The Importance of Failure
In the Creation and Implementation of Affordable Technology for Health

A Collection of Compelling Perspectives

In June 2012, global leaders from science, industry, and policy gathered at the Pacific Health Summit to discuss the role of technology in global health, innovative approaches to improving access to technology, and ways in which to foster a value-driven approach to the development of technologies for health.

Philip Campbell, Editor-in-Chief of *Nature* and Nature Publishing Group, moderated a panel discussion on lessons learned from misadventures in implementation of new technology solutions. He noted that, following on the conference's visionary talk about game-changing innovations, this discussion would focus on "pragmatic innovation, and how to make innovation that really works achieve the higher goals that we all want it to."

Participants identified one of the main challenges of innovation: that technology does fail. But failure, and how we deal with failure, is an integral part of the process of using technology to change outcomes, particularly in low-income countries. As participants pointed out, failure is a valuable teacher, and the more open we are in analyzing and discussing it the more effective we can be in identifying and solving the problems that stand in the way of success. Panel members and audience participants talked about things that didn't work to offer lessons from those experiences. What follows are highlights of this intriguing discussion, with experiences shared by people who have been involved in implementing, or driving the implementation of, new approaches.

Contributors

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Q. How do we define failure when implementing technologies for health?

Samukeliso Dube

When we're talking about technology failure we are not talking about the soft technology, the hard technology, or the gadget failing. We are talking about the failure of a system or of processes. Rather than a dichotomy between failure and success, I would define failure along a spectrum. On one end of the spectrum there is failing to effectively implement what we know works. For example, caesarean sections work but we have failed to implement them appropriately in various settings, and many women today die in childbirth because C-sections are not available.

In the middle of the "failure spectrum" there are technologies that we know work but were rejected by the population when we tried to implement them. For example, clinical trials have shown us that male circumcision is probably effective in helping to prevent HIV transmission, but in most countries in Africa we still have not reached the targets of what would, from a public health point of view, actually be effective. Global health has also launched and re-launched the female condom, but uptake has remained poor. On the opposite end of the spectrum we have offering what we know does not work. And that is certainly a more radical and dangerous failure. For example, counterfeit drugs.

David Boyd

Companies learn by failure, we all learn by failure, and we need to talk about it.

Ultrasound in India is a success in many ways because we've driven down the price point of that technology. It's now more available and simplified so people can use it in contexts that they couldn't have in the past. The big problem is the abuse of that technology, which is a regulatory and societal issue. It's not a technology issue *per se*, but we have to work with the government to find ways to make sure the clinician population is trained and people know what they can and cannot do with that technology. That's an enforcement issue which I think is going to hit many countries; but the technology itself, let's be honest, is a success. We've managed to get the tool out of the hospital and clinic and into portable use, and we've driven that cost down to scans costing a few rupees.

Ali Mufuruki

Failure is often blamed on the technology or the idea, but what we don't acknowledge often enough is that it frequently results from the way we have defined the problem, and this flawed definition of the problem has led us to solutions that don't work—solutions that are unsustainable, solutions that require governments to allocate funds that they don't have to healthcare, that require donors to step in and fill the gap, that require civil society to volunteer and support whichever way they can. And in the end we also measure the wrong outcomes, because when you are measuring from a base of zero there's always going to be an improvement— of 100%, 200%, 300%, whatever the number may be—and positive outcomes: this disease eradicated, this particular vaccine has had this impact, this cure.

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>
> Samukeliso Dube

One of the reasons for failure is too much focus on cost-reduction and not enough on localization. If there had been a better understanding of the local market maybe mistakes wouldn't have been made.

Kanav Kahol

Q. What are some common reasons for failure in the process of creating and implementing innovative technologies?

Ashok Jhunjhunwala

Sometimes we mistake impatience for failure. Those of us in science and technology are used to doing research where there are failures all the time—failures and then success, and failures and success. But we tend to contain that research until we are certain about our results. A common problem with these new technologies is that we start trying to push, commercialize, and scale technology before we recognize that it could possibly fail. We need to spend time on trials. Sometimes people are in a hurry—the government is in a hurry, corporations are in a hurry—but I think a good trial with good data that shows that something is going to succeed is very crucial before you scale. Irrespective of how good the technology is, it has to be tried locally.

Kanav Kahol

One of the reasons for failure is too much focus on cost-reduction and not enough on localization. If there

had been a better understanding of the local market, maybe mistakes wouldn't have been made. Misuse of ultrasound technology in India is a great example of where I think there's a huge misunderstanding. It's not just about the cost or the fact that the government is not doing a good job of implementing the law. It's actually about what the companies and players are also doing in order to address this major social issue of female feticide.

Samukeliso Dube

Largely the solutions that I'm seeing are more solution- and supplier-led rather than problem- and demand-led. How does GE, for example, innovate in such a way that it's going to be relevant in South Africa? Their clinical engineers have to interface with what is happening in the hospital, their clinical engineers have to know what is happening in doctors' rooms in the community, and so on. Within the ecosystem of innovation, the ecosystem of technology, we have to make sure all the moving parts are right and the whole puzzle is actually balanced. If you remove one part it may actually collapse the whole thing, and then we define it as failure at the end of the day.

Kanav Kahol

The Innovation That Did Not Happen:
A Sustainable Business Model for Africa

Ali Mufuruki called for a shift from the current emphasis on innovation in the lab and the finance world toward looking for ways of selling healthcare services to poor people through business models that work for these populations. He urged governments to view the poor as "customers with very special needs" and learn from the success of the mobile phone industry in Africa.

The elephant in the room is the innovation that didn't happen. How did we fail to come up with a business model that is capable of creating a viable and sustainable healthcare industry in Africa for poor and rich alike, as in the West? All the health efforts in recent decades in Africa—including increased budget allocations by government, increased donor funding, and more interventions from big foundations—reach only a very tiny part of our population. We have a philanthropy budget, we have a CSR[1] budget, we help with research, we give some generic licenses to some people to manufacture, and we're doing our best, but we are reaching only less than 1% of the population.

And yet, thanks to advancements in technology and to a very globalized, interconnected world, I think there are business models that can actually work for poor people. That innovation needs to happen not in the labs, not in the finance world, but in our minds by realizing that we actually can do business with poor people. We need to find a way of selling healthcare services to poor people that actually is financed by the poor people themselves.

But, for that to happen, we need a change in the way government looks at these things, and we need appropriate legislation to direct money in that kind of direction. We need the healthcare industry to innovate in the way the mobile phone industry innovated with pay-as-you-go. The telephony industry discovered that you can break down this sophisticated, complex, expensive product into a small device that poor people can consume, and to do that they had to get out of their box and look at these people not as needy, poor, problematic customers, but as customers with very special needs. And that is why the telephony revolution has taken off in Africa. So if 50% of the people in my country have a mobile phone, and they are spending $20 a month making calls and sending messages, don't you think it is possible for them to put aside $5 a month and put that money in some kind of a health insurance fund?

I can imagine a situation where I can join an electronic microinsurance scheme, moving money, maybe a small amount every day, to an insurance scheme from my phone. With my phone, I identify myself at the healthcare center as a paying member of an insurance scheme and I get treatment, the doctor gets paid, and the pharmaceutical company gives me medication. You need to break it down in a way that I can actually participate as a market participant, not as a hand-out recipient. At the end of the day we need universal access to healthcare through a business plan like this, not just an improvement from zero to 1%.

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[1] CSR (corporate social responsibility) is the responsibility of an organization for the impact of its activities on society and the environment.

Q. What mindsets hamper innovation and contribute to failure?

Fredrick Mutebi

Organizations in the West have been our traditional partners, but they're relating to us in the very wrong way by approaching [Africa] as a humanitarian project instead of a partner. Now the BRICS countries[2] are viewing us as an opportunity. Cipla[3] has partnered with us, and not with a product that is inferior or cheaper; the brands they are selling all over the world are the very ones we are marketing in Africa, and that people can afford and are buying ... You must start viewing us as people who can do something for ourselves and people who can afford to be consumers. Other businesses, such as mobile telephony, can succeed in Africa, and that is much more expensive than paying a small amount of money to an insurance plan so that by the time you get sick you go and access treatment for free. This is what we need to do in Africa in order to get the same services that you are being offered in the West, not anything lower because lower sometimes means inferior.

Ali Mufuruki

When we don't change our mindset, our mindsets will be changed for us. Fifteen years ago, in every African country, telephony was defined as a social public good. With donor assistance and tax dollars, governments invested billions to build phone networks to provide this very vital service, but reached less than 0.5% penetration by 2000. And then technology and the private sector came in, and eventually after failed attempts there was innovation so that today telephone penetration is 50%. Governments no longer make investments in this sector, and you'd be perceived as ridiculous if you referred to

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> Jon Pender

telephony as an essential social public good in Africa today, because it is a business—a profitable business. The government is collecting huge amounts of taxes on it from the private sector. What happened? It was innovation. A social public good became a sustainable, profitable business model.

Jon Pender

A change of the engrained mindset within the private sector is needed, but I think we also need to engender a mindset change within the public sector so that health is seen as an investment rather than a cost, and that the supply channels are put in to enable patients to fully benefit from the new business models which companies are now pursuing.

William Castell

Market conditions vary by country and change with local national problems, but I just wanted to make sure there is no misconception that the world of industry has ignored the African opportunity.

I can tell you, from the history of the Wellcome Foundation, there was manufacturing and distribution

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[2] Brazil, Russia, India, China, and South Africa.

[3] Cipla is an Indian pharmaceutical company.

in Peking in 1906, and India was the largest market for Wellcome in 1910. In the 1970s we formulated, registered, manufactured, and distributed throughout Nigeria. In Kenya, the former Wellcome Foundation had Cooper McDougall & Robertson, which formulated research and distributed veterinary vaccines throughout Kenya and made them available to the rest of Africa. So I think a little bit of history here is helpful.

Q. What role can Public-Private Partnerships play in encouraging innovation and increasing the chances for success?

Jon Pender

Some say that CSR and corporate philanthropic activities haven't really had an impact and are reaching a tiny fraction of populations, although programs like the Global Alliance to Eliminate Lymphatic Filariasis have reached over 500 million people. But I think we need to recognize why companies do these things in the first place. It's because of market failure, because of a lack of healthcare infrastructure and capacity. We wouldn't choose to give away hundreds of millions of dollars worth of product if we didn't see a need nor any impact. We think it's the right thing to do and pursue philanthropic approaches because there's no business opportunity in many of these areas.

Where business opportunities do exist, new approaches may also be needed. Take GAVI, for example, which has made a huge impact through new business models which have been created to ensure that all children in the developing world can benefit from the preventative aspects of vaccination immunization, in a sustainable manner. In Tanzania we've seen vaccination rates getting up to 80% to 95%, which is an

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Gopi Gopalakrishnan

incredible achievement. But, I don't think this could have been done through a traditional business model.

I believe that a business approach in global health, where appropriate, can make a real difference. Different approaches are needed, but unfortunately the problem for companies like ours operating in the highly regulated healthcare sector is that we don't have direct access to the consumer and to the patient in the same way that, say, Coca-Cola does or other industries do, and so we have to channel our activities through the existing, and sometimes limited, healthcare infrastructure in countries. This is one reason why we are reinvesting 20% of the profits we make in the Least Developed Countries back into projects in those countries to strengthen healthcare delivery, working with NGOs such as Save the Children, AMREF, and Care International.

Sameer Sawarkar

At this point in time, the involvement of NGOs and government, rather than the private sector, is posing a very great challenge to companies of our size—companies whose approach is to raise private investments, expecting certain returns over a certain period of time. And as the time gets stretched it becomes

more and more difficult for companies to move ahead and make newer and newer opportunities in this area successful.

Gopi Gopalakrishnan

A lot of the lack of success may be because the deployment is not adequate enough. Most of these technologies are developed for large-scale deployment and are targeted at the poorest segments of the population. Currently, all the use of technology is being taken forward by NGOs—fairly large NGOs—and some private companies. But, unless the public sector comes on board in a significant way, we are going to see many more failures than successes for some time.

Gopi Gopalakrishnan

Q. Where have technologies negatively influenced individuals and communities? How can we prevent misuse of technology?

Mohuya Chaudhuri

The ultrasound revolutionized the way we were treating healthcare, but in countries like India ultrasound machines are being used indiscriminately to commit female feticide … Regulation of the use of health technologies is also critical so that patients are provided with rational and quality care. A huge number of pregnancies are [also] ending in unnecessary caesarean sections, such as when a doctor schedules the date on which the baby should be born as a matter of convenience … So when introducing new technologies we also need to make the user aware of what can happen because I don't think they are given a choice when they go to the doctor. They're just told, do this, and they do it. The community, the user, must be well-informed about what they're doing … when they're using that technology and how much benefit they can expect to get from it.

Kanav Kahol

Failure is not just about what works and what doesn't; it's about how we respond—and who responds—to unanticipated and unintended consequences. For example, GE has produced great ultrasound technology, and we have the Pre-Natal Diagnostic Techniques (PNDT) law to protect unborn children against female feticide, which is a very important law for India where we have a huge sex ratio problem. This is not just a government problem—it's a societal problem that as members of the society we would like to address. Even

though the device is perfect, culture and social conditions may cause technology to be misused: Is that the fault of the creator of that technology? No. Can that creator play a role in addressing these unintended consequences? Yes. I would suggest that some human-computer interaction elements be added to the ultrasound that let the doctor know some of the sessions may be recorded for monitoring, and that would solve the issue.

Ashok Jhunjhunwala

I agree that technology can be misused, and I think we—technologists—should be the most conscious of it. Very often we say: Let the government handle it, society handle it. I think that as technologists we must have the foresight as to how it can be misused and look for ways to prevent such misuse. Of course regulations will help, but I, the technologist, must be proactive.

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> Kanav Kahol

Mia Malan, Ashok Jhunjhunwala, Phillip Campbell *(from left to right)*

The Role of the Media:
A Misadventure in South Africa

Philip Campbell noted that "The topic of the role of scientists and their voice is an interesting one, but actually more interesting is the capacity to do investigative journalism and hold people to account when they are rolling out these life-saving and health-saving technologies." **Mia Malan** told of a misadventure in South Africa in which the media played a significant role—good and bad.

In the early 1990s, Gervan Lubbe[4] developed the Action Potential Stimulation (APS) machine for arthritis pain, which he eventually marketed globally. For this work, Lubbe received an honorary doctorate from Free State University in South Africa, a business award, and an innovation award in Geneva. A few years down the road, in 2003, a major South African mining group, AngloGold, was looking for someone to develop a device that could detect the malaria parasite quite quickly in mine workers. Who did they ask? Gervan Lubbe. And within two months he claimed to have a prototype machine ready: the malaria monitoring wristwatch. To make a long story short, in early 2012 Gervan Lubbe was jailed for 20 years by the South African courts for major fraud and corruption.[5]

What did the media do? In 1997, when he released his pain device, a very credible investigative television program in South Africa called *Carte Blanche* reported on and celebrated this device. Praise from scientists and medical experts poured in. However, only one study has ever been done on the APS machine, and that study found the machine to be ineffective. Claims were also made that the device received FDA approval in the United States; in fact, it only received FDA clearance, which is an entirely different process.

In 2006, one of South Africa's only science journalists, Elsabe Brits, started to investigate the malaria-detecting wristwatch. Gervan Lubbe claimed that a major university was involved in his research, and Brits discovered that this claim was false. She spoke to malaria experts, who explained that the device was implausible and not based on good science. This reporting played a major role in the directors of Lubbe's company taking him to court and suing him, and as a result he is now in jail. I think one lesson we can learn from this is how important it is to have, and to empower, science journalists. The original *Carte Blanche* reporter was not a science journalist. Of course, this journalist was wrong to just report on it in an uncritical way, but I'm amazed that no scientists spoke up. Why did the organization that gave Lubbe the business award not investigate more deeply? And why were scientists not more proactive?

The other lesson to learn is that Elsabe Brits is a very rare breed in the developing world—there are very few journalists with a good understanding of how to evaluate scientific findings. She had many and excellent scientific contacts, something that few journalists have. So I think when you report on health technology, especially in a developing country, it's really important that there's a very strong partnership between technologists and scientists and the media.

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[4] "Gervan Lubbe: the fraudster who promoted pseudo-science and the media that believed him," Quackdown, April 10, 2012, http://www.quackdown.info/article/gervan-lubbe-fraudster-who-promoted-pseudo-science-and-media-believed-him/.

[5] "Action potential simulation (APS) in patients with fibromyalgia syndrome (FMS): a controlled single subject experimental design," US National Library of MedicineNational Institutes of Health, May 3, 2006, http://www.ncbi.nlm.nih.gov/pubmed/16670830.

Q. How and what can we learn from failures?

Ashok Jhunjhunwala

In recent times we have been using mobile phones for two-way communication. When we started using text for messaging, we found people in the villages are not comfortable with text since 50% of them are either illiterate of semiliterate.

Then we said, why not use voice and voice conversation, have people talking to the computers? The problem is that it has to be done in the local dialect, and the recognition capability is not that high—90%, 85% ... We used structured dialogue to ensure almost fool-proof recognition, but in the process made the dialog complex, and people were bored with that after a few calls. They said, no, it takes too long, we don't want to do that. Working in villages, where people do not have as much money, we learned that this does not mean that they are ready to give up quality. Quality is something that one has to worry about all the time. We of course fixed this problem, and things have started improving.

Samukeliso Dube

Everybody tries to publish their research successes, but you often learn a lot more from failures than you do from successes. It's difficult to find an open, safe place where you can share people's failures. And in healthcare, especially, it's a very fine line because you're working with saving lives. A failure is something you don't always want to publicize.

Mike Hess

Around fifteen years ago, Medtronic tried to make a pacemaker for China. We designed it locally for that market, recognizing cost pressures there, and brought it to market. Essentially it was a commercial failure. The primary reason was that the channel wasn't prepared for this kind of

> There are a lot of disincentives within a commercial entity to publicly analyze the failures, to assign blame or mistakes, because someone doesn't really want to be held responsible. It is very important, but it's hard to do.
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> Mike Hess

pacemaker. The customers that we were selling to wanted the pacemakers that were being sold in the United States and Europe. They didn't want a special Chinese pacemaker. And people who probably could have benefited from the price and functionality of the device made for China were in regions of country we weren't even accessing. We failed to judge the target of the product.

From an industry standpoint it was very hard to get the learnings from failure inside the company. It took around ten years for someone actually to go back and say: What actually happened here? It took years to interview everyone who was involved, to talk to the customers and to the internal project team and say: "Here are the key findings. What I just described right now is what we think happened, went wrong, and what we'd do differently." There are a lot of disincentives within a commercial entity to publicly analyze the failures, to assign blame or mistakes, because someone doesn't really want to be held responsible. It is very important, but it's hard to do.

Prevention in the Workplace: Taking Basic Infrastructure for Granted

Has the emphasis on innovative technologies for lower-income countries distracted from the need for more basic interventions that are taken for granted by richer countries? For example, fundamental infrastructure, such as functional sanitation systems and clean water supply are all critical to reducing the burden of water-borne diseases, which kill 1.6 million children each year. **Barry Kistnasamy** drew attention to the need for technologies focused on preventing health problems resulting from unsafe working conditions in developing economies.

The discussion has focused on the issue of technology in diagnostics and therapeutic technologies, but there are fundamental issues in Africa on which a lot more could be done to impact the health of these nations. The 21st century is about resources, and as a resource-led continent Africa is facing a range of health problems that mineral wealth brings. South Africa, which up to four years ago was the number one producer of gold in the world, has a history of 150 years over which dust suppression technology[6] was not being used effectively, with many workers at risk. I come from doing a major study in the mining industry on high rates of TB that have direct links to silica exposure. Canada and Australia have addressed the problem of dust exposure, but we don't deal with it in Africa. Three countries—Australia, Canada, and South Africa—dominate formal mining in sub-Saharan Africa at this moment. Years from now we're going to be facing legacy issues, such as pneumoconiosis in mine workers.

I'm dealing with the informal economy at the moment. Seventy percent of the people that work in Africa work in the informal sector. If there's a worker who's providing telephony services from a corner stand on the streets of Nairobi, can we present a decent work site for that person for protection from rain, hail, or wind? If we're buying minerals from Africa, can we ensure that workers are protected? Can we ensure that we do away with single-sex hostels, and create community housing? That's going to do a lot more for the health of the nation as opposed to continuing to do therapeutic and diagnostic interventions.

Let's start looking at vertical integration with protection of workers in Africa and in other developing country contexts, similar to how we protect workers in Canada and in Australia and in Europe. I think there are fundamental issues that we need to start dealing with on a macro level, such as workplace preventive interventions. How do we use technologies to prevent health problems at work?

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[6] Dust emission is a problem in mining and other industries. Most governments have introduced laws designed to protect workers from risks of exposure to pollutants that can be detrimental to health. Dust suppression technologies designed for the environment of mining can be effective solutions to this problem.

Q. How can we move from failure to success?

Ashok Jhunjhunwala

This is a success story involving something that was initially failing. A World Bank sponsored program for maternal and child health had set up clinics in Indian villages to which mothers brought their children every week. The children's health parameters were measured and they were given nutrient supplements. We found that in one particular area the clinics never opened. All the records were cooked. Nothing was happening. And there were people who were trying to fix the situation by using handheld devices and things like that.

The successful solution we finally found involved a simple, lowest-cost phone, which we installed in such centers. When a mother walks in with a child, with the press of one button she is connected to a computer, speaks a number, and is uniquely authenticated by a voice. While the child's measurements are taken she speaks the data to feed into computers. The back-end technology was complex, but the front end was kept extremely simple—a simple phone and voice. The lowest-cost mobile worked well, and the program started working.

Sameer Sawarkar

Having a lot of failures along the way is how innovation happens for the newer markets because they have multiple parameters that are not yet defined. For example, in our case we started with the technology solving the problem and eventually transitioned to figuring out that no channels actually existed into the areas that we actually want to solve the problem for, and so in the end we embarked on a much longer journey as compared to what initially would have been researched.

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Matt Theis

In dealing with failures, the private sector is going to tend to evolve because if they continue to fail they're not going to be in the private sector for very long, whereas in the public sector if you have a whole bunch of failed programs there's often a lot of engrained interest and momentum that keeps them alive. So it's trying to find a bridge between those two. We talked a lot about public-private partnerships, and I wonder if there's a mechanism there to try and take a lot of what's called the "fail-fast" in the private industry, to try and use some of that in the public sector as well.

Ali Mufuruki & Samukeliso Dube

A Story of Persistence:
Failure as the Key to Each Success

Failure is integral to innovation, as in the example Sameer Sawarkar shared of how his organization "embarked on a much longer journey as compared to what had initially been researched." **Ashok Jhunjhunwala**, who partnered with Sameer Sawarkar on this venture, gave more details of this journey in which persistence has begun to yield success.

One thing we did—along with a company called Neurosynaptics, which ITT Madras incubated—was to build a remote telemedicine kit to address the absence of doctors in the villages of India. The kit measures temperature, blood pressure, ECG, heartbeat, and is very low cost. We tested it on ourselves in front of the villagers, and seeing the doctors on the computer screen made them happy; they crowded around with excitement while we were being tested, but ran away when it was their turn.

What was the problem? It was very simple. Our kit required a person to be directly connected to the computers. But generally the villagers are afraid of electricity because wiring is typically very poorly done in the villages and people often get shocked. As a result they are wary of touching things that are plugged in. We had completely overlooked that reality. So we fixed the kit to make it wireless.

Then came our next misadventure: things didn't work because we were putting internet kiosks in the village, which itself is a fragile business, and we got involved in fixing that while trying to take care of health. Additionally, while urban doctors were initially very enthusiastic about how this would enable them to really work in the villages and make a difference, their enthusiasm wore off after several months. What we saw was that we had not worked out the business model. We had also not worked out how to deliver medicine once the doctors made recommendations to the villagers.

So we then came back with a new plan. We involved a pharmaceutical company to help deliver medicine. And then a new issue came along when the people there in the front end did not use or maintain the equipment properly. We then tried to bring in trainers. All this increased the cost. We had initially made our kit very low cost, but overall the cost was not that small. And the business model is something that we are still struggling with. This process has continued over about eight years, but we have not given up. And recently, with World Health Partners, it has been starting to succeed.

Q. What is important to keep in mind as we look to the future?

Gopi Gopalakrishnan

We make a point to keep in mind the ecosystem in which the technology is to be deployed. One of the humbling reminders for me is that on board the Apollo 11 spaceship was a computer with a 2-kilobyte memory and 32-kilobyte processing part, but guiding that was a 100-gigabyte device called a human being, in the shape of Neil Armstrong.

So while the technology is important we like to make it simple. We like to find that it is resonating well with that 100-gigabyte talent that we have in every village. If we forget that, which we often do, we try to find technology solutions by themselves. Especially in areas where the infrastructure are weak and the resources are scarce, it's very, very important for us to make the front end very, very simple ... and take all the sophistication that is needed for getting things to work at the back end. That's where the applications can be driven strongly and sharply and the best brains of the world can work. But unless we understand this connection it's going to be a difficult exercise to implement.

Mark Walport

Technology transforms lives. It is all around us. It is all-pervasive, and it is the modern world. One of the challenges is that technology does fail. It is not a magic bullet; the key is *how we use* technology. And in this discussion the power of people has been emphasized again. I like the idea of us being a multi-terabyte processor—but I think we're more interesting than that. I think one of the challenges is to fail cheaply.

Ashok Jhunjhunwala

Make the front end very simple, and take the technology to the back-end. I think that's a key message that we have learned over the years; something that people don't find obtrusive, something they're comfortable with. So it is because of that mobile

> In our thinking about investment we need to ride on that wave and think about that future that currently doesn't exist because we can't just invest for the status quo.
>
> Samukeliso Dube

phone is playing an important role. They're comfortable. They are using it, but can we further use it for healthcare?

Samukeliso Dube

To be leaders in healthcare, we need to create a future that does not exist right now, and that future is about task shifting. Probably we need to invest in that training now to deal with the current wars that we are fighting about getting nurses to use ultrasounds and even to prescribe drugs. There is war, we know, with their own professional bodies. So we need to think now about the kind of nurse that we want in fifteen years' time. For me that is also part of innovation.

The challenge that we have is we are currently investing for the status quo rather than investing in the future. And mHealth for me is a case in point, because right in Uganda there's actually a moratorium around mHealth projects. Everyone is wanting to use the cell phone as a platform for anything else around healthcare. But what we need to think about is the feature phones—those in-between the cheap Nokia "Brick" and the iPhone—because companies are already thinking about that. So in our thinking about investment we need to ride on that wave and think about that future that currently doesn't exist, because we can't just invest for the status quo. ✑

Contributor Biographies

David Boyd is Head of European Government and Public Policy for GE Healthcare. Mr. Boyd is a participant in the Coordination Committee of the Radiological, Electro-medical, and Healthcare IT Industry, and currently serves as Chair of its Sustainable Healthcare Group. He is Vice Chair of AmCham EU's Health Committee and is involved in U.S.-EU policy issues through the TransAtlantic Business Dialogue.

Philip Campbell is Editor-in-Chief of *Nature* and Nature Publishing Group. Previously, he was Physical Sciences Editor of Nature and Founding Editor of Physics World. Dr. Campbell has worked with the UK Office of Science and Innovation, the European Commission, and the U.S. National Institutes of Health (NIH) on issues relating to science and its impacts on society. He is Trustee of Cancer Research UK, Fellow of the Royal Astronomical Society, Fellow of the Institute of Physics, and Associate of Clare Hall at Cambridge University.

William Castell is Chairman of the Wellcome Trust. Prior to this role, Sir William was President, CEO, and Vice Chairman of GE Healthcare. Additionally, before its acquisition by GE, Sir William was Chief Executive of Amersham plc. He is also former Chairman of The Prince's Trust.

Mohuya Chaudhuri is an independent documentary filmmaker specializing in public health. Previously, as Senior Health Editor for New Delhi Television (NDTV), she reported on a wide spectrum of issues, including public health policy, maternal and child health, disease outbreaks, neglected diseases, the impact of conflict on health, and medical breakthroughs in research and technology. She is the recipient of a Kaiser mini-fellowship and WHO media fellowship.

Samukeliso Dube is Head of Health for Sub-Saharan Africa at ARK. She was previously Head of Africa programs for the Global Campaign for Microbicides at PATH and has undertaken various assignments in public health including HIV programming with a number of international organizations such as Oxfam, Action AID International, the University of Limpopo, and University of Pretoria.

Gopi Gopalakrishnan is President and CEO of World Health Partners. He has over 22 years of experience in setting up large programs that harness resources in the private sector to address the needs of the poor, including founding and administering Janani, a service delivery initiative targeting the rural poor in Bihar, India. He has also served as Director of International Programs and Vietnam Country Director at DKT International.

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Kanav Kahol is Head of the Affordable Health Technologies Division of the Public Health Foundation of India. He is the inventor of Swasthya Slate, a health tablet that allows point of care diagnostics on a mobile phone. He is also affiliated with the Center for Sustainable Health at ASU.

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Mia Malan is Health Correspondent for the Mail & Guardian and Lecturer in Health Journalism at the University of Rhodes. Previously, Ms. Malan was Knight Health Journalism Fellow in South Africa and Senior Health Journalism Advisor for Internews Network in Kenya and in Washington, D.C. Ms. Malan is the author of two journalism manuals on AIDS reporting and has worked as National Health Correspondent for the South African Broadcasting Corporation's radio and television divisions.

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Sameer Sawarkar is Founder & CEO of Neurosynaptic Communications Pvt. Ltd. Previously, Dr. Sawarkar was CEO and Chief Technology Officer at DACS Software and managed projects in software tools and digital signal processing applications at Motorola India Electronics Ltd. His primary work is in the rural e-Healthcare domain, for which he was awarded the Global Indus Technovator Award by MIT, for pioneering work in rural telemedicine.

Matt Theis is Country Director of India at Dimagi. Mr. Theis has worked on numerous levels of mHealth, with experience both in sub-Saharan Africa and India. Mr. Theis is currently leading an effort to decrease mother and infant mortality, increase community house visits, and integrate with national health data systems in Bihar. He was originally trained in aerospace engineering and previously worked for Boeing on unmanned aircraft.

Mark Walport is Director of the Wellcome Trust. Before joining the Trust, he was Professor of Medicine and Head of the Division of Medicine at Imperial College London. He serves on the UK Prime Minister's Council for Science and Technology, the India UK CEO Forum, the UK India Round Table, and the advisory board of Infrastructure UK. He received a knighthood in 2009.