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Luis Neves
CEO of GeSI

#DigitalOpportunity

ICT HOLDS THE KEY TO A GREEN FUTURE

**WHY DIGITAL TECHNOLOGIES ARE FUNDAMENTAL TO
ADDRESSING CLIMATE CHANGE**

November
2022





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DIGITAL OPPORTUNITY

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EDITOR'S NOTE

WHY DIGITAL CONNECTIVITY IS A FUNDAMENTAL HUMAN RIGHT

The power of positive thinking – digitalization is our sustainability solution



Gavin Allen

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At the tail end of September, two entirely unrelated debut events took place more than 15,000 kilometers apart. One was the inaugural International Carbon Handprint Awards in New York. The other was the first-ever Tech4City event in Singapore, organized by Huawei.

Different cities, different themes, different target audiences. And yet their central rallying cries unwittingly overlapped, resonating with the theme of this edition of *Transform* magazine: digital opportunity – the sheer unparalleled potential of technological innovation to embed reductions in carbon emissions and connect the unconnected. Together they provide the key to transforming the battle against climate change and turning that fight in our favor.

A sustainability machine

In New York it was the statistics that shone through: the scale of what the winning innovations would do to tackle emissions – “handprint” tech to reduce others’ carbon “footprints”. In 2019, the last “normal” baseline year pre-Covid, London’s greenhouse gas emissions were 31.4 MtCO₂e (million metric tons of carbon dioxide equivalent). Use of a single data-optimizing device from one of the award-winning companies on the night would save that much in just four years.

In Singapore it was a closing speech from the CEO of Huawei International Foo Fang Yong that stayed in the memory. Celebrating the innovative ideas from

young tech entrepreneurs to improve the city’s cultural, environmental and community life, he reached for a quotation from Albert Einstein: “Logic will take you from A to B. Imagination will take you everywhere.”

A Focus on the upside

And that sentiment was echoed by Luis Neves, CEO of the Global Enabling Sustainability Initiative (GeSI), when we met to discuss the subject of digital opportunity for *Transform*.

“Digital technologies are fundamental to addressing climate change,” he told me, citing the enabling effect of ever-more imaginative innovation. “There is a lot of focus on the problem side, but we need to focus on the solution side.”

Luis argues it’s a “universal right” for everybody to be connected: “Once you provide connectivity, you are also providing the fundamental conditions to reduce carbon emissions.”

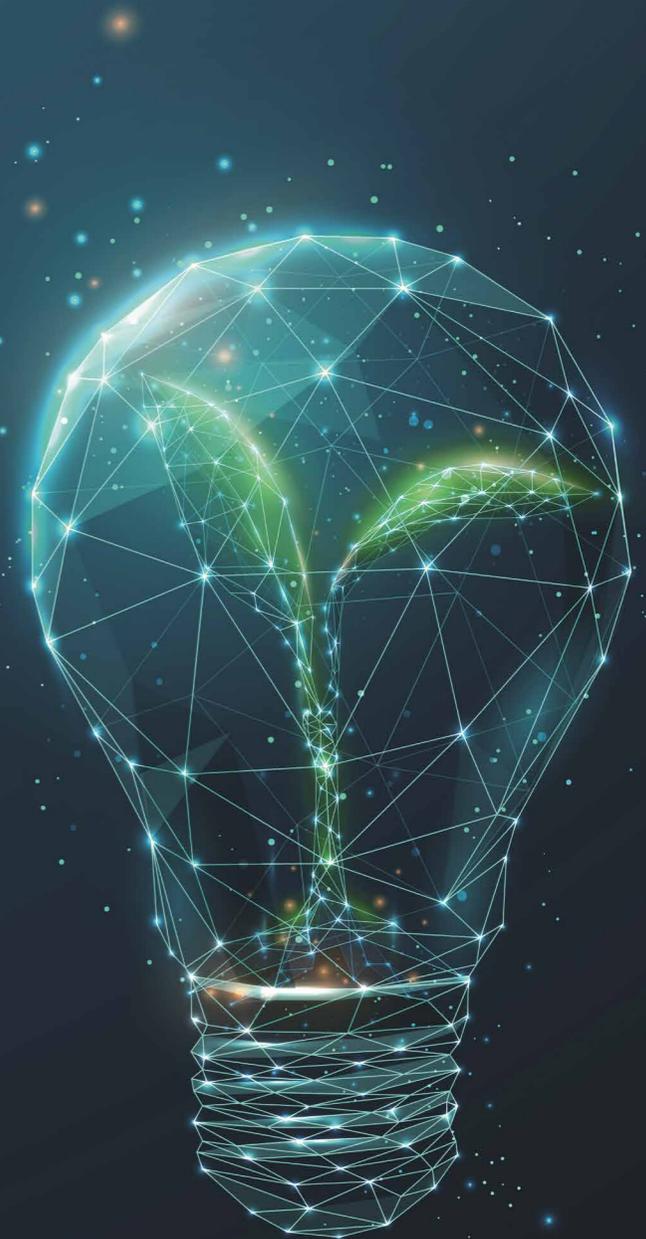
He cannot understand why digital is not at the heart of all climate change discussions and says showing CEOs the benefit of digital and sustainability combined – that there are profits to be made – will be key. “Because this is an atomic bomb, actually, that we could use to put the world on track.”

Also in this edition, we’ll hear how Huawei engineers slashed the cost of building a rural mobile base station from \$330,000 to just \$15,000... explain why viewing companies and countries only as sources of emissions could be an anti-innovation approach... preview a new White Paper on the green enabling effect of 5G... and take a look at four global snapshot studies highlighting how digital inclusion could:

- Reinvigorate elderly populations in Malaysia
- Rebuild rural counties in Kenya
- Boost higher education in the Philippines, South Africa and Australia
- Improve e-business and finance for micro-to-medium enterprises in eastern and southern Africa.

We’ll also show the real-life impact of Huawei’s commitment to connecting the unconnected with video stories from Bangladesh and France to Nigeria and, yes, even small-town America.

We hope this edition helps shift the focus away from solely being on the costs and restrictions of tackling climate change. Instead it’s time to start shining a brighter light on more positive enabling solutions.



ICT IS THE "ATOMIC BOMB" FOR GREENING THE PLANET



Luis Neves

CEO of the Global Enabling Sustainability Initiative (GeSI), explains why technology could blast through obstacles and put the world on a path to sustainability

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Gavin Allen: I'm delighted to be joined by Luis Neves, the Chief Executive of the Global Enabling Sustainability Initiative (GeSI). Luis, the litany of natural disasters that we've seen this year - is that a wake-up call to the world to finally take real action?

Luis Neves: Definitely. But these natural disasters have been happening now for quite some time. I think we are still in a kind of sleeping mode. We look at these happenings and see them as part of our normal life. We have not yet reacted in a proper manner, both personally and from a business perspective.

Gavin Allen: You've got a summit called Digital with Purpose, of which Huawei is a partner and co-founder. What do you want to achieve with this event?

Luis Neves: Digital technologies are fundamental to addressing climate change. Every single piece of research that GeSI has commissioned since 2007 shows that the more we deploy digital technologies, the greater the contribution to lowering carbon emissions.

But from a policy standpoint, we are not seeing enough support for this agenda. There is a lot of focus on the problem side, but we need focus on the solution side. And so we need make this call to the world, to organize the summit. The world will have 10 billion people in a couple of years. It's urgent that we start the conversation about how digital can really help to make this world a better place.

Luis Neves
CEO of GeSI

Gavin Allen: Often, because of energy emissions, the spread of technology is seen as adding to the problem. You're saying that ICT and the tech industry is actually an enabler for the solution?

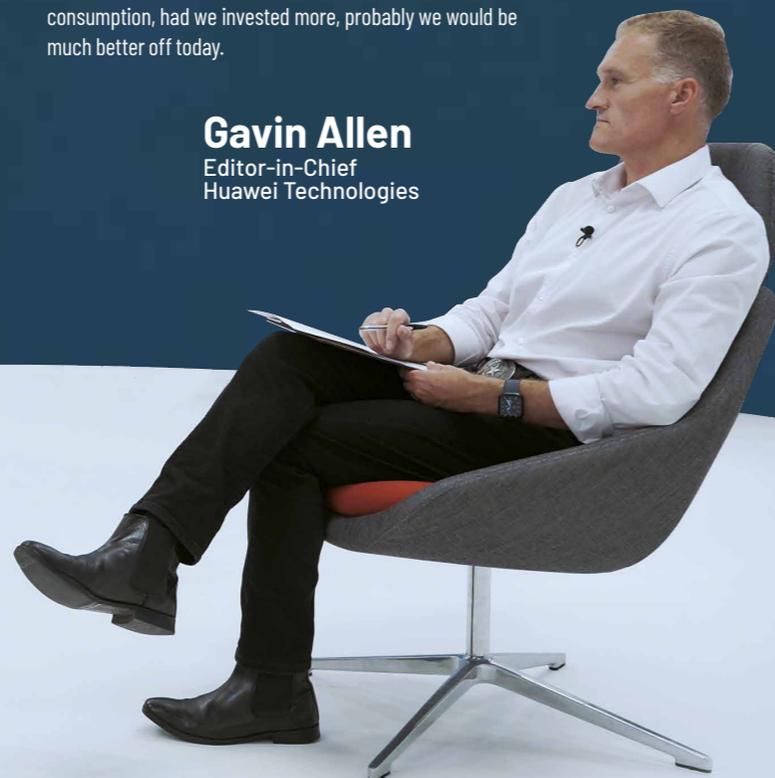
Luis Neves: Digital technologies are the solution for the problems that we are facing. At GeSI, we have been looking at the impact of digital technologies in relation to sustainable development since 2008. The first smart report for GeSI by McKinsey found that **digital technologies can reduce a quantity of carbon in various industry sectors 5.5 times greater than the carbon footprint of ICT itself. This is known as the "enabling effect."**

We've done the same report with different consultancies: in 2012 with Boston Consulting Group; in 2015 with Accenture Strategy. What we saw is that the multiplier changed over time, eventually reaching a factor of 10. So **the enabling impact of digital is undeniable.** That means the more we deploy, the more we invest, the more connectivity we give to people, the better contribution that we are making to the world.

Gavin Allen: Is it the great untapped, almost unrecognized resource? Are we being too slow to recognize that the solutions are almost in front of our face?

Luis Neves: We are. Policymakers need to pay attention. Had we considered the relevance of digital to address energy consumption, had we invested more, probably we would be much better off today.

Gavin Allen
Editor-in-Chief
Huawei Technologies



Gavin Allen: Huawei has a "more bits, less watts" approach, pushing for digitalization and de-carbonization. Do you think those twin elements are critical?

Luis Neves: Huawei's approach is the right one, although I think Huawei has not really been selling this in the proper manner. This can be promoted, this can be used to better sell Huawei's products into the market and position the company at the global level.

But this is not only related to Huawei. I've been seeing other companies not understanding the potential of the technology for people.

Gavin Allen: What two or three things do you really want to change, to stop the "sleepwalking" you mentioned earlier?

Luis Neves: Policy has been very much focused on the problem side, not on the solution side. So if you look at the European Green Deal, you see a lot of concerns about what kind of legislation needs to be put in place for companies to comply with something. Companies are worried about policymaking, so they pay a lot of attention to how can they respond to policymakers.

Instead, companies could help policymakers better understand the enabling capacity of digital technologies. This shift is urgent, and it will happen faster if companies educate policymakers about the benefit of those technologies. But that work has not been done.

Gavin Allen: And is this where we come to the topic of carbon handprints: the impact of those technologies on other industries, other sectors?

Luis Neves: Exactly. Digital is not only telco or telecommunications, it is everywhere. The energy sector, the power sector, agriculture, transportation, education, healthcare, and so on.

At GeSI, we ourselves have been, up to now, a kind of telco-driven organization. But we just spent the last three months looking at how we can change, to put digital at the center.

Gavin Allen: So, a much more joined-up approach?

“The enabling impact of digital is fantastic.”



“Telecommunications are basically a universal right”

Luis Neves: Exactly. And then **if you bring a sustainability mindset together with digital, I think we can create a powerful machine really to drive the sustainability agenda.** My ambition is that we move companies away from "the promise" conversation. So, at the climate summit, you have all those companies saying, I'm reducing 20% of my carbon emissions, 30%.

It's a conversation that companies like very much. But it's a bunch of nothing. And so that's one of the key things about Digital with Purpose. We are putting in place a framework that brings transparency to the process and helps companies on their journey to the sustainability agenda.

Gavin Allen: What are you doing with the EU on the carbon handprint to ensure that everyone works from the same metrics?

Luis Neves: The European Commission invited GeSI to develop a European standard to measure the handprint. That's a project that will last at least two years. Around 40 companies in Europe are collaborating with us in developing what will be the measurement solution for the handprint at the European level.

Hopefully, GeSI can eventually apply this at a global level because we are a global organization. We are already talking with different standardization organizations, such as the ITU, about how to apply this globally.

Gavin Allen: Do you think every company, maybe every country, should have a carbon handprint score?

Luis Neves: Well, we need a common measurement. It's fundamental. It will be very difficult for many reasons. But I hope that the end results of our European work can be applied at a global level.

GeSI is a business organization, but we have opened up to different stakeholders. We have universities working with us, and United Nations organizations like the ITU, UNEP, the UN Climate Convention. We have other business organizations like the World Business Council, or the International Chamber of Commerce. We have NGOs working with us, like the Carbon Disclosure Project.

We developed a set of metrics designed to help companies on their journey. And we are not asking the companies, "Okay, tell me if you'll be reducing 20% or 30%." What we are saying instead is, "Walk the talk, show me how you are progressing."

We attach the certification model to that with different layers. We call it The Road to the Sky. It's about an ambition. It's about getting there. So if, in 10 years' time, any company is halfway there, it's good.

Gavin Allen: Is there too much focus on a company's footprint, rather than the wider benefits of technology?

Luis Neves: That's what gets me mad. Companies are mostly focused on the footprint. It's nonsense.

Every company should take responsibility for its own footprint; that should be part of the business. But the enabling side, the handprint, is also the business. In Digital with Purpose, we developed both for the footprint and for the handprint for the first time. There is no other framework in the marketplace that takes both things into consideration.

You need to bring sustainability into the DNA of the company, bring it, top-down, to procurement, marketing, sales, product design, and so on. Once you

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Connectivity provides the fundamental conditions needed to reduce carbon.
 ”

do that, you have the instrument to address the footprint and the handprint. Right now, companies receive lots of different requests from different organizations to fill in metrics: on climate, on supply chain, on privacy, on inclusion.

We put everything together, aiming to give companies a "Digital with Purpose" stamp. That way, every single customer, B2B to B2C, understands this is a good company.

Yesterday I was on a debate with UNEP, United Nations Environmental Program, around what are the requirements to better inform the consumers that this product is green, or is not green. And the conversation was crazy. For instance, on the e-commerce platforms, such as Amazon or Alibaba. Companies are putting their online products and saying "My product is great." If they are selling a laptop computer, they say, "My laptop is more energy-efficient than the others."

But the green dimension of the product is not only about the product's energy-efficiency. You have to consider many other factors.

Take a product like cosmetics. Say a given company sells cosmetics online as a green product, because they have put a couple of measures in place. They explain this to their customers. But if I buy that, and have it delivered to my home overnight, it's no longer a green product.

That's why we need a different approach.

I'm very happy Huawei has joined this process. It is a journey that will take us a couple of years. But I'm convinced that in 10 years' time, we all will be much better off together.

Gavin Allen: We will be heading to the sky, as you said. But one of our core mantras is about connecting the unconnected. We've talked a lot about digitalization. But how important is it to bridge the digital divide? If you're going to have a sustainable, green future, how critical is that connectivity that benefits everyone?

Luis Neves: Connectivity is the fundamental piece of the conversation. Without it, we're not going anywhere. Twenty years ago, the telecommunications sector was a public sector, and we were talking about "universal service." There was a requirement to provide communication to anyone. It was a right.

That right has disappeared to some extent, and we live now in a competitive environment – which I think is good. But in this environment, we need to create the conditions for companies to apply technologies all over, for everyone. Otherwise, we'll be lost.

Gavin Allen: How do you make sure no one is left behind? How do you connect the unconnected?

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I do not understand why digital is not at the core of the climate conversation.
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Luis Neves: From a policy standpoint, you need to create the conditions for the companies to invest in less profitable markets. For example, if you do not provide connectivity to farmers, you cannot apply intelligent technologies to agriculture. You cannot reduce water consumption, you cannot control the crops, and so on. So, policymakers need to create the conditions for the private sector to invest in remote areas where connectivity is needed. Telecommunications are basically a universal right, and everybody should be connected.

Gavin Allen: So are we losing sight of those who are potentially left behind?

Luis Neves: We are. Once you provide connectivity, you are also providing the fundamental conditions to reduce carbon emissions.

In 2017, we did a study about the impact of not having connectivity across the world. And the conclusion was that we were losing per year 7% of the world's GDP. So we're losing a lot of money.

Bottom line: We're not providing communications to those in need. GeSI developed a Digital Access Index showing where 156 countries ranked with respect to technological development. Countries that have no connectivity are at the bottom of the index. They are the least developed countries, without education, without proper health.

Countries at the top, like Germany, Sweden, and so on, with full connectivity – they prosper, they grow. We need to bring that to every single country. But if you go to a climate summit, you don't hear anything about digital. It's simply stupid. **I do foolish understand why digital is not at the core of the climate conversation.** They talk about the oil industry, but we know those industries are polluting and there is a need to change. But digital can be the agent of change.

Gavin Allen: You've talked about sustainability as a cash cow for businesses. How do you get businesses to recognize that this isn't a burden, this is a massive opportunity for them?

Luis Neves: That's a good question and very difficult to answer, because companies are very much focused on short-term profitability, maybe because they have to be accountable to their shareholders. But what we have seen in reports like GeSI Smarter 2030 is that efficiencies around digital technologies applied to electric power, agriculture, transportation, e-commerce, buildings, just to name five industry sectors, would generate a benefit of \$11 trillion. Why are these companies not looking into that?

Gavin Allen: Why isn't there even more investment in digital? What is holding investors back?

Luis Neves: I knock my head against the wall to understand that. If the companies think with purpose, they would probably give the answer to your question. I do not see many CEOs that are purpose-driven. A CEO of a company can only be accountable to shareholders. But the company is part of society. It has a responsibility towards the society. Part of the CEO role is to understand that.

Digital with Purpose is a CEO-driven movement. And if we get the commitments from the CEO to the movement, we can accelerate the process. And one of the things that we have in the movement as well is that we will not be allowing for any greenwashing.

Gavin Allen: It's a commitment.

Luis Neves: It's a commitment. If they are not progressing, we throw them out. We don't want them. Either they progress or they have to leave. That's the way we can transform and accelerate.

And I think this is probably the answer to your question. It's about how do we make sure that the CEOs understand the benefit of digital and sustainability combined. Because this is an atomic bomb, actually, that we could use to put the world on track. If you think about the world with 10 billion people in 30, 40 years' time, we need fundamentally to change the way that we are operating. We cannot continue on *with* business as usual.



Scan QR code
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full interview video

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**We can create
a powerful
machine to drive
sustainability**

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CARBON HANDPRINTS ARE MORE THAN JUST A NUMBER

An interview with Tiina Pajula, Senior Principal, AFRY, Finland



What exactly is a carbon handprint?

It's a positive impact that helps others reduce their carbon footprint. You do it by providing new technologies, energy solutions, raw materials, or business models that replace something currently being used.

Is the handprint a number?

Yes, it's a numerical score you get when once you're able to quantify how many kilograms of CO₂ you could help someone else cut. You can score an individual product, but you can also assign a number to quantify total yearly output or the product portfolio of a particular division of your company.

Does having a handprint reduce your footprint?

No! This is the biggest mistake companies make. They quantify their footprint, and their handprint, then subtract the handprint score from the footprint score and say they're carbon neutral, even carbon negative.

But the handprint and the footprint express different things. Generally speaking, they should not be combined. Trying to mix them could actually be seen as greenwashing.

Why is it wrong to subtract the handprint from the footprint?

There are some situations where you might combine them, but it would create

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Now that investors have joined this discussion, companies need to start thinking about it.
”

a mess. The footprint measures actual reductions in carbon emissions. The handprint measures emissions avoided – that is, they never happened. It's not fair to compare something that never happened to emissions you actually create. Most companies do this by accident because they misunderstand the concept. But we need the discussion to make it clear.

Are there any international standards for calculating handprints?

Not yet. That's why we started to develop a method for quantifying carbon handprint. It's 80% based on existing standards – of life cycle assessment, of carbon footprint, etc. We only added one specific element: defining how you select the baseline. Choosing your baseline is critical, because the worse your baseline, the better your handprint. That part is not yet standardized, but hopefully it will be in the future.

What's the benefit to a company of having a carbon handprint?

Companies want to communicate their positive impact, and quantification helps. But it has turned out to be useful for other things too, such as product development. We have many companies which, during a product development phase, felt, “Wow, this is a very green product and should have a handprint.” But after some analysis, they realized there wouldn't be one, and this was a shock, and an eye-opener.

But it turned out to be a very useful way for companies to identify where they could improve. So it can be used for strategic decision making.

Back in 2018 you co-authored a report which stated that, “the use of the handprint clearly looks set to increase.” Has it done so – at the rate you expected, or hoped for?

It has increased, but I've run into different types of handprints, and not all are in accordance with the baseline approach. It's country-specific, too. Canada is really excited about this, but in Sweden, they are worried of being accused of greenwashing. So it depends. I think it's important that once you do it right, it should not be seen as greenwashing.

Huawei is driving a “more bits, less watts” approach – digitalization and low carbonization to enable green development. What more would you like to see companies like Huawei doing?

In order to track resource use, you need lots of data on the product. The more information you have on various processes, the more timely you will

be in doing the right things. I hope this sort of data will be made available automatically in the future.

Should policymakers demand that handprints be compiled and published?

I give this a 50-50 possibility of happening. In the EU, for instance, some politicians are developing a new taxonomy, to establish a list of environmentally sustainable economic activities. And there have been discussions about whether the handprint approach could play a role there. But I don't think it will happen any time soon. This does divide authorities.

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Having a handprint does not reduce your carbon footprint.
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This year alone we've seen droughts, wildfires, floods – horrific tragedies. But perhaps in a terrible way, the “shock and awe” will wake people up to the urgent nature of global climate change?

Not all companies have been interested in sustainable development and climate mitigation. Now, the problems are becoming too obvious to ignore.

But again, it's different in different continents, industrial sectors, markets. Some companies are already taking this seriously. Some talk a lot, but don't do much. The rest don't really care yet. Luckily, at least in Europe, investors and authorities are pushing more. I think now that investors have joined this discussion, it's a signal that companies really need to start thinking about this.

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You can score an individual product, or products from part of your company
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Five years from now, what would be the ideal state of play in terms of companies' and consumers' and policymakers' relationship with the carbon handprint?

I hope companies have implemented it in a way that they really see the benefit of it, using it for product development, strategic decision-making, and customer communication. I hope it's widespread and well understood, so people know what it means and, just as important, what it does not mean, because now there's a bit of confusion around this and still lots of misunderstanding.

So there's work to do to spread the knowledge and educate each other. I'm glad Huawei is writing about this!

DIGITAL COOPERATION DRIVES A GREEN TRANSFORMATION IN EUROPE

Within the OECD, European countries occupy the top 15 slots for lowest greenhouse gas emissions. But the continent's green transition faces major challenges. These include the electrification of heating, transport and industry – a process that experts say requires a build-out of the electricity sector “at a scale that is hard to grasp.” In addition, the electricity generated must come from clean-energy sources, such as solar and wind.

Reuters, with support from Huawei, will publish a forthcoming white paper looking at how Europe can rise to meet these and other sustainability challenges.

Check the Transform website for updates



TECHNOLOGY'S HIDDEN HANDPRINT

You can't always see it, but it's there



Dr. René Arnold

Huawei VP Public Affairs Strategy, looks at the different ways in which tech is helping others operate more sustainably

The term carbon handprint was first officially used at a UNESCO conference in 2007. Anders Andrae, a Huawei researcher in Stockholm, was among the first to popularize the term, which refers to the indirect, positive effect of digitalization on carbon emissions across businesses and society.

That positive effect is significant: Andrae estimates that the emissions avoided by digitalization are roughly 11 times greater than technology's direct carbon footprint.

Some of these effects are obvious. Just think of the number of video calls you've been on in the past two years, and how many miles of travel they probably saved. In the same vein, digital sensors that prevent unnecessary heating or lighting in buildings eliminate greenhouse gas (GHG) emissions.

But the world is full of other, more subtle examples of digitalization's carbon handprint. Huawei collaborated with Germany's Wuppertal Institute for Climate, Environment and Energy to develop a series of reports shedding light on just what they were.

Digital, down on the farm

If asked to think of an industry that's highly digitized, you might not immediately think of agriculture. But digital innovation has entered farms around the world. Farmers use aerial imaging in conjunction with image recognition algorithms to optimize fertilizer and water use, reducing nitrogen residue by 30% to 50%.

Tractors and other farm machinery equipped with sensors move across fields almost autonomously today. Precise routing alone can cut fuel usage by 17%. Meanwhile, sensors can reduce pesticide use by up to 80%. And farming is seeing a shift from larger machinery to smaller autonomous guided vehicles (AGVs) or robots, which use less energy.

In cities, Building Information Modeling (BIM) helps urban planners design energy-efficient skyscrapers and subways by creating digital models of real-world objects. Tests can be run on those models before the real-world twins are built, allowing engineers to test the energy consumption of streetlights, water systems, and other vital bits of urban infrastructure before they are constructed. Ideally, cities would be designed this way from the outset, but significant improvements can also be retrofitted in many places – for example, adding capacity to existing public transport systems, thereby supporting a shift away from individual car use.

Circular reasoning

The same principle can be applied to a "circular economy" designed to minimize businesses' impact on the environment. In such an economy, waste is re-purposed or eliminated from the manufacturing process entirely, reducing flows of physical materials and their associated greenhouse gas emissions.

Digitalization goes full circle here. During product development, computer-aided design (CAD) optimizes material use at the start of the production cycle. Additive manufacturing, whose best-known application is 3D printing, allows for efficient production in small batches. This enables manufacturers to create tailored replacement parts, enabling otherwise impossible repairs and extending the useful life of a piece of equipment while minimizing waste.

Data analytics can be used to better plan and forecast material requirements, production volumes, and shipping capacity. By better matching the actual supply of goods to customer demand, these tools can also help avoid or reduce return shipments.

Manufacturing inevitably generates waste, but much of that material can be recycled. Advanced controls and robotics can sort items more accurately, to optimize the process. And digital marketplaces enable economical trading in recycled material by connecting companies that generate waste with those that recycle it.

ICT: Improve, Convert, Transform

But even the largely hidden handprint of digitalization has a footprint, so we must keep working to improve the sustainability of digital solutions themselves. For example, while data centers are becoming much more energy-efficient, those gains have been offset by rising data flows over broadband networks in the last decade.

But once again, we have an important tool that often remains absent from the public debate: data itself. Accessing, sharing, and using data from other actors helps keep the environmental impacts associated with data within

tolerable limits. Sharing data paves the way for managing complex systems using circular business models and smart, clean decentralized energy systems. In short, the only green data is shared data.

As a systematic way to think about the digital handprint, the Wuppertal Institute researchers have suggested the concept of "ICT: Improve, Convert, Transform – for sustainability."

This means we must Improve current procedures, processes and structures, and Convert existing business models into a different form.

At the same time, digitalization must also effectively reorient society towards more ecologically-sustainable lifestyles and Transform the economy.

This last level of impact will be the decisive factor in whether this effort succeeds. It must therefore be made the focus of future debate.

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Emissions avoided by digitalization may be 11x greater than technology's own footprint.
”

FROM TECHNICAL FOOTPRINTS TO HUMAN HANDPRINTS

The digital age needs a new generation of purpose-driven companies



By Dennis Pamlin

Head of Strategy, Digital with Purpose, GeSI
Executive Director, Mission Innovation's
Net Zero Compatible Innovations Initiative

Society is undergoing one of the most significant transformations in human history, one that poses fundamental questions about what we produce and how we produce it; about what we value and how those values are reflected in society; about how we interact with other people; and more.

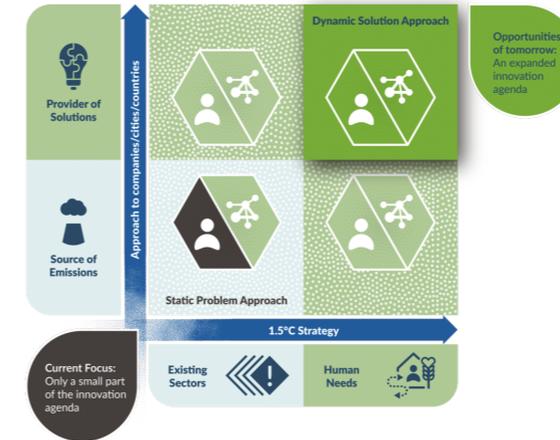
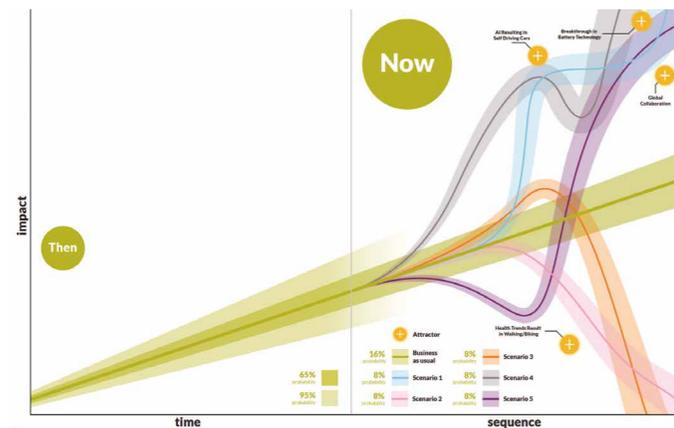
At the core of this societal shift sits climate change. How we view climate change depends in part on how we view climate science, which rests on tools and ideas that were largely unknown only a few decades ago; and on what we see as possible and desirable.

Although new solutions to climate change are emerging fast, they are often held back by existing structures and stakeholders. Current innovation ecosystems sustain economic growth primarily by improving existing systems and protecting existing assets. As the OECD notes, “most climate action today focuses on optimizing parts in systems that are unsustainable-by-design.” As a consequence, even efforts to replace internal-combustion engines with electric vehicles “can be inefficient if embedded in car-dependent systems.”

From footprints to handprints

When the focus is on improving current systems, the obvious way to approach companies is to ask them to reduce the negative impact of their operations. But when new opportunities arise, the focus should shift to how they can provide solutions for others – their handprint.

One example of such a shift is the need to focus on getting people access to what they need, rather than physically moving them from one place to another. Digitalization has helped greatly: Not only can cars become self-driving and shared, but tele-meetings, 3-D printers, and AI can support city planning with fewer roads, more green spaces, and vertical farming. This gives people access to education, healthcare, nutrition and exercise, in ways that do not require physical movement. Companies that enable such opportunities should begin focusing on their handprint.



This refocusing could occur if we make two changes in the existing innovation ecosystem:

From existing sectors to human needs

Instead of concentrating only on current sectors and the products they provide, we can include strategies and initiatives that focus on human needs. Instead of asking what can be done in existing systems, with existing thinking, we can use a human-need approach to better understand the gap between what is needed and what is currently seen as possible.

Studies have shown that smarter and more resource-efficient solutions become easier to identify when the objective moves beyond simply reducing greenhouse gases. For example, a recent study by a professor of civil engineering at Stanford looked at the risk of blackouts if renewable energy sources are integrated into the electric power grid. The study concluded that “an energy system running on wind, water and solar coupled with storage avoids blackouts, lowers energy requirements and consumer costs, while creating millions of jobs, improving people’s health, and reducing land requirements.”

From stakeholders as sources of emission, to stakeholders as solution providers

Current climate innovation looks mainly at how to reduce the carbon footprint of products and services on the supply side. Companies, cities, and countries are seen purely as sources of emissions, and the future imagined is a copy of the present – just without greenhouse gases.

Experts acknowledge that most current climate initiatives aim either to promote incremental change in existing technologies, or to improve performance in existing renewable alternatives. With a new generation of companies putting digitalization at the core of their purpose, the need to include a handprint approach becomes clear.

Companies must provide solutions to climate change

A change in thinking is required to trigger a change in behavior. So far, climate change has mainly been approached as a problem of reducing emissions from companies and their value chains. This perspective is supported by news media and investors who ask companies about their carbon reduction targets, and by existing reporting frameworks and tools that help companies track and report their reductions.

While companies must ensure that their own emissions are compatible with a 1.5 degree Celsius development path, their own emissions are only one side of the coin. Companies exist to provide society with needed solutions. Their role as solution providers can no longer be ignored.

Instead of the reduction of emissions from existing companies and structures – a footprint approach – the main challenge is to deliver what is needed in a society where the estimated global population of 11 billion people in the year 2100 can live flourishing lives: a handprint approach. This means that “avoided emissions” must be included in corporate climate strategies covering innovation, product development, marketing, sales and business model innovation. These strategies can help everyone on the planet to live better lives.

How did we get here?

There are many reasons for the primacy of the current approach. Most climate-related initiatives and organizations were created before the Fourth Industrial Revolution, at a time when many large polluters questioned whether climate change was real. They were created before sustainable solutions became cost-competitive, and before the scope and scale of the reductions needed were accepted and understood.

Most initiatives and tools dealt with laggards in the corporate sector. As a result, companies, as well as cities and even countries, are viewed as problems. The best these “problems” can do is reduce their emissions.

But to view companies, cities and countries only as sources of emissions can easily become an anti-innovation approach. A climate solution innovation approach, with a focus on handprints, provides the opportunity to focus on the solutions the world needs, and to look for ways that companies, cities, and countries can provide them.

Digitalization, arguably the most powerful catalyst humanity has ever created, could exacerbate negative trends if not carefully managed. But with strategic collaboration, it could also provide better lives for everyone on the planet, not only meeting their basic needs but allowing them to flourish as creative citizens in a society that will expand the horizons of what is seen as possible.

5G'S CARBON HANDPRINT WILL MAKE EVERY INDUSTRY GREENER

Most people don't know about this hidden benefit



By Andy Purdy
Vice President, Huawei U.S.A.



Media coverage of 5G has centered on advances in speed, less delay, and ability to connect thousands of devices in a small area. But 5G also has a less-publicized benefit: it's extremely energy-efficient.

For that reason, it promises to dramatically reduce the energy consumption in telecom networks, and across a range of industries, shrinking the carbon footprint and contributing to the fight against climate change. Already, more than 200 5G networks have been launched around the world. As the 5G rollout continues, the energy savings will really start to add up.

5G saves energy by eliminating waste

In the ICT industry, cellular base stations account for roughly 57 percent of a typical network's total power use. In older generations of mobile tech, only 15 to 20 percent of the power consumed was used to transfer data, the base station's main function. The rest is wasted because of heat loss, equipment that runs when no data is being sent or received, and inefficient cooling systems and battery units.

5G greatly reduces this wasted energy or harnesses it for other uses. For example, in the same way that a smart streetlight saves energy by turning itself off when no one is around, 5G wireless cells can automatically shut down when there is no data traffic. Such techniques can shrink base-station energy use by 40 percent. On a global scale, that translates to big energy savings and reduced carbon emissions.

Smartphones and other devices are becoming more energy efficient as well. New techniques aim to extend battery life to at least three days for phones, and up to 15 years for IoT devices such as connected refrigerators and smart factory equipment.

Moving beyond ICT

5G won't move the needle on climate change just by "greening" telecom networks. Perhaps its greatest potential may lie in making other industry sectors more energy-efficient. Known as the "enabling effect," 5G's energy-reduction potential stems from the changes to processes and behavior enabled by a fast, high-capacity 5G network. Together with virtualization, edge computing, AI-enabled analytics and cloud computing, 5G provides a platform that can help make industries and cities much more energy-efficient.

A white paper by Huawei and Analysys Mason, a research outfit, lists of some of the notable success 5G's enabling effect has already produced:

- Britain's Department of Transport set aggressive targets for increasing energy efficiency in its large fleet of government vehicles. To meet those targets, it deployed telematics systems in 600 police vehicles to measure fuel consumption and greenhouse gas (GHG) emissions. This helped the Department better understand its

vehicle utilization rate, which ultimately enabled it to shrink its fleet by 120 vehicles, reducing greenhouse gas emissions and saving money on fuel costs.

“**5G means big energy savings and reduced carbon emissions.**”

- A financial institution in Taiwan wanted to reduce its GHG emissions by 30 percent by 2050. It implemented AI-enabled solutions to optimize energy consumption in all of its 189 branches. Since the system was deployed in 2016, it has already reduced the average electricity use of each branch between five and 15 percent.

- To comply with EU-mandated energy regulations, a Slovenian cement factory in 2017 deployed a smart-energy solution based on wireless low-power, wide area network protocol (LoRaWAN) technology. The solution enabled accurate real-time monitoring of the energy consumed by each production process. The factory was able to identify consumption patterns, receive notifications when energy consumption went beyond certain thresholds, evaluate historical data, and predict future energy needs, giving the factory the information it needed to make better decisions and reduce its energy consumption and GHG emissions.

To re-create this type of success elsewhere, governments should invest in speeding up the deployment of 5G. This requires a number of specific actions, including making spectrum more widely available; incentivizing network build-out in various locations, including remote manufacturing plants and agricultural regions; and allowing different operators to put their base stations on the same site or cell tower, a process known as co-location that has the added benefit of reducing costs for the operator.

Governments should encourage the deployment of "small cell" 5G sites in cities by making available locations such as tall buildings, bus and train stations, towers and lamp posts to facilitate blanket 5G coverage in cities.

“**5G's energy-reduction potential stems from changes to processes and behavior.**”

By working collaboratively, we can help ensure that 5G is deployed quickly and intelligently to accelerate the fight against climate change while making fast and reliable connectivity accessible by everyone.

“WE SHOOT AT BIG TARGETS”

An interview with Dimitri de Boer
Regional director of programs for Asia, ClientEarth



What are your goals?

We want to use the law to protect people and the planet.

Why focus on the law?

The law sets a moral bottom line in society for what is acceptable. We outlaw theft, for example, because it crosses a moral line. It's similar with the environment.

If there is a major problem in society, and you pass a law, then enforce it for a few years, obeying the law just becomes common sense. The problem is solved.

China is a good example. Around the time of the 2008 Beijing Olympics, the government began legally mandating disclosure of environmental information, such as air pollution levels, which at the time were really severe. Soon after, an Air Quality Index had become available on people's smartphones. Suddenly, everyone knew exactly how good (or bad) the air was on any given day. That led to dramatic improvements in air quality, and in people's awareness of the environment.

So how do you actually use the law to improve the environment?

In Europe, we take governments to court. We shoot at big targets: major oil companies, national governments, the European Union. We just took the European Central Bank to court over their quantitative easing package. Money is flowing into business-as-usual sectors – not sectors that are strategic for our sustainable future.

In China, we work as an advisor to the government, supporting the Ministry of Ecology and Environment, legislators, the Supreme People's Court, and the Supreme People's Procuratorate—the equivalent of the Attorney General.

At COP26 in Glasgow, last year, the US and China agreed to work together to reduce carbon emissions. Does this give you hope that even rivals can work toward a common goal?

Yes! Unfortunately since then, US-China climate cooperation has been suspended. And there's uncertainty around the next Presidential administration in the USA, so it is hard for China to consider the US a reliable partner when it comes to climate action.

That said, China and the US together emit 40% of the world's carbon, so we really need them to be committed to the climate transition. And many societal

actors are committed. Some individual US states, for example, are actively de-carbonizing: by 2030, California aims to reduce greenhouse gases from buildings to 40% below where they were in 1990.

China, for its part, announced last September that it would not build any more coal-fired power plants overseas. As recently as 2019, China was spending US\$6b to US\$8b per year building new coal-fired plants. The decision to stop was hugely important. I'm hopeful that maybe China and the OECD countries can help developing countries leapfrog to a low-carbon future.

What do you think about technology's potential to reduce carbon emissions?

Some technology activities are very energy-intensive, like Bitcoin mining. In fact earlier this year, a Chinese court invalidated a contract between two companies involved in Bitcoin mining because mining wasted so much energy.

But more broadly, I would say that ICT is more an opportunity than a threat. Tech sectors provide much higher GDP per unit of energy consumed than traditional industries. And ICT can be used to optimize economic efficiency and industrial processes, which will go a long way toward reducing the world's carbon emissions.

Also, technologies like remote sensing and AI can increase your effectiveness as an environmental watchdog. They can easily spot changes in the use of land – forests, coastal areas, wetlands – and identify misuse of those natural resources. This is great for enforcing environmental laws and prosecuting those who violate them, because you've got data, you've got evidence. These are hugely important tools.

Where do you see room for improvement?

One area is the big e-commerce companies. They could really use their leverage to nudge people into more environmentally responsible behavior. For example, think of all the waste generated by the packaging of delivered items. These companies could use various tools on their platforms to push change among consumers, sellers, delivery companies. At a minimum, there should be a little box people can check when they place their order that says, "Please give me sustainable packaging." It might seem like a small thing for any given order, but it would show the demand for such green behavior, and over time sustainable packaging would become the norm.

GETTING TO NET ZERO REQUIRES A SYSTEMS APPROACH

No time to lose in helping Nature heal itself



By Dr. Alexandre Strapasson

Honorary Lecturer at the Imperial College's Centre for Environmental Policy



You're an expert on agronomy and agriculture. Many people, when they think of sustainability, typically think of the need to clean up "smokestack industries" that emit a lot of pollution. Where does agriculture fit into the sustainability picture?

Agriculture, forestry and other land use (AFOLU) is responsible for about 23% of all greenhouse gas emissions globally. Although this is an alarming figure, this sector can become part of the solution to tackle climate change because it can provide carbon removal in forests and soils. For example, regenerative agricultural systems usually increase soil carbon and biodiversity, whereas large-scale monoculture plantation schemes can be detrimental to biodiversity, water, and soil conservation in the long term.

Another example is sustainable bioenergy (from biomass, such as wood pellets, biofuel crops, and agricultural residues), which can substitute part of our fossil-fuel consumption. In addition, bioenergy can be associated with carbon capture and storage systems, providing net negative emissions, i.e., a net carbon dioxide removal from the atmosphere, instead of only reducing emissions. Therefore, looking at this sector from a systems perspective is fundamental.

Nature-based solutions are an interest of yours. Are these mainly related to conservation - soil, coral reefs, etc.? How do they fit into the larger effort to limit climate change?

This concept is based on the idea that some environmental solutions can be addressed through natural processes if we work towards resilient systems and increase carbon sequestration via photosynthesis. For example, when we convert degraded lands into forestlands, there is an increase in the

carbon content in the above-ground biomass and soil carbon, as well as an increase in water retention and biodiversity. Another example is the integration of agriculture, livestock, and forestry, such as agroforestry systems, which can increase total productivity and biodiversity, reducing the need for pesticides and land resources. Nature-based solutions should be addressed as part of a broader bioeconomy strategy, including food security, bioenergy, and forest conservation, respecting traditional communities' rights.

On the other hand, nature-based solutions have scale limits and are subject to temporal uncertainties and vulnerabilities, such as droughts, wildfires, and land use change. They are not a panacea. We should also increase the share of renewable energies globally, transform our cities, transport systems, and industries, reduce wastes and residues, increase energy efficiency, and change our lifestyles. We also need new technologies to tackle climate change more rapidly, including carbon-dioxide removal technologies. If we take too long to achieve net-zero emissions in the coming decades, we will also require such technologies to remove carbon from the atmosphere to bring them back to pre-industrial levels. Otherwise, the global mean surface temperature will continue to be high, given that the cumulative emissions will remain high in the atmosphere for centuries and millennia, even after achieving a net zero.

Global Calculator - What is it, and what was your role in creating it? Is there more than one?

The Global Calculator is a system dynamics model aimed at simulating climate change mitigation pathways by 2050, including all sectors of the

global economy. The objective is to inform policymakers, business leaders, and NGOs, but it is also a powerful learning tool for education. It has a simple web interface and is available in fully open access. The UK Government led the project, involving a multidisciplinary team from several institutions, including Imperial College London. I was one of its lead modelers.

We recently published a European Calculator too. Several nations have already developed their own 2050 Calculators, including Australia, Austria, Bangladesh, Belgium, Brazil, China, Colombia, Czech Republic, Ecuador, India, Indonesia, Ireland, Japan, Kenya, Mauritius, Mexico, New Zealand, Nigeria, South Africa, South Korea, Southeast Europe's countries, Switzerland, Thailand, the United Kingdom, the United States, and Vietnam. I would encourage all those interested in climate change mitigation to explore them online.

You've worked and studied all over the world – Brazil, the UK, France, Japan, the United States ... Do you think any particular country, region, or continent is taking the "right approach"?

Countries have different historical contexts, geographies, political aspects, infrastructures, and availability of natural resources. There is no one-size-fits-all approach, but important lessons can be shared. The calculators we have mentioned can help visualize and identify sustainable pathways for each nation. China, for example, has been a global leader in developing renewable energies and electric vehicles, but it remains very reliant on coal. At the same time, it is not easy to rapidly change the energy mix of a country with the largest population worldwide. Most investments in the energy sector take decades to be implemented and decommissioned. India, Pakistan, Bangladesh, and Indonesia, for example, also have high populations and significant development challenges, such as poverty reduction, education, housing, sanitation, health, and social inclusion. Therefore, comparing them with a few rich countries with a small population, good infrastructure, and political stability is unfair.

The right approach, so to speak, is associated with the capacity of national governments to translate their international commitments into effective policies domestically, for example, through innovative regulatory frameworks, carbon finance, certification schemes, private sector

engagement, agroecological zonings, and environmental education. However, each country should find its own pathway according to its conditions and realities.

Does your home country, Brazil, face particular challenges in sustainability? If so, what are they, and how are they being addressed?

Yes, it does. Brazil has several sustainability changes, such as halting illegal deforestation and providing sanitation and waste treatment to its entire population, among other examples. Most of its greenhouse gas emissions are associated with deforestation and agriculture, including livestock, rather than the energy sector. Brazil has struggled to reduce its deforestation rates, particularly in the Amazon and Cerrado (a Savannah-like biome). This is a complex issue involving several vectors, such as illegal logging, land tenure, livestock expansion into critical areas, land-use opportunity costs, illegal mining, infrastructure development, criminality, and corruption, although the environmental law is already quite rigorous in the country.

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Each country should find its own pathway

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At the same time, it is important to contextualize that about 58% of its territory is covered by forests, mainly native forests, whereas most nations are not even close to that. Brazil's deforestation rates have increased in recent years, but the country significantly reduced them from 2004 to 2012. This shows that it is possible to achieve a net zero deforestation in the future, depending on the government's efforts. Moreover, Brazil is one of the largest food producers and exporters, contributing to food security in several nations, including China. The country also has room to keep increasing crop yields, no-tillage systems, and agro-livestock-forestry integration, reducing the net greenhouse gas emissions related to food production.

In addition to agriculture, forestry, and other land uses, Brazil should continue to work on its energy transition. About 45% of the Brazilian primary energy mix is already comprised of renewable sources, including a successful biofuels program and a significant share of hydropower, wind power, bioelectricity, and solar energy. As a comparison, the world average is approximately 14%. Brazil's renewable energy capacity has been increasing in the past decades. Still, its share in the total energy mix has been roughly the same because fossil fuel consumption has also increased. Therefore, the country should increase its renewable energy capacity more rapidly to achieve a net zero scenario by 2050 and simultaneously reduce its fossil fuel dependence and deforestation. By choosing this pathway, Brazil has the potential to become one of the largest markets for green investments globally.

The "carbon handprint" is the notion that organizations can (and should) not only try to reduce their own emissions, but also employ technology that lowers emissions for entire industries or cities. This is sometimes called carbon avoidance, or the enabling effect. How helpful do you think this will be in addressing climate change in the future?

Climate change is a collective and systemic problem. Heavy industries and converting companies are interconnected with several players, such as energy and feedstock suppliers, third services, and final customers. Cities also work as large networks involving residences, commerce, lighting, heating, transport, and other actors. Therefore, an organization should

not only reduce its emissions but also work in harmony with a broader carbon mitigation strategy. Some sectors, for example, have emissions that are hard to eliminate, such as the cement industry, iron and steel, aviation, long-distance road transport, shipping, and load-following electricity, which is required to meet the growing share of intermittent renewables in the grid. Therefore, to achieve net zero, some negative emissions technologies will be necessary to offset such emissions. These technologies should not be used as an excuse to delay actions in reducing emissions. Both strategies, carbon reduction and removal, should be simultaneously addressed. We have no time to lose in tackling climate change.

Thus, concepts like carbon handprint, industrial ecology, circular economy, smart cities, and negative emission technologies are gaining momentum due to their importance in providing a systems approach to tackle complex problems. For example, from a systems perspective, if you buy an electric vehicle, but the electricity supplied to the grid is mostly from conventional coal power, the idea that your car is not emitting anything is just an illusion.

Anything else that you think is important?

Technology innovation is fundamental to help address the grand challenges of our time. However, technology alone is not sufficient. Every year, we have extrapolated our planetary boundaries due to overexploitation of natural resources, including fossil fuels, freshwater from aquifers, rocky fertilizers, such as phosphorus and potassium, and scarce elements, particularly lithium, copper, cobalt, and rare-earth metals. Therefore, as individuals, we are also part of the problem. We should reconsider our development patterns, social behaviors, and lifestyles, reconnecting ourselves to the environment, and using technology more wisely. This change includes, for example, reducing consumerism and selecting candidates more effectively committed to sustainability agendas in the elections. Nature can only heal itself if we stop damaging it and build more resilient systems, from local to global.

UPDATE FROM STOCKHOLM: ENERGY USE IN ICT

Several years ago, Anders Andrae, a researcher at Huawei in Sweden, published an article about the growing volume of carbon emitted by the ICT industry. He looked at two main factors: how much global data traffic would grow; and how levels of energy-efficiency in the industry would change.



Anders Andrae

Senior Expert, Life Cycle Assessment
Huawei Technologies, Sweden



What's happened since you wrote that article?

The first factor I looked at was global IP data traffic. From 2017 until now, it has increased at a rapid clip: about 26% per year, based on the volume of device shipments and the number of users connected to the internet. A growing number of internet users, combined with higher-bandwidth networks, has caused this steady rise.

The second factor, energy-efficiency, is a bit more encouraging. Gains in energy-efficiency at the chip level have arrived faster than expected, and there may already be chips that perform better than what had been predicted for 2030. Content transfer – moving bits across wireless and fiber-optic networks – is also improving with each generation of equipment and network design. Energy-efficient chips help decrease the power used in the computation/software share of ICT.

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The potential of the carbon handprint is great.

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One of the take-aways from your article was that 5G was more energy-efficient, so therefore, the faster 5G was rolled out, the better off the planet would be. What's happening there?

Global 5G roll-out has proceeded in line with expectations. Uptake is much higher in certain regions, such as China, the US, and South Korea, and much lower in others, including Europe and Africa.

According to my personal predictions, by the end of this year, 5G mobile data will make up about 16% of the world's global wireless mobile and voice traffic. By the end of next year, it may rise to about 22%. By year-end 2030, the share could be somewhere around 94%. In a related forecast, Ericsson predicts that by 2027, 5G networks will carry 62% of all mobile data traffic worldwide.

In 2017 you estimated that by 2025, ICT could consume 20% of the world's available electricity. How does this prediction look today?

Well, 20% looks way too high. Instead, ICT looks set to continue consuming about 10% of the world's electricity through 2025. But the share of ICT production may increase as 2025 gets closer. That's due to the rise of the Internet of Things, plus server-related demand not foreseen in 2017. Overall energy use is being kept under control by energy-efficiency improvements in chips. But data center deployment will drive consumption, so we'll have to keep an eye on that.

What do you think of the notion of a "carbon handprint"?

The potential is great. From what I have seen, handprint calculations are well defined, simple enough, and business-oriented; and they are accepted by academia. But we need more examples of handprints calculated from the bottom up. That means a specific solution – for example, Huawei's cloud storage – is analyzed using the handprint method with a particular customer. We should perhaps not try again to estimate the overall handprint of cloud computing on industry as a whole, as that would be a repetition of earlier work.

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**Low- or zero-
 emission
 data centers
 use renewable
 energy as a
 power source**
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Are carbon handprints difficult to calculate?

Yes, they're complex. The global handprint of ICT has already been estimated, but complex individual cases are lacking.

So far, the typical bottom-up handprint case studies in ICT are rather simple. For example, you can look at the use of liquid cooling vs. normal cooling in a cellular base station. That generates a handprint, because some emissions are prevented by the liquid cooling. But beyond that, there are no further discussions on exactly where the handprint is reducing emissions, and what the side-effects of that are. The handprint calculation needs to be refined (in standardization and beyond) to better quantify avoided emissions and rebound effects.

What's a rebound effect?

When you implement new technology that changes some economic factor - such as cost, or profit - that may change the behavior of industry players, businesses, and consumers. Higher profits, for example, may be saved or spent in different ways. Those second-order changes are known as rebound effects. They're hard to quantify, but we're working on it.

Anything that makes you hopeful about the carbon future?

Semiconductors have become more energy-efficient than expected - that's the major development of the last five years. New research in that area is very promising.

Another interesting trend is the prospect of low-, or even zero-emission data centers. These facilities can make use of renewable energy as a power source, optimize the re-use of wasted heat, and use free cooling where possible by siting data centers in colder parts of the world. AI, in conjunction with heat sensors, can also pinpoint the precise areas where more cooling is needed.

By contrast, traditional data centers are less efficient, and, given the rapid overall growth in data traffic and data center construction, could cause global ICT power consumption to increase significantly. Upgrading data centers to make them greener could really make a difference in the ICT industry's carbon footprint in the coming years.

HOW A VILLAGE IN GHANA GOT CONNECTED

A Huawei innovation expands broadband access to rural parts of Africa

By Christopher Marquis and Haitao Yin

For most of us, the Internet is like electricity: something you don't even notice unless it shuts off.

But for millions of people, Internet access remains a distant dream. No apps, no streaming video, no social media channels; no GPS or online banking or using an app to book a doctor's appointment.

The good news is that access to broadband is increasing. The number of people who are not connected to broadband networks has shrunk from 750 million in 2018 to 570 million today. Most of that improvement came from South Asia, particularly India, which in 2019 launched its National Broadband Mission to provide broadband access to every village in the country by 2022.

But in other areas, mobile broadband access remains low. In sub-Saharan Africa - where 60% of people live in rural areas - 36% of the population is still not even covered by a 3G network and only 21% subscribe to mobile internet services.

Why is the digital divide still so wide in rural and remote areas? One reason is that expanding access to broadband has traditionally been a costly endeavor: cell sites are 18% more

expensive in rural areas and 35% more expensive in remote areas in comparison to cities. Installing a cell site usually costs around \$300,000, although the cost can reach \$1 million depending on local conditions.

Also, revenue generated for operators in these areas can be 90% lower than at urban sites, so it can take up to 10 years for operators to recover their initial investment. This means many villages remain cut off from the internet and, effectively, from the world.



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**One of our
 biggest priorities
 as a society should
 be closing the
 digital divide**
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Overcoming obstacles with innovation

Installing base stations in remote places involves unique challenges. In a rural area, a typical cell site needs at least three high-powered antennas mounted on towers, which are usually around 78 to 164 feet high. Furthermore, the local power grid is likely unreliable, so each site will require a diesel generator. These sites also usually need a microwave connection to the rest of the network, so dishes must be installed with a line-of-sight connection to each other.

Connecting rural areas profitably is an ongoing challenge. Students from both of our universities, Cornell University and Shanghai Jiao Tong University, went to Ghana to see how Huawei engineers had helped solve the problem by creating a new type of cell site tower. Dubbed RuralStar, it was optimized for rural areas. The idea was to lower installation costs and give operators a quicker return on their investment. The idea was to lower installation costs and give operators a quicker return on their investment.

The Huawei team had started by experimenting with the material of the cell tower. To minimize costs, team members initially made prototypes from wood, although later they went back to using steel. They also shortened the tower height from 164 feet to 19 feet, lowering construction costs. This was possible because they used a 4G wireless connection to link base stations to the network rather than microwave dishes. Operators no longer needed a line-of-sight connection between the dishes and had more flexibility on where to locate the site.

From \$330,000 to \$15,000 per site

The team also experimented with different ways to power each cell site. By using solar panels instead of a diesel generator, they freed operators from having to buy diesel fuel and helped reduce overall energy consumption. Plus, operators would no longer need to regularly and technicians to refuel the base station, cutting down on labor costs.

These innovations helped reduce the overall cost of building a base station from \$330,000 to less than \$15,000, making it an economically viable proposition for operators.

Just two months after the pilot project was launched, more than 500 people were connected to the system. This usage rate, which was much higher than expected, meant that the operator, MTN Ghana, only had to wait 30 months to see a return on its investment. Since then, MTN Ghana has deployed more than 400 RuralStar sites in Ghana, connecting 900,000 people. To date, this system is being used across 60 different countries to connect more than 50 million people to the internet.

One of our biggest priorities as a society should be closing the digital divide so that no one gets left behind. With innovative approaches to deploying broadband that deliver both business and social value, we're hopeful that the telecoms industry can help reach the UN's lofty goal of connecting everyone to the internet by 2030.

Chris Marquis is the Sinyi Professor of Chinese Management at the University of Cambridge and formerly Samuel C. Johnson Professor of Global Sustainable Enterprise at Cornell University. Haitao Yin is Professor of Business Economics and Public Policy at the Antai College of Economics and Management at Shanghai Jiao Tong University.

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**Huawei innovations reduced the cost
 of a cell tower from \$330,000 to less
 than \$15,000**
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SUSTAINABILITY: WHAT'S DATA GOT TO DO WITH IT?



Stephan Ramesohl

Sustainability Researcher at Germany's Wuppertal Institute

We have dedicated this issue of *Transform* to the Internet's handprint.

What's data got to do with that?

A large part of our ability to achieve climate targets depends on data. It starts with proper ways of measuring emissions and climate change, but it certainly does not stop there. Digital data is a critical enabler because it paves the way for managing complex systems solutions involving multiple stakeholders. This, in turn, makes possible innovations such as circular business models and smart, clean decentralized energy systems.

Following this logic, do we have to collect even more data than we do today?

Yes and no. We certainly need more data in many areas, but the greatest property of data is that it can be used by an infinite number of actors at the same time without losing its value. I think we need to take full advantage of this by sharing data much more frequently than we do at the moment. So, while data is not being consumed as fossil fuels are, its collection, storage, and processing have a sizable carbon footprint. With increased re-use of data, this footprint can be minimized. So the question is not about more data, but getting more value from data.

What do you think is needed to encourage data sharing?

I think we need to build data sharing into all products. One way to achieve

this is so-called product passports, which aim to gather data on a product and its supply chains. The passport includes all the life-cycle information about the specific product, including how to disassemble and recycle it. However, we also need to work on common standards for data exchange across companies; shared trusted data spaces; and joint efforts for improving data analysis. In a nutshell: we need to build collaborative data ecosystems.

Can you think of a good example?

Examples include the work of the International Data Space Association and GAIA-X, or, more specifically, Catena-X, which covers the automotive value chain. Notably, only a minority of the projects under the GAIA-X initiative feature sustainability as a focus area. In other words: data ecosystems need more orientation towards green purposes. This failure to connect the dots reflects a need to change how we think about data in the context of sustainability. As part of this change, businesses need to kiss their siloed thinking goodbye. Without a fundamental change in the data culture, the best infrastructure and standards can do very little.

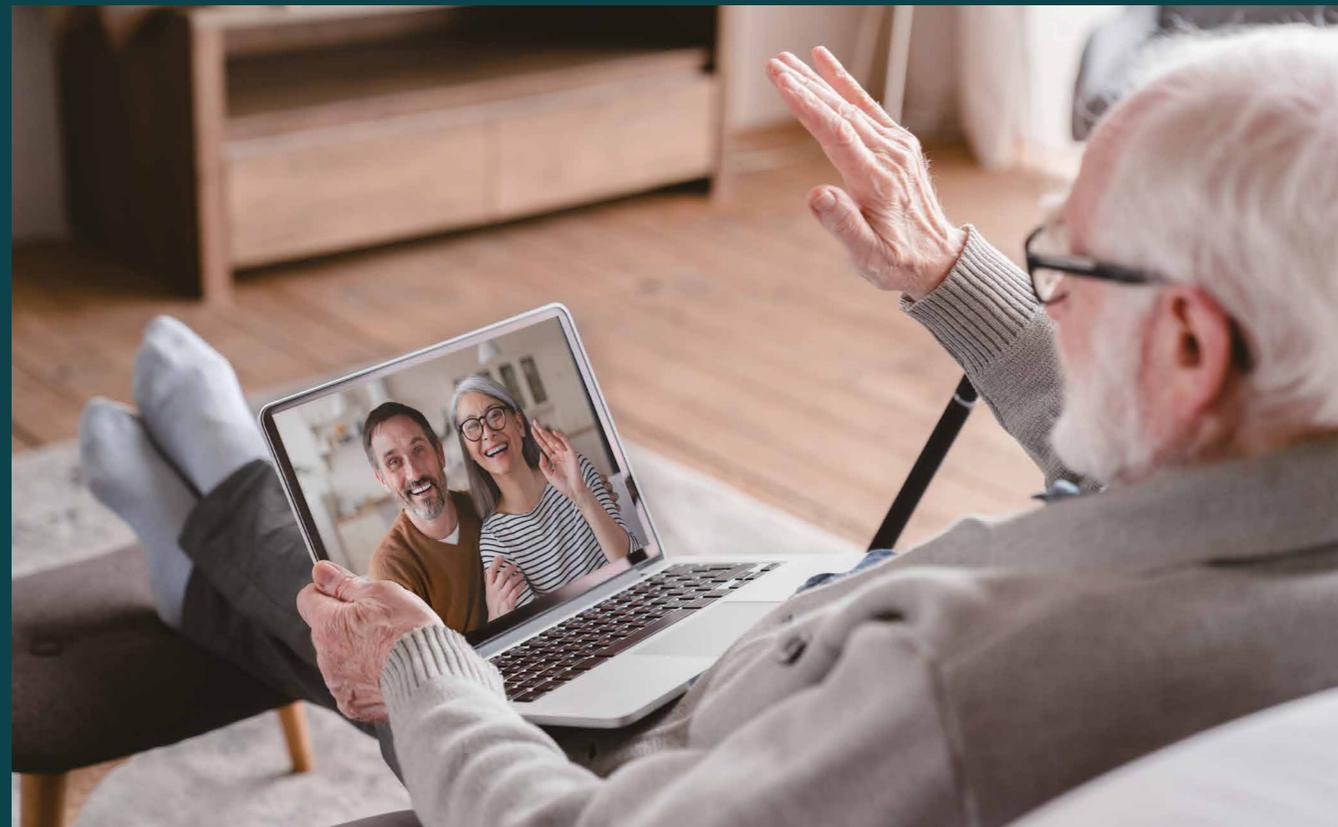
That's the same as for the sustainability transition as a whole, isn't it?

Absolutely. "A little greener" will not cut it. We need to profoundly change our behavior, and we have to do it quickly.

REINVIGORATING THE ELDERLY THROUGH DIGITAL INCLUSION

Malaysian researchers find the elderly are eager to embrace technology, if given the chance

By Maniam Kaliannan, Associate Dean, School of Business, University of Nottingham, Malaysia



Global populations are aging. By 2050, 16% of the world's people will be over 65, compared to just 11% in 2019.

Malaysia is no exception. In 2020 it officially reached "aging society" status after its over-65 population hit 7.2%, just above the UN's 7% threshold.

Aging populations start to be seen as a burden on society when the share of its working-age population starts to decline. Partly as a consequence, there is now a global push for greater civic participation of senior citizens in social, economic, and political life. Older people armed with years of knowledge, skills and experience are encouraged to take part in public policy formulation and inter-generational activities – which can also enhance their quality of life. Research indicates that participation in civic activities boost physical and mental health, increasing cognitive function, and even help people live longer.

Tech-savvy seniors

Research also suggests that age is not a barrier to embracing digital technology. In fact, many elderly people are more eager to use ICT following the pandemic, which severely restricted social mobility. Aging populations experienced depression and mental disorders linked to prolonged isolation. Being connected online can help.

Malaysia launched an initiative to better understand the experiences and behaviors of older people with a view to reinvigorating elderly populations in the post-COVID 19 era through digital inclusion strategies. Researchers used focus groups, expert interviews with policy makers and caregivers, a short pilot experiment on digital literacy, and surveys of 418 respondents in urban and semi-urban areas.

The focus group interviews were directed towards policymakers, development practitioners, caregivers, caregiving institutions, social activists, and volunteers. This approach is illustrated in Figure 1.

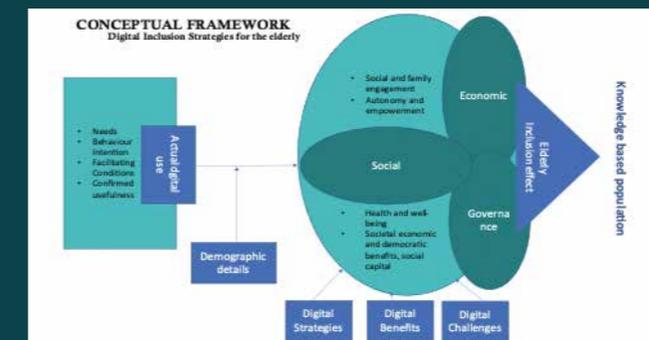


Figure 1: Integrated Dragon Fly Model and Sociological and Behavioral Theory Models

WhatsApp, Doc?

The research showed that a significant proportion of older people own either a smartphone or mobile phone, but mainly just for communication. Of this number, only a small number of senior citizens actively use tools like WhatsApp, Facebook, Instagram, Video Calls and TikTok. Those who did use those tools did so mainly to seek information on health, travel, religion, and online shopping.

The study showed that public policies and programs aimed at improving digital lifestyle and digital literacy among senior citizens are very limited, unlike the public resources being directed at improving connectivity infrastructure. Yet evaluation suggested participants were eager to learn more.

Model behavior

The main findings from the study relate to the evident disparity between IT-savvy and non-IT-savvy older people. This gap should be bridged through public policies, continuous digital infrastructure development, training, and coaching for digital skills.

The findings and recommendations are summarised in the table below.

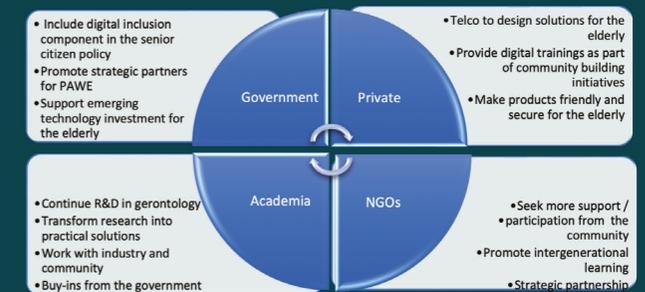


Figure 2: The Digital Inclusion Partnership Model

Based on the social, economic, and governance elements of the Dragonfly Model, we proposed an action plan through the Digital Inclusion Partnership Model (see Figure 2). We recommend that the government champion a policy for the elderly that reinforces digital skills, funds training and activities, invests in the digital infrastructure of public buildings, and supports and strengthens activity centres for older people.

REBUILDING RURAL DIGITAL INCLUSION IN POST-COVID KENYA

How Kenya can exploit opportunities to provide all citizens with affordable internet access

By Leonard Mabele

Researcher, Strathmore University, Kenya

In March 2020, Kenya went into lockdown, but lacked the level of Internet connectivity required to keep the various sectors of the economy fully functioning.

Despite boasting the largest economy in the Eastern Africa region, Kenya is a country where the digital “have-nots” significantly outnumber the “haves.” The effect of COVID-19 began to be felt as 18 million students – from primary schools to colleges and universities – had to continue their education online.

Out of 47.6 million Kenyans, most live in rural areas, while only about 30% live in cities and towns. With schools locked down, more than half of all students had to travel back to where their parents and guardians were, which in this case meant the rural areas.

Kenya’s land is largely rural with a number of areas still missing power connection to the grid, so the rural areas face low levels of income, dispersed human settlements, low digital literacy levels, and other challenges. For that reason, the lockdown dealt a huge blow to the academic system.

The healthcare sector was also hit. Under the Connect2Recover initiative, led by the ITU and supported by Huawei and other partners, my colleagues and I studied these two sectors in terms of Internet access before and during the pandemic; and what mechanisms the government was putting in place to guarantee sustainability of Internet access.

We chose two counties Kakamega and Turkana because in the 2019 census, Kakamega came out as the most populous rural county while Turkana was the second largest by land area. Both faced multiple challenges, including drought and climate change, inadequate social services, and poor physical infrastructure.

What we found

Our findings showed that both academic and healthcare facilities in the two counties faced similar challenges at the height of the pandemic. However, Kakamega had a more reliable infrastructure compared to Turkana, particularly in terms of National Optic Fiber Backbone Infrastructure (NOFBI) – the country’s fiber optic connectivity initiative. The spotty 4G/LTE coverage affected both students and teachers, who were expected to join online sessions for continuation of studies. Initiatives by the government to unlock access to content through Television (TV) and radio FM were not sufficient to meet the needs of the learners. Some students did not have TVs at home, and some couldn’t guarantee enough electricity to even have reliable radio access via mobile phones.

The one-hour slots for joining the TV or radio FM classes were insufficient and there was no opportunity to access recordings. The opportunity to address such challenges, such as through the use of High-Altitude Platform Stations (HAPS), unfortunately did not live up to expectations. While a lack of alternative access options, affordability, quality of access to data services and content for the students were present in both counties, Turkana was more affected than Kakamega. Issues identified during the field surveys included cost, backhaul limitations, electrical power and quality of service as variables needing further study. Conversely, spectrum sharing (SS) could provide more alternatives of access to the rural areas of Kenya – an opportunity that can be leveraged to “build back and better” the connectivity needs of rural Kenya.

Analysis and observation

The Communications Authority of Kenya (CA) often bases the country’s connectivity on the coverage of the cellular network, neglecting the opportunity provided by other Internet access options. This limits the data available to paint a real picture of the state of connectivity in the country, particularly through technologies such as satellite, microwave links, 5 GHz Wi-Fi networks as well as other Fixed Wireless Access (FWA). The CA reports

often use the number of SIM subscriptions as a measure of coverage, which in reality is not the case, since much of the rural population uses mobile devices that cannot connect to the Internet.

While Turkana occupies almost 13% of Kenyan land, NOFBI coverage had not reached the county at the onset of the pandemic, which means it faces an extra level of digital divide. Levels of literacy and appreciation of the value of the broadband network also have to be addressed to help contribute to bridging the usage gap

There needs to be a proper mapping of broadband needs based on real infrastructure coverage. While the initiative of HAPs by Google Loon got large media coverage during the pandemic, very little in-country feasibility studies have been done on its deployment, benefits and sustainability for rural broadband access. There is also a need to increase the number of Community Networks (CNs) in underserved rural communities. Unfortunately, 90% of the ISPs engaged seemed unaware of the newly enacted regulations through spectrum sharing. This calls for more efforts to rally stakeholders not to remain behind in novel efforts that can contribute to their business models and rapidly spur alternative connectivity options for the unconnected.

Recommendations

- 1. To connect rural areas of Kenya such as Kakamega and Turkana stakeholders need to consider factors beyond infrastructure, such as electricity requirements and levels of income.**
- 2. More schools and healthcare facilities can be connected by incentivizing initiatives such as spectrum sharing to increase the number of Community Networks (CNs).**
- 3. The extent of dark fiber coverage needs to be assessed and backhaul access for the last-mile Internet initiatives enhanced.**
- 4. School and healthcare centre connectivity needs should be mapped. This will help establish a data-driven decision-making ecosystem that can save on cost, minimize duplicated effort, and strengthen the available options for connectivity.**

DIGITAL AND FINANCIAL INCLUSION IN EASTERN AND SOUTHERN AFRICA POST-COVID

By Forbes Makudza, Reason Masengu, and Lucia Mandongwe

“Never let a good crisis go to waste,” said Churchill. The advice is certainly true for the business strategy lessons the world should draw from the COVID-19 pandemic. Most governments and the private sector reacted swiftly to studies on COVID-19 treatment and prevention. Lives were saved, but lockdowns meant their livelihoods were often jeopardized. Essentially, only companies that embraced online business remained viable.

The lack of e-business agility during the pandemic wiped out 4 million jobs in Africa. The situation was even worse for the micro, small and medium enterprises (MSMEs) in the COMESA (Common Market for Eastern and Southern Africa) region. So, our team embarked on a research study to assess digital financial inclusion in the COMESA region through e-business adoption by MSMEs.

We collected data from SMEs in five COMESA countries: Eswatini, Kenya, Rwanda, Zambia, and Zimbabwe. The study revealed an increase in the use of digital tools, platforms and technologies for business.

Nuggets we bring to the world

The largest proportion of e-business users was found in Kenya, Rwanda, and Zambia. Countries in Southern Africa (Zimbabwe and Eswatini) had a slightly lower adoption rate compared to countries in East Africa (Kenya and Rwanda). The main platforms of e-business in use, in all countries targeted, were websites, social media, mobile money applications, and the Internet, in that order. However, the more respondents became educated the more they moved away from over-dependency on social media toward websites. Social media was the most used e-business platform by newer MSMEs, with operating experience of less than one year. The use of social media declined gradually, and conversely website use grew, as businesses gained more operating experience.

In Zambia, Rwanda, and Kenya, at least 70% of the MSMEs had access to Internet banking; the rate was about 60% in Eswatini. Zimbabwe was the only country where the majority of MSMEs did not have access to Internet banking. Money market accounts were commonly used in the business activities of MSMEs in Rwanda, Kenya, and Eswatini. Wire transfers were mainly used in Zambia and Zimbabwe. Mobile money transfer was the single dominant mobile money application and service across all MSMEs in the region. Mobile payments and mobile banking did not constitute any significant proportion.

Our study further showed that the key determinants of e-business adoption in the COMESA region are not fully explained by the theoretical factors of technology adoption. There was no statistical evidence to support the idea that e-business is driven by the simplicity of e-platforms, value of e-business, social support, e-business infrastructure, or intrinsic factors. The study, however, found that years in business, years using e-business platforms, and country-based differences have an impact on the decisions to adopt e-business. By contrast, the results also showed that e-business adoption does not have a significant association with digital financial inclusion in the region.

How to bridge the chasm between e-business and digital financial inclusion in COMESA

E-business models which align with the country-based needs of MSMEs are required for the COMESA region to fully embrace the digital benefits of e-business and digital finance. A blanket approach in COMESA may not yield positive results due to differences in enabling environments among member states. We also note the need for the transition from cash towards digital mechanisms for e-business platforms and to drive demand and support for the transformation of micro-merchants onto formal e-business platforms. As the cost of data and device acquisition were highlighted to be major deterrents to e-business adoption, we believe that the reduction in the cost of devices and internet data will give MSMEs the ability to acquire and use the different digital platforms.

TRULY INCLUSIVE EDUCATION DEMANDS FAIR ACCESS TO TECHNOLOGY

Michael P. Cañares, Step Up Consulting, Philippines
Francois Van Schalkwyk, Stellenbosch University

COVID-19 forced developing countries to start delivering higher education online. While information and communications technology (ICT) has enabled teachers and students to continue working and learning remotely, it has also exacerbated pre-pandemic inequality: those with access to the internet and devices can adapt more productively compared with others.

Our research, launched by the International Telecommunications Union and implemented in South Africa and the Philippines, highlighted several challenges that existed pre-pandemic.

Making inequality visible

In South Africa, almost half of students surveyed reported difficulties completing assignments or participating in online discussions due to a lack of access to computer equipment or an internet connection. As campuses closed, and universities pivoted to emergency online teaching, it became apparent that some students either lacked computers or could not afford the data costs to access online resources and teaching platforms.

The capacity to adapt, however, is not only a challenge among students. In the Philippines, for example, most teachers had intermediate computer competency, but had no training in online teaching. Despite the drive towards blended learning in the past 20 years, only a few educational institutions have implemented it because of weaknesses in technological infrastructure. Private universities that are better resourced have the advantage of devising systems and procedures to make flexible learning more adaptive to student needs. They have been able to efficiently pivot using technology and various online platforms.

Technology is not neutral

When it comes to ICT's effects on society, we have to admit that it is not "neutral." Better-resourced universities and individuals are better able to leverage technology to manage severe systemic shocks, such as those delivered by COVID. The longer-term risk is that university-level stratification will become more entrenched and manifest in the

form of unequal higher education systems. "Stronger" universities will accumulate more, at the expense of those at the other end of the spectrum.

When people lack a connection, devices, or both, governments should strengthen broadband infrastructure and access to learning devices. Policies and programs in higher education should help eliminate the gap in digital infrastructure between private and public educational institutions and also the digital gap among students whose ability to own devices and use the internet is often dependent on their socio-economic condition. Private companies engaged in ICT should assist in ensuring access to technology by making learning devices and internet costs more affordable.

Digital as a teaching tool

The increased use of, and reliance on, digital technologies in education during the pandemic has also highlighted deficiencies on the part of teaching staff. The competency framework for higher education teachers should include using digital technology to design, deliver and assess teaching and learning outcomes. The government should provide public support for training to attain these competencies, focusing on public universities and higher education institutions with limited resources.

Higher education policies and programs should provide targeted education support to institutional providers, teachers, and students based on income and deprivation levels, to transition towards better use of technology in education. This can take the form of technical assistance, funding support, capacity building, or low-cost loans.

The extent to which online learning is a viable option in the developing-world countries such as South Africa and the Philippines post-COVID remains uncertain. Any future integration of online education alongside face-to-face learning will require substantial investment both in developing teachers' capabilities and in digital communication infrastructure. Only then can we ensure equal benefits from tech-enabled higher education delivery.

VIDEO GALLERY

Huawei is helping connect the unconnected all over the world. Here's a look at some of the lives being transformed in Europe, Asia, Africa, and even the United States.



Scan the QR code to watch the videos

Huawei in the heartland

Shot several years ago, this video shows that before restrictions were imposed, Huawei helped small US telecom operators bring broadband connectivity to underserved communities in rural America.



When the unconnected live in Paris

A former French chef learns to do his taxes online, with help from Huawei's Digitruck.



RuralStar in Nigeria

Nigeria wants entrepreneurs, farmers and families to have universal mobile service no matter where they live. See how an innovation called RuralStar made it happen.

Connecting Bangladesh

In the early 2000s, few Bangladeshis had mobile phones. Twenty years on, nearly everyone does – thanks in part to networks rolled out by Huawei.





**In the next issue,
we look at the subject of healthcare.**



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