



TECHNOLOGY

When Technology Gets Ahead of Society

by Tarun Khanna

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Drones, originally developed for military purposes, weren't approved for commercial use in the United States until 2013. When that happened, it was immediately clear that they could be hugely useful to a whole host of industries—and almost as quickly, it became clear that regulation would be a problem. The new technology raised multiple safety and security issues, there was no consensus on who should write rules to mitigate those concerns, and the knowledge needed to develop the rules didn't yet exist in many cases. In addition, the little flying robots made a lot of people nervous.

Such regulatory, logistical, and social barriers to adopting novel products and services are very common. In fact, technology routinely outstrips society's ability to deal with it. That's partly because tech entrepreneurs are often insouciant about the legal and social issues their innovations birth. Although electric cars are subsidized by the federal government, Tesla has run afoul of state and local regulations because it bypasses conventional dealers to sell directly to consumers. Facebook is only now facing up to major regulatory concerns about its use of data, despite being massively successful with users and advertisers.

It's clear that even as innovations bring unprecedented comfort and convenience, they also threaten old ways of regulating industries, running a business, and making a living. This has always been true. Thus early cars weren't allowed to go faster than horses, and some 19th-century textile workers used sledgehammers to attack the industrial machinery they feared would displace them. New technology can even upend social norms: Consider how dating apps have transformed the way people meet.

Entrepreneurs, of course, don't really care that the problems they're running into are part of a historical pattern. They want to know how they can manage—and shorten—the period between the advent of a technology and the emergence of the rules and new behaviors that allow society to embrace its possibilities.

Interestingly, the same institutional murkiness that pervades nascent industries such as drones and driverless cars is something I've also seen in developing countries. And strange though this may sound, I believe that tech entrepreneurs can learn a lot from businesspeople who have succeeded in the world's emerging markets.

Entrepreneurs in Brazil or Nigeria know that it's pointless to wait for the government to provide the institutional and market infrastructure their businesses need, because that will simply take too long. They themselves must build support structures to compensate for what Krishna Palepu and I have referred to in earlier writings as “institutional voids.” They must create the *conditions* that will allow them to create successful products or services.

Tech-forward entrepreneurs in developed economies may want to believe that it's not their job to guide policy makers and the public—but the truth is that nobody else *can* play that role. They may favor hardball tactics, getting ahead by evading rules, co-opting regulators, or threatening to move overseas. But in the long term, they'd be wiser to use soft power, working with a range of partners to co-create the social and institutional fabric that will support their growth—as entrepreneurs in emerging markets have done.

What Emerging-Market Entrepreneurs Know

Let's look quickly at what I mean by institutional voids. Most entrepreneurs setting up a business in the United States or Germany can trust that an array of institutions will be in place to support them. For example, courts will uphold property rights, universities will provide a skilled workforce, and credit rating agencies will provide essential information about suppliers and buyers. The table “The Roles of Intermediaries in Mature Settings” lists typical institutional supports available in established markets.

The Roles of Intermediaries in Mature Settings

ROLE	FUNCTION	EXAMPLES
Credibility enhancer	Provides third-party certification of claims by suppliers or customers	Auditors ISO certification Education admission tests
Information analyzer and adviser	Collects and analyzes information on producers and consumers in a given market	Credit rating agencies Market research firms Publications that rank universities and professional schools
Aggregator or distributor	Provides buyers and sellers with low-cost matching and other value-added services, through expertise and economies of scale	Banks Mass retailers Universities
Transaction facilitator	Provides a platform for the exchange of information, goods, and services	Stock, bond, and futures exchanges eBay Executive recruiters
Adjudicator	Resolves disputes regarding law and private contracts	Courts and arbitrators Bankruptcy specialists Union arbitration specialists
Regulator or other public intermediary	Creates and enforces appropriate regulatory and policy frameworks	U.S. Securities and Exchange Commission U.S. Food and Drug Administration U.S. Equal Employment Opportunity Commission

Many of those supports don't exist in developing markets, though, so entrepreneurs need to either fill in some of the blanks themselves or work with others to do so. Successful emerging-market entrepreneurs actively shape the institutional context they work within, usually to the benefit of the entire system. Let's look at some examples.

One involves Charles Shao, who founded Huaxia Dairy Farm in 2004 in reaction to the quality problems endemic in China's agricultural sector. The country's regulatory structure was not robust enough to ensure that food was uncontaminated—and businesspeople knew they could get away with ignoring the regulations that did exist. In the wake of numerous damaging scandals, wealthier Chinese elected to purchase expensive products imported from other countries, but most consumers didn't have that option.

Shao resolved to go above and beyond the poorly enforced regulatory standards—in fact, he decided he'd try to meet the more stringent U.S. food safety standards. In an earlier life, he had worked in California's technology sector, from which he borrowed the idea of open-source information collection and sharing. Over time, Huaxia Dairy became known for giving away intellectual property and research to other farms—including competitors—to propel the whole industry forward. Working with Cornell University's College of Veterinary Medicine, Shao also created free seminars with the aim of developing talent for a high-tech Chinese dairy industry. One of his goals was to make dairy farming “cool” so that top performers would be

SOURCE ADAPTED FROM *WINNING IN EMERGING MARKETS*, BY TARUN KHANNA AND KRISHNA G. PALEPU (HARVARD BUSINESS REVIEW PRESS, 2010)

attracted to it. He thus became an aggregator of know-how and talent, in the absence of other intermediaries filling that role.

What Shao was doing, in essence, was trying to upgrade the entire institutional infrastructure. His efforts to exceed Chinese regulatory standards and his willingness to share best practices with competitors were not initially popular with his investors. But he persisted because he realized that unless quality standards improved throughout the industry, and unless the entire industry prospered, his business would eventually suffer.

Before Shao intervened, many agricultural businesspeople in China simply ignored regulations. Shao rejected such an approach, obviously. But he could have decided that lobbying the government to privilege his own efforts was his best strategy. Instead he chose a non-zero-sum approach that expanded the pie for everyone. Over time, independent certifiers of quality began to arise and act as credibility enhancers, filling another institutional void. The hope is that regulatory standards—and producers' and buyers' adherence to those norms—will also become stronger as time passes.

The story of Huaxia Dairy is not unusual. BRAC, the world's largest and arguably most effective NGO, has created a whole ecosystem of intermediaries in its quest to alleviate poverty. Founded by Fazle Hasan Abed in 1972, BRAC focused initially on using microfinance to rebuild communities in Bangladesh; the organization gave women small loans so that they could start businesses. It quickly became clear that the loans weren't going to be effective without numerous supporting institutions: There were immediate needs, such as a market to sell products into, and longer-term needs, such as primary education for the recipients' children and health care for their communities. I can't do justice to the whole story here, but suffice it to say that through both for-profit and nonprofit ventures, BRAC has achieved extraordinary results and is a trusted partner to even the most demanding of foundations. Note the word "trusted": I haven't observed any entrepreneurs who've forged a climate for success without also having earned the trust of other stakeholders in the system.

Recently I've been working with the business historian Geoffrey Jones to profile other entrepreneurs across the developing world who have created the conditions they needed in order to flourish. In many cases they set up structures or services that are normally provided by the government in more-developed economies, simply because they couldn't move forward without them. Mo Ibrahim, who founded the telecommunications company Celtel, had to install all of the foundational infrastructure, including wires and cables, before he could bring mobile phones to

Africa. Roberto Angelini Rossi, chairman of the energy and natural resources company Empresas Copec, wasn't able to ensure reliable, continuous power supplies across Chile until his company had invested in roads and a large fleet of trucks.

As I've noted in other work, private entrepreneurs like those described above are partially providing public goods. Society benefits more from food safety standards, roads, and reliable power than any single consumer or company does, so the state has the biggest incentive to provide those goods. But if the state is defunct, compromised, incompetent, or just very poor, entrepreneurs like Charles Shao, Mo Ibrahim, and Roberto Angelini Rossi may fill some of the gaps—and still be better off than if they had not stepped up.

What Can Tech Entrepreneurs Learn?

The knowledge that emerging-market entrepreneurs have gained can't simply be transferred wholesale to technology-based companies in developed markets. (Practices that are successful in one setting always need to be reimagined for a different setting, as I argued in a 2014 HBR article, "Contextual Intelligence.") That said, tech firms should remember the high-level lesson I took away from my research: They will probably need to create (or help create) the conditions that allow them to succeed.

To see what that might look like, let's first examine a hybrid case with one foot in the developing world and the other in the developed world: modern medical tourism as practiced by an Indian health care network. The new "technology" here is a business-model innovation, not a scientific one, but it's an instructive case nonetheless.

Tech firms will need to help create the conditions that allow them to succeed.

Narayana Health is world-famous for having learned to do very low-cost, high-quality heart surgery at scale, profitably. That capacity enabled it to provide many of India's poorest citizens with access to cardiac care and heart surgery—and to build and operate hospitals, heart centers, and primary care facilities across the country.

In 2014 the organization launched a hospital in the Cayman Islands, a short flight from Miami. The near-term goal is to provide health care for people in the Caribbean, Mexico, and the rest of Central America. Eventually, more-affordable care can also be offered to some of the tens of millions of Americans who lack health insurance or are underinsured (the U.S. health care system has the highest fees in the developed world). In seeking to serve these new populations, Narayana Health

faces an array of problems caused by a lack of institutional support. However, having dealt with similar challenges in India, company leaders are drawing on their experience as they proceed in the Caymans, and they're choosing to tackle certain challenges but not others:

- **Quality assurance.** One priority has been convincing non-Indian patients that Narayana offers world-class care. As it happens, the Joint Commission International, a U.S. entity that certifies hospitals outside the United States as high-quality care providers, has given the Cayman operation its stamp of approval, thus serving as a credibility enhancer. That will be important not just to patients but also to the insurance industry and to the first-rate medical practitioners the hospital hopes to attract.
- **Cultural brokerage.** Indian health care professionals understand the local context in India, naturally, but they don't have a visceral understanding of American, Caribbean, or Central American expectations when it comes to communicating with patients, the manner in which physicians work in teams with nurses and auxiliary staff, and so on. Narayana has invested in training to address those needs.
- **Logistical help.** Ensuring access to care for the target populations is another priority. Narayana has established protocols to minimize any trouble potential patients might have getting travel visas.
- **Payment options.** Narayana is still working to determine how the hospital will be paid for treating patients. In the case of Americans, mainstream insurers have taken a conservative, wait-and-see approach to covering services, so in the short run Narayana plans to work with large, self-insured corporations in the United States, which collectively account for about a third of the private health-insurance market. Over time, the data on performance should bring mainstream insurers on board. As for payment models for treating the uninsured, experimentation is still needed.
- **Means of redress.** Most medical tourists won't have any recourse if something goes wrong—no regulatory function crosses borders to protect patients from harm. Until an appropriate intermediary emerges, this will remain a problematic institutional void.

Narayana knows it can't plug every gap, but it isn't just in the business of providing care. In India its expenditures on direct services are nearly matched by the resources it puts into ensuring that people can use its services—and many of those latter investments benefit other players as much as they benefit the organization and its customers. In the Caymans, Narayana will make the same commitment to strengthening the institutional fabric, for its own good and for the public good.

Considering the Drone Industry

The institutional voids that Narayana Health confronts look simple compared with those dogging the drone industry. Military organizations around the world have been using unmanned aerial vehicles for years, but commercial drone flight didn't become legal in the United States until recently. Companies in an array of industries were immediately interested in using these remote-

controlled flying objects, which can take aerial photographs, help manage agriculture, deliver packages, and monitor infrastructure (to name just a few of the potential applications). But these uses raise numerous regulatory and other soft-infrastructural questions. The industry is still in its infancy, with the rules of the road only starting to emerge. Because of this immaturity—and complexity—the drone market provides a fascinating look at the issues facing many emergent technologies.

The creation of an institutional infrastructure is inherently collaborative.

In the United States, the regulations are continuing to evolve. At first drone operators needed to seek approval from the Federal Aviation Administration for any specific application; observers refer to this as the FAA's "crawling" phase. We're now well into a "walking" phase: Applicants have been granted blanket exemptions as long as they follow some broad rules focused on risk avoidance: The drone must weigh less than 55 pounds, it can't fly at night, it needs to avoid restricted airspace, and it must remain within the operator's view. Individual exceptions are approved on a case-by-case basis, and the FAA has been reasonably flexible about allowing nighttime flights and other advanced operations when they don't appear to pose any risks.

The new regulations have made it possible for drones to be used in agriculture and aerial photography but not for the large-scale package delivery that companies such as Amazon and Google hoped for. That's because clear guidelines for flying beyond the line of sight have still not been established.

Things may change as the pas de deux between entrepreneurs and rule makers continues. Individual approvals to fly near large airports, for example, are already being granted more readily. Meanwhile, other operational questions remain murky. For instance, if a company uses drones to monitor corporate infrastructure, how does it spot and deal with an outsider's unauthorized drone flight over its assets?

One of many complicating factors is that the FAA has jurisdiction over national airspace—a system that has worked well for air traffic control in general. But with the advent of drones, the efficiency of a single regulator has to be balanced against local needs that are sometimes in contention. Local communities may be uncomfortable about, say, drones flying over schools or prisons, and most such jurisdictional boundaries haven't yet been addressed.

As the United States transitions into a “running” phase, the government is trying to up its game. The U.S. Department of Transportation and the FAA recently began a three-year pilot program aimed at accelerating their stewardship of the institutional infrastructure and learning whether state and local governments can regulate effectively. What’s noteworthy is that the FAA will rely on the experiences of the drone makers and users to develop these rules. A similar process occurs when any new technology starts becoming mainstream: Done right, the creation of an institutional infrastructure is inherently a collaborative enterprise.

In the examples that follow, we’ll see companies working both directly and indirectly to build that infrastructure—both within and beyond the United States. We’ll look first at a U.S. company that emphasizes learning and lobbying, second at a different U.S. company experimenting with package-delivery methods in an emerging-market context, and third at a Chinese company focused less on regulation than on the development of a “commons” infrastructure.

AES: Learning and Lobbying

AES, a global power company headquartered in Arlington, Virginia, operates many generation and distribution facilities in 15 countries worldwide, with an extensive footprint across the Americas. In recent years it has become a pioneer in using drones of all sorts in the power industry: to monitor wind and solar plants, to access dangerous tunnels dug into mountains, to keep an eye on distribution facilities in remote locations, and to ensure that transmission lines are not damaged by storms and natural disasters.

Creating a joint venture focused on learning.

As the value of drones became increasingly clear—in terms of both operational efficiency and increased safety—AES decided to partner with a young drone-services provider, Measure, to develop and deploy intellectual property regarding the use of drones in the utility industry. Together they’re figuring out how drones can help AES perform various tasks better. AES contributes specialized utility-related know-how about such matters as inspecting wind turbines, interpreting images of solar panels, integrating data from the drones into a utility workflow system, and responding to identified damage. Measure contributes expertise about the drones dispatched, the cataloging of drone flight records, best practices for safe and efficient operations, and the software architecture that governs the global deployment of drones across all AES facilities.

AES benefits from this partnership by lowering its operating costs, spotting maintenance issues earlier, improving employee safety, and so on. Measure benefits because it can use the jointly developed intellectual property in its work with other customers, and its credibility as a provider of

drone-related services has been enhanced by its association with the well-respected AES. Meanwhile, the knowledge the two companies amass together also pays dividends to the entire ecosystem.

Exploring the line-of-sight issue overseas.

As already noted, the FAA has to date generally not permitted commercial drones to fly outside an operator's line of sight (LOS). Hoping to get data that will bolster the case for non-LOS flights, AES is using its presence in El Salvador and other countries to help Measure build a business outside the United States. El Salvador has allowed Measure to gain experience with non-LOS drone use at AES utilities.

This kind of overseas experimentation is useful for gathering evidence that can influence regulatory development in the United States. It also pressures U.S. regulators. Elaine Chao, the secretary of transportation, has said that the United States cannot fall behind other countries in this emerging space. The Transportation Department now appears to be engaging in a form of crowdsourcing by seeking comments and information from industry experts about which regulations need to be updated.

Using industry associations to lobby.

AES is an active participant in the Edison Electric Institute, an association that educates and lobbies for its energy-industry members and thus functions as a transaction facilitator. Because this group is specifically focused on the power sector, it's a particularly effective resource for AES to leverage. In other industry organizations with many big-name players, AES's voice, and certainly Measure's, can be drowned out. The Association for Unmanned Vehicle Systems International, for instance, represents not only the drone industry but also Tesla, Ford, General Motors, and Uber—not to mention well-connected defense contractors such as Lockheed Martin and Boeing.

Zipline: Experimenting

Zipline, whose roots go back to the founders' time at Harvard College, started in 2011 in the Bay Area; it's a drone-delivery company focused on getting medical supplies to underserved markets in the developing world. It's working with other interested parties to achieve that goal.

Choosing a test case.

In 2016 Zipline started using fixed-wing drones to deliver blood to remote hospitals in Rwanda. Poor transportation infrastructure and hard-to-reach areas, often many hours' drive from the capital, Kigali, mean that medical care is difficult to access in most parts of the country. But because Rwanda is small in land area and densely populated, a single drone launch site can serve a large number of its people.

Many aspects of medical care could be facilitated using drones. Zipline started with blood for several reasons: It's frequently needed (for example, to curb maternal mortality resulting from hemorrhaging during childbirth); it has limited shelf life even if stored under sterile, refrigerated conditions; and the multiplicity of blood types adds to the challenge of keeping adequate supplies on hand. The economic value of Zipline's service will ultimately lie in reducing the enormous waste that accompanies poor (hard and soft) infrastructure—the financial and human costs of failed deliveries, expired goods, and so on.

There's a lot more to filling institutional voids than just laws and rules.

Testing the service in a business-friendly environment.

Rwanda's government runs in a centralized fashion under President Paul Kagame. Whatever its downsides, it is generally seen to be technocratic and business-friendly. The government has been willing to modify its civil aviation rules so that Zipline can function. Furthermore, although Zipline intends to develop an economically viable model that is not dependent on handouts, the government has guaranteed business to the company. For the state, this is sensible, since what it pays is determined by the market—that is, Zipline has contracted to be at least as cheap as the alternative of shipping blood by road, using motorcycles, over unforgiving terrain. The state's guarantee, coupled with Zipline's efficient operations, in turn reassures investors that the experiment is reasonable and will eventually be financially self-sustaining.

In fact, the business plan appears to be working. Since October 2016, Zipline has created a single base set up to deliver blood, platelets, and plasma to 21 transfusing facilities using 15 drones. It now delivers 40% of the blood needed outside Kigali. That figure will climb to 100% when Zipline opens its second base in Rwanda—a project that is under way.

Partnering with strategic investors.

Part of the funding for Zipline's work in Rwanda has been provided by strategic investors, including the global logistics giant UPS, through its philanthropic foundation, and Gavi, the global nonprofit set up to promote and facilitate access to vaccines worldwide. UPS provides expertise in warehouse management and gains an understanding of the logistics of handling sensitive products in a context different from its home market. That knowledge enhances the understanding UPS gains from its other investments in drone-related uses as both a substitute for and a complement to existing package-delivery methods. Gavi, for its part, operates across the developing world and is interested in using drones to supply products that, like blood, require speedy delivery—such as the rabies vaccine after an animal bite. The skill sets and protocols learned through Zipline's Rwanda experiments will doubtless be useful in other countries with underdeveloped supply chains.

Expanding gradually into more-challenging markets.

Other African countries are not typically as pro-business experimentation as Rwanda, but they have just as much need for better infrastructure. Zipline recently announced its expansion into nearby Tanzania. Because that country is far bigger, Zipline plans to set up five drone-launching bases that will reach 20% of the population. In a sense, the company has learned sufficiently from the Rwanda experiment to roll the dice again in this somewhat more complex setting. That, in turn, may position it to enter additional markets where cumbersome bureaucracy and stakeholders with vested interests in the status quo make regulatory experimentation less likely.

DJI: Building a Commons

People interested in the rapid growth of new technologies tend to focus disproportionately on the legal and regulatory issues they raise—and on the lobbying that inevitably comes with them. These laws and rules are, as the examples above show, responsive to practices that are shaped through the collective experimentation of diverse stakeholders. But there's a lot more to the emerging "commons infrastructure"—the filling of institutional voids—than just laws and rules. Shenzhen-based DJI, the world's largest drone manufacturer, with 70% of the global market, is doing some of that work in the Chinese marketplace.

Creating a registry.

DJI has taken on the task of "geo-fencing"—defining virtual perimeters for—certain regions that drones are forbidden from entering. It is working with the Chinese government to create, maintain, and update the necessary systems. In addition, DJI is collaborating with the government to establish a registry to keep track of drone operators' names and where drones are flying. This registry will function as a quasi-public good, acting as an information analyzer and thus enabling some authority to corral the various actors in the drone industry. But it would have been less likely to come into existence purely by regulatory fiat.

The need for a registry is actually identical to that in microfinance in many developing countries, as different as the two settings might seem. The Indian microfinance sector learned the importance of an industry-wide registry the hard way in 2010. Prospective lenders had no way of knowing the aggregate indebtedness of individual and typically penurious borrowers, some of whom had taken on excessive debt. As a result, the whole industry was badly overexposed and almost collapsed when some unscrupulous politicians got involved. Survivors of that experience now maintain a reliable registry.

Developing the workforce.

DJI understands that a more professional workforce is needed to grow the drone industry as a whole. In 2016 the company set up a network of training centers in 60 cities around China, with short, affordable courses for would-be drone pilots. More than 200 professional instructors train aspiring operators in aerial photography, filmmaking, agriculture, and so on.

Just as there is a parallel between DJI's registry and the microfinance registry, there's one between DJI's efforts to develop talent for drone applications and the efforts made to develop talent for a high-tech Chinese dairy industry. That's because in both these emerging sectors, agencies to train specialist talent don't exist. Therefore, it has fallen to proactive entrepreneurs to fill that institutional void and take on an aggregator function.

CONCLUSION

As the drone industry continues to grow and mature, certain observations are worth keeping in mind:

- The knowledge and business models being developed by companies like AES (using drones to improve utility performance) and Zipline (using them to deliver medical supplies) are quasi-public goods. The corporate protagonists will have better access to what's been learned because of their firsthand experience (that's the private advantage they gain), but they are paving the way for other entrepreneurs, incumbent enterprises, civil society, and regulators to step in, mimic, and improve those practices. That's the "public goods" part.
- Entrepreneurs who develop quasi-public goods won't succeed in their efforts unless they're seen as trustworthy by other stakeholders in the ecosystem.
- It's rare that a single entity will be able to shape an emergent technology in isolation.
- Conventional, self-interested lobbying is inevitable and may even be necessary, but it's not sufficient. Emergent enterprises need to corral regulators and the state by working together, sometimes through industry associations, and by developing the data that the regulators will need. Hand-holding will work better than hardball, for the most part.
- Rules and laws aren't remotely the whole picture (though they're huge issues for many of today's emergent technologies). As DJI's and Narayana's experiences show, entrepreneurs must sometimes invest in training, intellectual property development, information collection and sharing, and other elements of a soft infrastructure.

Nobody knows enough right now to be a rule maker for the drone industry. Regulators have to accept their own inexperience and realize that the relevant expertise is being generated by the entrepreneurs making and using drones in a variety of ways. Entrepreneurs have to embrace the idea that they too are responsible for creating the soft infrastructure that will enable their success

and that of their future competitors. The fabric of trust that's needed in an industry of this kind must be collectively woven. And industry leaders must also consider what nonregulatory institutions are needed and how they can be built.

Different emergent industries confront distinct challenges, of course. Huge online platform companies like Facebook, which turn out to be easily manipulated by unfriendly players, face one set of challenges. Autonomous vehicles, which are potentially safer than human-driven cars—but not unless their developers are extraordinarily cautious and risk-averse—face another. Companies that tinker with the genetic makeup of human beings face yet a third set of issues. But I suspect that the entrepreneurs behind those technologies would all benefit from reframing their challenges more broadly: They should become leaders *outside the bounds of their own companies* by building trust among stakeholders and helping to establish the institutions necessary for their success. Such advice runs counter to entrenched ideas about focusing only on your core business and on short-term value for shareholders. But if tech leaders take more responsibility for the whole ecosystem and bring regulators and consumers along with them, all of society stands to benefit.

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