that when animals are kept in better conditions, routine low doses of antibiotics have very little impact on their growth.

The pig farmer in Wuxi meant well. She clearly didn't understand the implications of overusing antibiotics. But even if she had, she'd have faced the same economic incentives to overuse them. And that is ultimately what needs to change.

42.

M-Pesa

When fifty-three policemen in Afghanistan checked their phones, they felt sure there'd been some mistake. They knew they were part of a pilot project, in 2009, to see if public sector salaries could be paid via a new mobile money service, M-Paisa. But had they somehow overlooked the happy detail that their participation brought a pay raise? Or had someone mistyped the amount of money to send them? The message said their salary was significantly larger than usual.

In fact, the amount was what they should have been getting all along. But previously, they received their salaries in cash, passed down from the ministry via their superior officers. And somewhere along the line, some of that cash had been getting skimmed off—about 30 percent. Indeed, the ministry soon realized that one in ten policemen whose salaries they had been dutifully handing over cash for did not, in fact, exist.

The policemen were delighted suddenly to be getting their full salary. Their commanders were less delighted at losing their cut. One was reportedly so irate that he optimistically offered to save his officers the trouble of visiting the M-Paisa agent: just hand over your phones and PINs, and I'll collect your salaries myself.[1]

Afghanistan's is among the developing-country economies currently being reshaped by mobile money—the ability to send payments by text message. The ubiquitous kiosks that sell prepaid mobile airtime effectively function like bank branches: you deposit cash, and the agent sends you a text message adding that amount to your balance; or you send the agent a text, and she gives you cash. And you can text some of your balance to anyone else.

It's an invention with roots in many places. But it first took off in Kenya. The story starts with a presentation made in Johannesburg in 2002. The speaker was Nick Hughes of Vodafone, at the World Summit for Sustainable Development. Nick Hughes's topic was how to encourage large corporations to allocate research funding to ideas that looked risky, but might help poor countries develop.

In the audience was a man with an answer to that question: an official for DFID, the United Kingdom's Department for International Development. DFID had money to invest in a "challenge fund" to improve access to financial services. And phones looked interesting: DFID had noticed the customers of African mobile networks were transferring prepaid airtime to one another as a sort of quasi-currency. So the man from DFID had a proposition for Hughes: Suppose DFID chipped in a million pounds, provided Vodafone committed the same; might that help Hughes's ideas attract the attention of his bosses?

It did. But Hughes's initial idea wasn't about tackling corruption in the public sector, or any of the other imaginative uses to which mobile money is now being put. It was about something much more limited: microfinance, a hot topic in international development at the time. Hundreds of millions of would-be entrepreneurs were too poor for the banking system to bother with, so they couldn't get loans. If only they could borrow a small amount—enough to buy a cow, perhaps, or a sewing machine, or a motorbike—they could start a thriving business. Hughes wanted to explore having microfinance clients repay their loans via text.

By 2005, Hughes's colleague Susie Lonie had parked herself in Kenya with Safaricom, a mobile network part-owned by Vodafone. The pilot project didn't always look destined to be a success. Lonie recalls conducting one training session in a sweltering tin shed, battling the noise of a nearby football match and the incomprehension of microfinance clients. Before she could explain M-Pesa, she had to explain how to operate a basic mobile phone. (*Pesa* means "money" in Kenya, as does *paisa* in Afghanistan.)

Then people started using the service. And it soon became clear that they were using it for a whole lot more than just repaying loans to microfinance institutions. Intrigued, Lonie dispatched researchers to find out what was going on.

One woman in the pilot project said she'd texted some money to her husband when he was robbed, so he could catch the bus home. Others said they were using M-Pesa to avoid being robbed on the road, depositing money before a journey and withdrawing it on arrival. It's the same need that the Templars met for pilgrims traveling to Jerusalem almost a thousand years ago. Businesses were depositing money overnight rather than keeping it in a safe. People were paying one another for services. And workers in the city were using M-Pesa to send money to relatives back home in outlying villages.[2] It was safer than the previous option, entrusting the bus driver with cash in an envelope.

Lonie realized they were onto something big.

Just eight months after M-Pesa launched, a million Kenyans had signed up; as of 2017, that number is now about twenty million. Within two years, M-Pesa transfers amounted to 10 percent of Kenya's GDP—that's since become nearly half. Soon there were a hundred times as many M-Pesa kiosks in Kenya as ATMs.[3]

M-Pesa is a textbook "leapfrog" technology: where an invention takes hold because the alternatives are poorly developed. Mobile phones allowed Africans to leapfrog their often woefully inadequate landline networks. M-Pesa exposed their banking systems, typically too

inefficient to turn a profit from serving the low-income majority. If you're plugged into the financial system, it's easy to take for granted that paying your utility bill doesn't require wasting hours trekking to an office and standing in a line, or that you have a safer place to accumulate savings than under the mattress. Around two billion people worldwide still lack such conveniences, though that number is falling fast—driven largely by mobile money.[4] Most of the poorest Kenyans—those earning less than $1.25 a day—had signed up to M-Pesa within a few years.[5]

By 2014, mobile money was in 60 percent of developing-country markets.[6] Some nations, such as Afghanistan, have embraced it quickly—but it hasn't even reached some others. Nor do most customers in developed countries have the option of sending money by text, even though it's simpler than a banking app.

Why did M-Pesa take off in Kenya? One big reason was the laissez-faire approach of the banking and telecoms regulators.[7] Elsewhere, the bureaucrats have not always been as relaxed.[8]

According to one study, what rural Kenyan households most like about M-Pesa is the convenience for family members sending money home.[9] But two more benefits could be even more profound.

The first was discovered by those Afghan policemen—tackling corruption. In Kenya, similarly, drivers soon realized that the policemen who pulled them over wouldn't take bribes in M-Pesa: it would be linked to their phone number and could be used as evidence.[10] In many places, corruption is endemic: in Afghanistan, bribes amount to a quarter of GDP.[11] Kenya's *matatus*, the minibuses that transport people around cities, lose a third of their revenue to theft and extortion.[12]

You might think, then, that *matatu* operators would have welcomed Kenya's government announcing an ambitious plan to make mobile money mandatory on *matatus*—after all, if the driver has no cash, he can't be asked for bribes. But many have resisted, and the reason isn't hard to work out.[13] Cash transactions facilitate not only corruption but

also tax evasion. *Matatu* drivers understood that when income is traceable, it is also taxable.

That's the other big promise of mobile money: broadening the tax base by formalizing the gray economy. From corrupt police commanders to tax-dodging taxi drivers, mobile money could eventually lead to profound changes in culture.