100 Network,⁶ a pre-competitive innovation program helping organizations to develop new opportunities and realize their circular economy ambitions faster. We bring corporations, governments and cities, academic institutions, emerging innovators, and affiliates together on a multi-stakeholder platform. There are specially designed program elements to help members learn, build capacity, network, and collaborate with other key organizations. Actually, bringing all these parties together around the circular economy helps all of us develop an understanding that we wouldn't have if some of them weren't in the room.

Then we have our Global Partners. With them, we work to try to understand how to transform individual business through analysis and gaining deeper insights.

With the shared ambition to realize wider economic, environmental and societal benefits, we also work with governments and cities. They play a crucial role in creating and enabling the right conditions for a circular economy to emerge. The city of Toronto has integrated the circular economy in their procurement policy, for example, and San Francisco has passed a law requiring Cradle-to-Cradle carpets to be installed in all government buildings. At the national level, the French government is currently drafting circular economy legislation, countries like Finland and Denmark have circular economy roadmaps in place, while China was an early adopter of circular economy legislation in its 11th Five Year Plan.⁷

Beyond this, our activities extend to a wider network of international bodies such as the European Commission, the UN, the OECD, and the G20.

We also focus on systemic initiatives applying circular economy principles to key materials streams. We are bringing together key industry stakeholders to rethink the plastics economy, but also the fashion industry and the food system.

Recognizing the importance of information and knowledge sharing, the Foundation communicates cutting edge ideas and insight on circular economy through digital media, its websites,⁸ research reports, case studies, and books⁹ (Figures 3 and 4).

So we have this broad structure with many different stakeholders in the room because the circular economy is very broad – it's the *entire* economy (Figure 5).

Figure 3 (left) Cover of the report titled *Cities and Circular Economy for Food*. © 2019 by Ellen MacArthur Foundation.

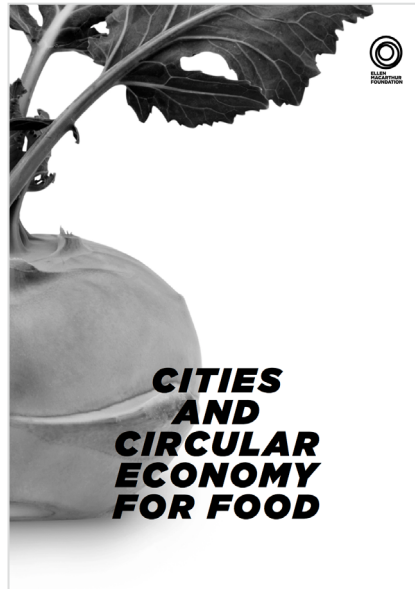


Figure 4 (right) Cover of the report, *The Circular Economy Opportunity for Urban & Industrial Innovation in China*, The Ellen MacArthur Foundation, 2018, available at <https://www.ellenmacarthurfoundation.org/publications/chinareport>. © 2018 by Ellen MacArthur Foundation.

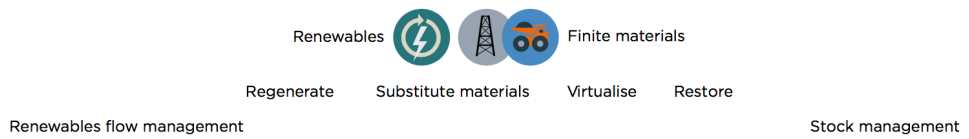


OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

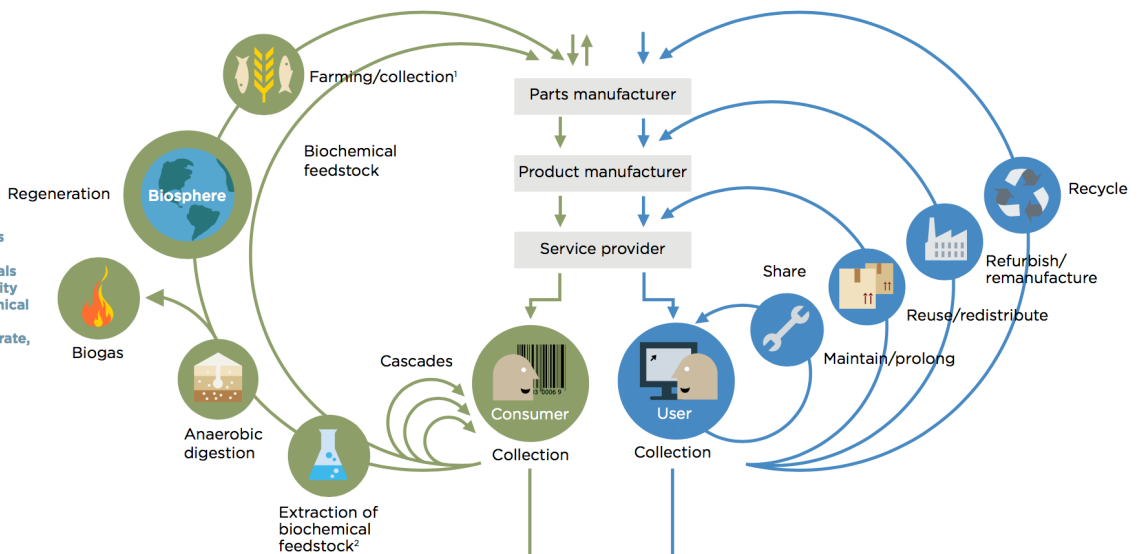
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
 ReSOLVE levers: regenerate, virtualise, exchange



PRINCIPLE

2

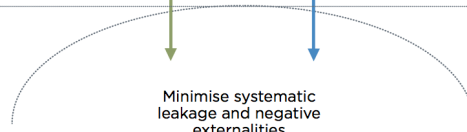
Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
 ReSOLVE levers: regenerate, share, optimise, loop



PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
 All ReSOLVE levers



1. Hunting and fishing
 2. Can take both post-harvest and post-consumer waste as an input
 Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Figure 5 The circular economy system map. Image from Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; adapted from Michael Braungart and William McDonough, *Cradle to Cradle: Remaking the Way We Make Things* (New York: North Point Press, 2002). © 2015 by Ellen MacArthur Foundation.

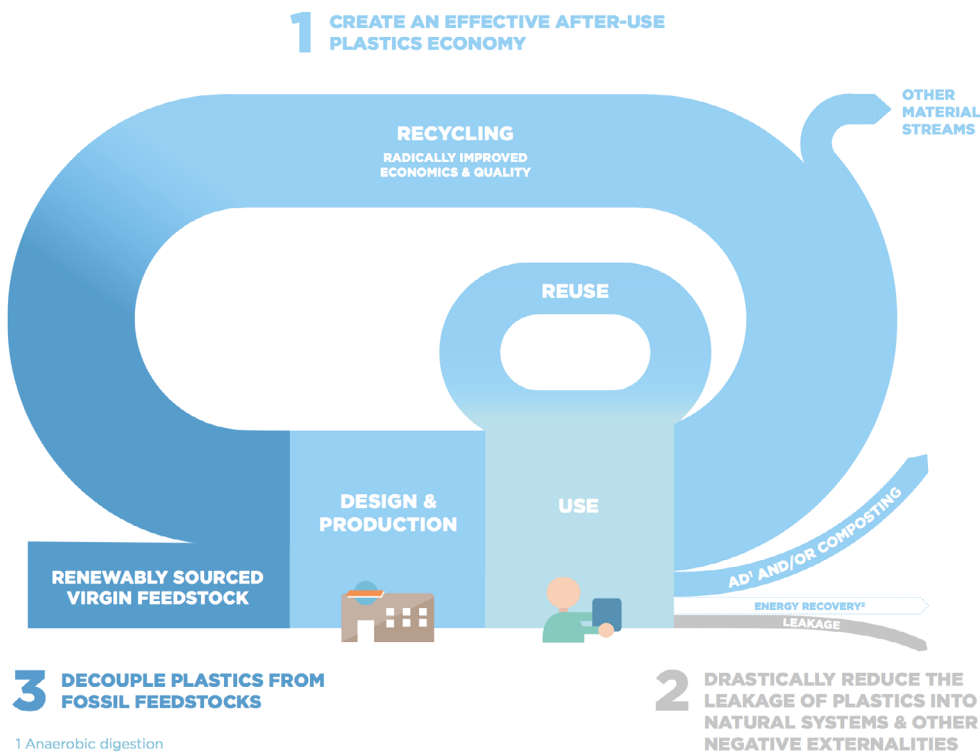
YG: Where do you see the Foundation going in the next decade? What do you think will be the next step?

EM: I think we will continue to do what we do. In principle, those areas – business, cities and governments; economic analysis and insight; systemic initiatives; education and communication – have been there from the beginning.

The systemic initiatives have been an important development of the Foundation’s work over the last years. This is about trying to actually *physically* challenge the global material flows. The new plastics economy is one example (Figure 6). Plastic packaging represents 78 million tons a year. Most of it is not valorized at all. Only fourteen percent globally is collected for recycling and only two percent is recycled to the same quality of material. How do we tackle that systemic challenge? The only way is to get everybody into the room together – cities, regions, chemical companies, brands, waste reprocessors, and others – and say, “What system *could* work?” In October 2018, we launched the New Plastics Economy Global Commitment in collaboration with UN Environment: a

set of targets to eliminate plastic waste and pollution at its source. It has been endorsed by more than 400 organizations that are determined to build a circular economy for plastics, including many of the world’s largest packaging producers, brands, retailers, and recyclers, as well as governments and NGOs. Signatories include well-known consumer businesses such as Danone, H&M group, L’Oréal, Mars Inc., PepsiCo, The Coca-Cola Company, and Unilever, plus major packaging producers, plastics producers, and resource management specialists.

Where I see us moving forward over the next decade? We will continue to work in these areas we know to be crucial: cities and governments; businesses; education; insight and analyses; systemic initiatives; communication; and working on analysis and insight. The systemic initiatives have also proven to be very powerful because they begin to demonstrate *how* to create systemic change, and then, ultimately, show *what* these changes will look like. Systemic change lies at the heart of a circular economy, so we have to figure out exactly how that kind of change happens.



1 Anaerobic digestion
 2 The role of, and boundary conditions for, energy recovery in the New Plastics Economy need to be further investigated
 Source: Project Mainstream analysis.

Figure 6 Ambitions for the new plastics economy. Image from *The New Plastics Economy: Rethinking the Future of Plastics*, The Ellen MacArthur Foundation, 2016, 31, available at <https://www.ellenmacarthurfoundation.org/publications/the-new-plastics-economy-rethinking-the-future-of-plastics>. © 2016 by Ellen MacArthur Foundation.

YG: At the Foundation you have developed a university network and a range of educational programs. What is the thinking behind this?

EM: The Foundation works with higher education institutions worldwide to develop, share, and scale circular economy learning. Higher education is a priority focus for the Ellen MacArthur Foundation. We have a vision of a global network of higher education institutions that explore, develop, and critique key ideas. To bring this about, the Foundation is working with universities around the world, as they themselves work with business, to find solutions which educate and inspire future leaders to address emerging economic realities.

We are building on the success of the Schmidt MacArthur Fellowship program to design an entirely new learning program. This combines online learning with collaborative, face-to-face workshops designed to give the next generation of circular economy pioneers the knowledge, tools and networks to lead the transition to a circular economy. As we did with the Schmidt MacArthur Fellowship, we are connecting with the Foundation's extensive networks in academia, business and government to create a unique learning experience for the participants. The first set of learning paths are available on the resources section of our website, giving people the chance to go deeper on a range of topics.

YG: We know that with IDEO you have launched the *Circular Design Guide*. How do you think this can help disseminate the ideas of the circular economy?

EM: We have an ambition to reach the people who impact materials flows on a day-to-day basis, from those involved in the design and creation process of a huge business, to those working in an agency or independently, or people learning their craft at student level. We created the *Circular Design Guide*¹⁰ as a first step, hoping that people understand and experiment with these new approaches. For us, that's a very positive thing. We could have tried to do that by ourselves, but we don't have the knowledge and expertise that IDEO has. We don't have the network that IDEO has. Just partnering with them as a multiplier for us is very important. The partnership expands our network, and our collaboration expands the ways we think about and approach the topic of the circular economy more generally.

YG: What role does design play in the circular economy?

EM: Design obviously plays a vital role in the circular economy, but it can't exist on its own. There is the designing of products, but there is also the designing

of services and the designing of *systems*. Many people think about design in terms of objects, but design actually involves more than objects. As a designer, you know what I mean – designers design cities, materials flows, waste flows, nutrient flows. Designers look at mobility, and at food systems. Design is massive, but we can't look at design in isolation. What we try to do at the Foundation is not focus on one element in isolation. The circular economy looks at design, materials science, systems, cities, infrastructure, business models, and the financing of those business models. Design is absolutely critical, but it can't sit on its own, it has to be integrated with the rest of the system. As a result, we recently announced an ambition to reach 80 million designers and creators with the basics of circular design, and empower them to have a positive impact.¹¹

YG: Do the established disciplines and sciences have the power to generate the changes we need in the world today? Are they enough? What must people in the established disciplines do to achieve a circular economy?

EM: Are they enough? It's an incredibly hard question to answer. Together, they demonstrate the fact that you need to work in interdisciplinary ways to create the changes that are necessary. But in their own right they are not enough – you need more. You need a broader input of people and thinking. You have to start somewhere. It's back to the fellowship question of "Where do we begin? What's the best plan? What participants do we begin with and where do we end up? Is it enough?"

It's a good start. We can bring people together around the table who can effect that change if they understand the systemic nature of what has to happen and they create the dialogue with those other people who have to make that change happen. It's the same within a business – where do you start? When you're trying to go from linear to circular, you can't speak to everybody. Who do you go to? Where do you begin those conversations? We have a picture of the circular economy that is something like a sixteenth century map. We see the general contours of it – what is missing are the details about what it would look like in each country and each sector, and at any scale. I think we have a very good starting point. We have enough to get the momentum going and continue the conversation.

YG: You've studied the circular economy in China extensively, and you published a report focusing on China in 2018. What do you see as the challenges and opportunities for China?

EM: There are some big challenges – but *all* countries in the world face these challenges. We know that the linear cannot work in the long term. The majority of the economy is still linear, so therein lies the challenge. We have to shift to a restorative and regenerative economy that can work.

Our study on China¹² identifies opportunities across five focus areas: the built environment, mobility, nutrition, textiles, and electronics. It shows that a nationwide transition to a circular economy presents cities with significant opportunities for value creation, economic growth, and further innovation, while enabling them to become more livable for citizens. In China, applying circular economy principles at scale could save businesses and households approximately CNY 70 trillion by 2040 (16% of China’s projected GDP). This would enable more people to enjoy a middle-class lifestyle, while at the same time see China’s cities reduce emissions of fine particulate matter by 50% and greenhouse gases by 23%, and reduce traffic congestion by 47%.¹³

China is a pioneer of policies and practices in the transition to the circular economy. But we need more joint initiatives worldwide, and we need to globalize the circular economy. The “Memorandum of Understanding on Circular Economy Cooperation”¹⁴ between the EU and China signed in July 2018 represents a major milestone. This agreement could pave the way for China and the EU to create the building blocks – like product standards and policies – of an effective circular plastics economy, for instance.

Since 2016, the Foundation has been actively working to engage circular economy actors in China. We are committed to following China’s circular economy development, and believe that coupling this new understanding with our established networks can create a mutually beneficial mechanism that will leverage China’s remarkable progress to date.

YG: I have one last question. Your personal story is exciting and inspiring. You went from being a solo, around-the-world sailor to the leader of a team of more than one hundred people. What changes do you see in yourself?

EM: It’s a big change, but there are strong similarities. The first similarity is that when you try to break a round-the-world record, you have a clear goal. You want to be the fastest person ever to sail solo, non-stop around the world. Only when you have that goal, can you actually make that happen.

You know, I didn’t say, “I want to go sailing.” I said, “*This is the goal.*” I wanted to be the fastest person ever to sail solo around the world. That

focused the efforts of fundraising, designing, putting a team together, and preparing for the journey. It’s a complex project that involved many elements, all focused around that goal – to be the fastest.

So for the circular economy, what is the goal? To shift from a linear economy to a circular economy. That’s complex. It involves many different organizations, people, conversations, and inputs. But the goal is clear – linear to circular.

We need to understand many different elements on that journey. So the goal element is just the same, the team element is the same. It’s easy to imagine that sailing solo is all about just the sailor alone, on the boat – but it’s not like that at all. I had an amazing team of people to work with who designed the boat, built the boat, prepared the boat, and helped me practice on the boat. A skipper has to understand the engineering, the design, the sails, the technology, and the computer systems – all in great detail. I worked with an amazing group of people to do that. I worked with a team that was on the boat every day, but also with many teams not on the boat who made the equipment, the rope, and the sails.

It’s the same in the circular economy. You know, we have our team at the Foundation, but without the relationship we have with Tongji University for example, working with Global Partners, CE100 companies, and Knowledge Partners, this can’t happen. You build a team around you, and that wider team is very important. Our ambition to address ocean plastic pollution is a great illustration of this: to be successful at the systemic level, we need the full participation of every actor across the whole value chain – from resin producers and manufacturers through brands and retailers to collectors and recyclers – plus governments and NGOs. If we didn’t bring these wildly disparate organizations together, the results would be far less impactful.

When we talk about the circular economy, we talk about changing the system. And one thing I did understand from sailing around the world is systems. There was the system I lived on – the boat – which I had to run and maintain, and keep the battery charged. I needed to eat enough to survive. I had to monitor *everything*, and check that everything was not about to break.

I was constantly aware of what was around me in my little system, and acutely aware that the little system of my boat lived in a much, much bigger system – the world, the weather, the water temperature, the air temperature, the wave height, the depth of the ocean, and the 500 HPA charts I studied to see where the weather was going to go.

I saw that I was a part of this big system. Everything in that big system is interconnected. Did you know that when the water temperature changes by two degrees, the wind speed changes and the wind direction will change? It takes years to understand how the water temperature change affects the wind speed. That understanding of interrelated elements is very useful for the circular economy. Because it's the same – it's incredibly complex, but everything is interconnected.

Acknowledgments

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Notes

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- 2 Hunter Lovins, "3 Circular Principles for Healthy Agriculture," *GreenBiz*, February 11, 2017, accessed August 12, 2019, <https://www.greenbiz.com/article/3-circular-principles-healthy-agriculture>; L. Hunter Lovins, "The Circular Economy of Soil," in *A New Dynamic 2: Effective Systems in a Circular Economy*, ed. Ken Webster (COWES: Ellen MacArthur Foundation, 2016), available at <https://www.ellenmacarthurfoundation.org/publications/a-new-dynamic-2>, chapter podcast available at <https://circulatenews.org/2016/05/hunter-lovins-the-circular-economy-of-soil/>.
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- 5 For more information, see <https://www.ellenmacarthurfoundation.org/programmes/education/schools-colleges>.
- 6 For more information, see <https://www.ellenmacarthurfoundation.org/ce100>.
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- 12 Ellen MacArthur Foundation, *The Circular Economy Opportunity for Urban and Industrial Innovation in China* (COWES: The Ellen

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13 *Ibid.*, 11.

14 For more information, see European External Action Service, "Joint Statement of the 20th EU-China Summit," news release, July 17, 2018, https://eeas.europa.eu/headquarters/headquarters-homepage/48424/joint-statement-20th-eu-china-summit_en; and http://ec.europa.eu/environment/circular-economy/pdf/circular_economy_MoU_EN.pdf.

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