

Coller Venture Review²⁰²⁰

Coller School of Management
Tel Aviv University

Bridging Theory and Practice in Venture

Venture Policy and Management

New Venture Creation in the Gig Economy

Deep Innovation

Blockchain – for Better or Worse?

Virtual Roundtable

University-led Entrepreneurship

Trends in Venture

Opportunities in the Investment Future

Industry Analysis

Fashion Technology



Coller School of Management
Tel Aviv University

Letter from the Editor

Coller Venture Review, the flagship journal of the Collier Institute of Venture at Tel Aviv University, relaunches with this issue in a new format. To start, we retain our core focus on bringing together theory and practice. We believe that fostering the dialog between academics and practitioners is critical to successful and sustainable new venture creation. It broadens our perspective and the range of views we can integrate into a new synthesis. In its most applied perspective, it helps us engage in new ways of thinking related to the conceptualization, financing, and execution of innovation and new venture creation.

While our core focus has remained consistent, our approach to tackling the content has evolved. In each issue, starting with the current one, we address four sections: Venture Policy and Management; Deep Innovation; Trends in Venture; and, to support future generations of researchers, Industry Analysis. Each section includes the perspective of both academics and practitioners.

In addition, we also report insights from the perspective of a Virtual Roundtable, to bring together global leaders in a specific field of interest – in this case, university-led entrepreneurship. We expect that future issues of the Journal will include case studies to help isolate best practices, and a reader’s digest of outstanding articles in the fields of entrepreneurship, innovation and new venture creation.

Bridging the dialog between theory and practice is particularly significant at a time when action-oriented entrepreneurs must rapidly adapt from the field. This presents a rare opportunity to develop generalizable new insights and feedback loops. The imperative is even greater when one considers that the substantive outcome we seek to address – successful and sustainable new venture creation – can affect life-altering fields including health, education, food, agriculture and many others.

This is the place to thank Leslie Broudo Mitts, our Managing Editor, for her endless efforts and dedication, Josh Lerner, our Associate Editor from Harvard Business School, for his insightful comments and suggestions and Tal Sossover, our editorial assistant. Special thanks to all our contributors, colleagues, and collaborators worldwide for their dedication and vision.

While the results of our work will not be measurable in weeks or months, we hope this first step can help guide our future. We welcome any comments and suggestions from our readers that will help us improve the value of *Collier Venture Review* to its readership.

Sincerely,



Moshe Zviran
Editor-in-Chief

4

Venture Policy and Management New Venture Creation in the Gig Economy

- 7

3 Steps to Build a Labor Market for the Gig Economy
Diane Mulcahy
Author, The Gig Economy
- 14

The Future of Cities in the Gig Economy
Carmen Ferrigno
Vice President Communications, Saint-Gobain Corporation
- 23

The Challenge Regulating Big Tech Platforms
Eric K. Clemons
Professor of Operations and Information Management, The Wharton School, University of Pennsylvania

32

Deep Innovation Blockchain — for Better or Worse?

- 35

Blockchain Revolution Without the Blockchain?
Hanna Halaburda
Associate Professor of Technology, Operations and Statistics, Stern School of Business, New York University
- 44

The Darker Side of Blockchain
Nouriel Roubini
Professor of Economics and International Business, Stern School of Business, New York University
- 50

Blockchain as a Solution to Cyber Threats in the Smart Grid of the Future
Jacob Mendel
Head of the Cyber-Security Track, Coller School of Management, Tel Aviv University

56

Virtual Roundtable University-led Entrepreneurship

- Freddy Boey**
Deputy President, National University of Singapore

Anjani Jain
Deputy Dean, Yale School of Management

Jonathan Levin
Dean, Graduate School of Business, Stanford University

Stephen Spinelli
President, Babson College

Kar Yan Tam
Dean, The Hong Kong University of Science and Technology

Moshe Zviran
Dean, Coller School of Management, Tel Aviv University
- 77

Bringing Entrepreneurial Theory to Practice in the Classroom
Michellana Jester
Lecturer and Course Faculty Lead, MIT Sloan School of Management

82

Trends in Venture Opportunities in the Investment Future

- 85

Democratizing the World of Venture Capital
Jonathan Medved
Founder and CEO, OurCrowd

92

Industry Analysis Fashion Technology

- 94

The Impact of Technology on the Global Fashion Supply Chain
Jacqueline M. Jenkins
Executive Director of Strategic Planning and Innovation, Fashion Institute of Technology



Venture Policy and Management

New Venture Creation in the Gig Economy

7

3 Steps to Build a Labor Market for the Gig Economy

Diane Mulcahy
Author, The Gig Economy

14

The Future of Cities in the Gig Economy

Carmen Ferrigno
*Vice President Communications,
Saint-Gobain Corporation*

23

The Challenge Regulating Big Tech Platforms

Eric K. Clemons
*Professor of Operations and
Information Management,
The Wharton School,
University of Pennsylvania*

Overview

Our *Venture Policy and Management* section frames questions at the intersection of new venture creation and policy globally. In this issue, we address the “Gig Economy” and the changes that new ways of working and interacting are transforming – and being transformed by – the economic and associated social policy.

Diane Mulcahy, author of *The Gig Economy*, systematically addresses flaws in the current regulatory system. Mulcahy offers concrete steps intended to help shape and eventually build equitable labor markets globally.

Writing from the perspective of global urban infrastructure, Carmen Ferrigno from Saint-Gobain helps us to consider interaction between people, their buildings, and their broader socio-economic context. Ferrigno’s article attempts to bridge the gap between working conditions and urban development in labor’s new age.

Eric Clemons from the Wharton School at the University of Pennsylvania offers a view on regulation of new ventures, emerging monopolies, and potential market failures absent transformative policy changes.

Together, these three articles combine theory and practice to help us consider how seeming individual-level changes become aggregated and amplified. They suggest both promise and shifts in policy and regulation to ensure the distribution of benefits. Looking forward, future discussions in the *Venture Policy and Management* section will continue to raise important policy questions and suggestions in response to innovation and new venture creation globally.



3 Steps to Build a Labor Market for the Gig Economy

Diane Mulcahy

*Author, The Gig Economy;
Adjunct Lecturer, Babson College*

It's no secret that the Gig Economy – made up of consultants, independent contractors, freelancers, and on-demand workers – is disrupting how we work. The growth of independent work challenges the traditional structure of office-based full-time jobs for a single employer.

Current data suggests the Gig Economy is here and here to stay. An estimated 20 to 30 percent of the U.S. and EU-15 workforce engages in some form of independent work, and that share is growing. Almost all net employment growth in the U.S. since 2005 has come from “alternative work arrangements” such as independent work, rather than traditional full-time jobs. At highly valued, high-growth, multinational tech companies like Google, traditional employees are already a minority of the workforce.

The benefits of the Gig Economy are evident. McKinsey's Global Institute found in a study of 8,000 independent workers in the U.S. and EU that independent work mitigates unemployment, increases labor force participation, and raises productivity. Companies benefit from a more flexible workforce that allows them to staff up and down based on their business cycles and access the specific talent, skills, and expertise they need when and for how long they need them.

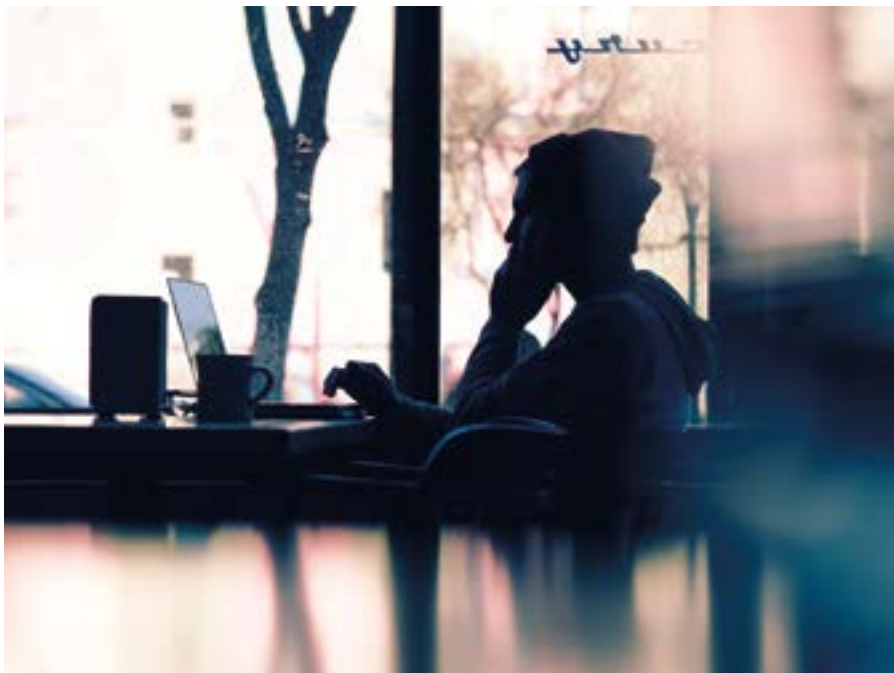
The Gig Economy increases entrepreneurship. Independent workers who start side gigs or take the risk to strike out on their own are the new entrepreneurs, launching new

products and services, growing their own small businesses, and creating economic opportunities by hiring other independent workers or employees. McKinsey also reports – and other surveys confirm the findings – that independent workers are more satisfied than employees with their work, feel more empowered and creative, are more productive, and are happier with the number of hours they work and the flexibility they have.

The downsides of the Gig Economy are also clear. There are corporate bad actors that hire independent workers to avoid the costs and responsibilities of complying with labor laws and regulations for employees. There are also a minority of individuals who work independently out of necessity and would rather have a full-time job. ➔

“Independent workers who start side gigs or take the risk to strike out on their own are the new entrepreneurs

”



But the real culprit in the Gig Economy is outdated labor laws and regulations that fail independent workers by denying them the benefits, rights, and protections only awarded to employees. Our labor laws have simply not kept pace with the changes in the workforce that allow people to work more flexibly, independently, and for more than one employer. Anyone who chooses – or isn’t able – to work in a traditional full-time job is denied critical labor protections and benefits.

Our labor markets weren’t designed for the varied, diverse, and flexible workforce, or the choices about how to work, that we have today. They were designed to only support employees in a traditional job with a single employer. As a result, they penalize independent workers and fail to support the entrepreneurs who leave full-time employment to launch their own business. They also stifle innovation, restrict choice, and create a two-tier workforce of employees and everyone else. This needs to change.

Maximizing the productivity of our workforce and the potential of the Gig Economy means updating labor laws to include and support everyone who works, not just employees. It’s a monumental undertaking, but one that is necessary to sustain a productive, efficient, and equitable labor market. To start, there are three key steps we need to take to create a labor market for the Gig Economy.

“Our labor markets weren’t designed for the varied, diverse, and flexible workforce... they were designed to only support employees in a traditional job with a single employer”

1. Eliminate the Worker Classification System

The most fundamental, important and structural change is to eliminate the outdated two-category worker classification system that exists in so many labor markets globally. It no longer makes sense to force today’s workers into a classification system that doesn’t recognize the multi-faceted ways people work. There are numerous problems with this binary distinction:

– **The classification systems are vague and subjective.** Even though labor markets distinguish between employees and all other workers, there isn’t one that offers a clear, objective definition of which workers are employees and which are independent contractors. These unclear categories leave many workers and the companies who hire them unnecessarily exposed to the legal and economic risks of misclassification, including potential lawsuits and tax penalties.

In the U.S., for example, the IRS, Department of Labor and National Labor Relations Board each have their own unique and subjective definitions for classifying workers. Adding to the confusion, federal and state definitions also vary and often conflict. For example, the U.S. Department of Labor released a letter this year stating that independent

workers who find work on online platforms are independent contractors, while California recently passed legislation that classifies them as employees. At the state level, it is possible to be considered an employee by one government agency and an independent contractor by another.

This persistent lack of clarity creates a confusing, unworkable system, provides incentives for companies to misclassify employees as independent contractors, leaves workers on unsure footing when negotiating their status, and leads to ongoing lawsuits about worker classification.

– **The classification systems distort the labor market by creating a “classification kink”.**

A “kink,” as economists use the term, is an economic inflection point created by policies. The most familiar example of a kink is an income tax bracket. The point at which one tax bracket ends and a higher one begins is the kink. People who have discretion over their income — or over how they report their income — try to stay at the upper limit of a lower tax bracket and avoid moving into the next higher bracket. The main problem with kinks, as the income tax bracket example illustrates, is that people try to game them. Behavioral economists have found that people “bunch,” or cluster, at kinks in order to maximize their economic benefit.

Worker classification introduces a kink in the labor market that causes both companies and workers to “bunch” around it in an attempt to maximize their economics. Companies have incentives to hire independent workers, and workers have incentives to get hired as employees. Changing the worker classification policy that creates the kink would eliminate the inefficiencies and distortions it causes in our labor market.

The most common proposal to fix the worker classification system is to add a third category of workers called “independent worker” or “dependent contractor.” Members of this new category would receive more benefits than independent contractors but fewer than those offered to traditional employees. This option fails to solve the existing problems of the classification system. It doesn’t offer a clear, objective definition of an independent worker, it would introduce an additional kink into the labor market, and it would continue to distort the behavior of companies and workers.

“The most common proposal to fix the worker classification system is to add a third category of workers...(but) it would introduce an additional kink into the labor market, and continue to distort the behavior of companies and workers”

An alternative solution is to eliminate classification entirely and have one type of worker called “worker.” The fundamental belief underlying this solution is that our labor market should support everyone who works, not just traditional employees. It would require extending to all workers the benefits, subsidies, and protections that are now available only to employees.

2. Extend Critical Employee Benefits to All Workers

Our labor laws and regulations create a two-tier workforce because there is one set of benefits and protections for employees and a second, consistently lesser, set for all other workers. The most critical benefit for all workers is access to health insurance.

In the U.S., benefits such as health insurance are provided primarily through employers only to their employees. This leaves independent workers on their own to create a personal safety net. In theory, it’s possible to replicate an employer-provided benefits package on the private market, but it is much more time-consuming, complex, and expensive to do so.

One reason it’s more expensive is that employer-provided health insurance in the U.S. is massively subsidized by the federal government through a series of tax breaks that are unavailable to independent workers. These tax breaks add up to about \$300 billion annually. For example, employers don’t have to pay payroll taxes on the value of the health insurance they provide, and their employees receive that health insurance coverage as a tax-free benefit.

There are numerous ways to modify this system to support independent workers. One strategy is to reduce the tax breaks awarded to employers by, for example, collecting payroll taxes on the value of the insurance coverage they provide to employees. Those additional tax revenues could be used to extend subsidies for health insurance to independent workers. Another option is to cap the tax breaks that companies receive for providing health insurance and extend tax breaks to independent workers who purchase health insurance on the private market. ➡

“
The changes in the way we work encourage us to consider whether an hourly minimum wage still makes sense if it only offers a life of poverty
”

The European approach of relying more heavily on governments to offer key safety-net benefits such as health insurance is a proven, viable model. It’s unlikely to be politically appealing in the U.S. currently, but it is a system that gives independent workers the ability to access affordable healthcare benefits without the need to hold a traditional job.

Another critical benefit is creating a safe working environment by protecting workers against discrimination and sexual harassment. The right to work in an environment free from harassment and discrimination is only awarded to employees and is not currently extended to independent workers. Existing regulations allow employers to discriminate against or harass independent workers for any reason (including gender, age, sexual orientation, and race). Changes in federal policy are needed to extend these protections to independent workers. In a promising first step in the U.S., Representative Eleanor Holmes Norton (D-D.C.) introduced a bill in Congress to what would do just that.

3.
Rethink Income Protection

An essential goal of labor markets in the U.S. and the EU is to protect worker income. Current income protection policies, including unemployment insurance, the minimum wage, and preferred retirements savings plans, currently apply to employees in traditional jobs. There are no similar policies to protect the income of independent workers. The Gig Economy offers us a chance to revisit the intent and structure of existing policies and rethink the type of income protection we want to offer to all workers. There are several ways we can consider changing existing policies to include everyone who works.

Replace Unemployment Insurance with Income Insurance

Unemployment insurance protects employees’ incomes if they lose their jobs. But a growing percentage of today’s workforce don’t need unemployment insurance, because they don’t have a traditional job. They need income insurance if they lose a significant amount of work. The basic idea of income insurance is the same as unemployment insurance: to provide a minimum level of financial stability without creating incentives to stop working.

To create a system that provides income protection for everyone who works, companies would make prorated income insurance payments for all workers they hire. Since companies already have systems and mechanisms for making unemployment insurance payments, those processes could be extended to make prorated income insurance payments for all workers.

Reconsider the Minimum Wage

Lower skilled employees in entry-level jobs are protected by hourly minimum wage laws. In the U.S., nearly 60% of the workforce is paid hourly, and although just 2% of them earn the minimum wage or less, they are some of the most vulnerable workers.

Yet, minimum wage laws offer limited protections to those workers. Earning the minimum wage, even as a full-time worker, doesn’t guarantee a life above the poverty line. Minimum wages don’t come with minimum benefits. And the minimum wage isn’t a promise of a minimum income, since employers usually control the number of hours someone can work.

The changes in the way we work encourage us to consider whether an hourly minimum wage still makes sense if it only offers a life of poverty. Should workers instead be guaranteed a minimum income? Should a minimum wage or income include the cost of basic benefits such as health, disability, and life insurance and some retirement savings? After all, how much protection does a minimum wage really offer, without an accompanying safety net of benefits?

It’s also important to recognize that the minimum wage doesn’t apply to all types of work. In our traditional economy, freelance writers, along with many other creative professions, have not been subject to minimum wages. Most freelancers are paid on a project or deliverable basis, with no calculation at the end to determine how many hours it took. As more workers take on project-based work, it raises the question of whether we should extend wage protections to workers who can set their own rates and control their own effort? If so, what would that look like?

Reform Retirement Savings

Pensions have traditionally provided income protection for employees after they stop working, but the pension system is facing

numerous challenges. Government pension funds are in trouble. They are underfunded and struggling to meet their obligations to beneficiaries who are living longer. Corporate pension funds face the same pressures of increasing costs and longer beneficiary lives. Companies are responding by opting out of the retirement savings game by phasing out or eliminating their pension plans for new workers (who aren’t likely to have a long corporate career anyways).

Governments and companies are no longer taking responsibility to provide income to workers once they stop working. That leaves individual workers to save for their own retirement, which, if relied upon, is a public policy disaster in the making. In the U.S., where the responsibility for retirement savings has already been largely shifted to individuals, the results are terrifying. Nearly half of Americans have not saved enough to replace even one year of income in retirement, and the same percent have saved insufficiently for retirement under normal scenarios of health and longevity. This lack of savings is persistent across income levels. Both high- and low-earning workers, including many employees, fail to save sufficiently – or at all – for retirement.

Instead of saving, workers are working, or planning to work, beyond traditional retirement age. That strategy is reasonable as long as the later years are healthy ones, but in many cases they are not. More than 40% of workers leave the workforce involuntarily, due to their own, or their spouse’s, poor health or disability. Many others leave due to mandatory retirement ages, age discrimination against older workers, or changes at their company that result in involuntary job loss.

Any realistic solution for paying for retirement will include more than one payor and will continue to rely at least partially on the corporate contributions that have traditionally funded retirement. Today, many companies provide contributions to retirement savings for their employees. One approach is to require companies to contribute prorated retirement savings for all their workers, not just employees. An option for helping individuals save more is to implement more automatic savings plans. These plans have proven to be successful at increasing savings rates.

Going Beyond Labor Market Reforms to Support the Gig Economy

Governments can support the changing workforce and the Gig Economy through policies and initiatives that go beyond transforming labor laws. Two important areas to focus are preparing the workforce to successfully compete for work globally and recognizing the role of innovative startups in supporting independent work.

Prepare the Workforce to Compete Globally

Governments have long exercised control over their national workforces via immigration policy. The rise of both independent and remote work does an end-run around these traditional controls. Companies seeking knowledge workers with particular expertise or skills no longer have to bring workers to a physical location to employ them. They can find and recruit skilled workers from around the world and hire them in their current locations, without the need for work visas.

As remote work becomes more common, so too will globally distributed workforces, particularly among the most highly skilled knowledge workers. This trend benefits companies who can more easily access the precise talent they need. It also benefits the workers who are hired for better work and compensation than their local alternatives. The negative impact is on workers who may not have the skills, work ethic, or knowledge to successfully compete in a global market.

Governments are so far ignoring this trend. They have yet to respond to this technology-enabled work drain and remain myopically focused on preventing foreigners who are physically in the country from working in traditional jobs. It’s an increasingly ineffective approach. The knowledge workforce now competes for work across borders and around the world. Countries that focus on offering the best education and training systems to their citizens will be best positioned to create the most competitive workforces globally. ➡

“
Should we extend wage protections to workers who can set their own rates and control their own effort? If so, what would that look like?
”



Recognize the Role of Startups

Innovative startups have a critical role to play in supporting independent workers and the growth of the Gig Economy. They can create products and services that make it easier and more efficient for people to find work, and for companies to recruit and hire independent workers. They can also help companies provide benefits to workers and manage compliance with labor regulations, as well as make it easier for workers to pay taxes, save for retirement, manage their income, and access benefits. For example, technology platforms such as Catalant, TopTal, and Upwork efficiently match independent workers and companies with projects and assignments: They are the new recruiters of the Gig Economy. Companies like Stride Health are making it more efficient and increasingly automatic for independent workers to save for and pay taxes, purchase health insurance, and manage the back office and administrative functions of being self-employed. EdX, Coursera, Udemy, and NovoEd and other online learning platforms make it possible for workers to acquire skills and knowledge when, where, and as quickly as they want at low or no cost. These companies are disrupting traditional education, as well as corporate learning and development.

A New Labor Market for All Workers

Labor and tax policies that support only employees in traditional jobs make less and less sense in a workforce that is increasingly made up of independent and Gig Economy workers. Creating a labor market that supports everyone who works requires a new way of thinking about worker classification and extending the benefits, rights, and income protections awarded to full-time employees to all workers. It's a monumental political undertaking but a necessary one if we want to maximize the potential of the Gig Economy and our increasingly independent workforce. ■

“**Innovative startups have a critical role to play in supporting independent workers and the growth of the Gig Economy. Technology platforms such as Catalant, TopTal and Upwork efficiently match independent workers and companies with projects and assignments: They are the new HR department of the gig economy**”



About the Author

Diane Mulcahy is the author of *The Gig Economy: The Complete Guide to Getting Better Work, Taking More Time Off, and Financing the Life You Want* (Harper Collins), a best-selling book on Amazon that has been translated into five languages.

Ms. Mulcahy is an Adjunct Lecturer at Babson College where she created and teaches the first MBA course on the Gig Economy.

The Future of Cities in the Gig Economy

Carmen Ferrigno
Vice President, Communications,
Saint-Gobain Corporation

It's a simple formula: People + buildings + environment. That straightforward relationship has driven the evolution of human existence for hundreds of thousands of years. But today, the formula is shifting. The Gig Economy, with its independent contractors, small-scale companies, and rapidly evolving relationships, is forcing an algorithmic shift in the way actual cities evolve.

For Saint-Gobain, that combination of different ways of working, new players and the evolution of urban environments happens in a very unique context that takes into account sustainable development, new and innovative building materials, and how both impact the well-being and comfort of people around the world. In fact, those activities are more than a business model — it's the company's overriding purpose. The 354-year old company, founded by Louis XIV, is one of the world's largest building materials company and spends much of its time focused on how to deliver comfort and well-being to people in every corner of the world. But the trend toward urbanization and the growth of megacities means that we can and must grapple with how we build these complex urban environments, how people interact with each other and the buildings and, most importantly, how those interactions improve the experience of all involved.

In the Saint-Gobain gigonometry equation, the math is a little bit different than for the typical building company. Most people who manufacture and construct buildings

are focused on the actual experience of construction, in that complex (and changing) process of designing and constructing the building. Saint-Gobain takes that process one step further. When all those design and construction experts leave, who stays to understand how the behaviors of the people in these new spaces changes and evolves over time as they get used to these spaces, as their activities shift and morph, and as their needs evolve? Saint-Gobain realized that if they stay when traditional builders leave, their role shifts in that relationship to occupants from a temporary resource and more toward a long-term partner. They effectively shift the timeline of the experience and change the equation.

But to fully advance that shift, Saint-Gobain has started to look at the concept of enterprise innovation, where every employee, partner and contractor is tapped for their expertise and their ability to not simply have a good idea, but implement those ideas in ways that add value to the company, customer, end-user and, ultimately, to society. It's a pretty bold idea spearheaded by Saint-Gobain's Chief Innovation Officer, Tom Kinisky. Kinisky, who started his career in Research and Development, shifted to business management and ran a wide range of businesses for the company over the course of his 30-plus year career. In that time, he came to understand that innovation is not simply the purview of Research and Development, but really more about how we apply unique points of view and areas of expertise to solve real world problems. The gigonometry in this case is more around

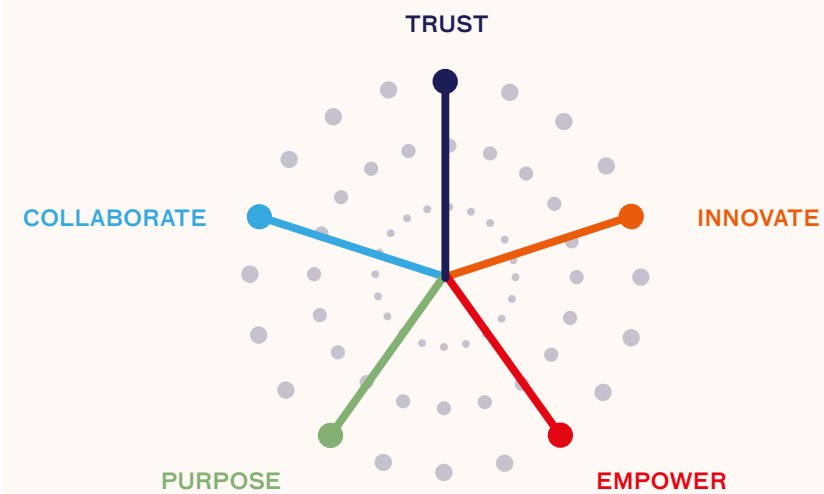
the interaction of diverse backgrounds and experiences of experts and implementing a rigorous innovation discipline across the company, all in the service of solving real practical business problems.

From Jazz Improvisation to Enterprise Innovation

Recently, Kinisky partnered with author and entrepreneur Josh Linkner on a corporate event for Saint-Gobain, where the two used the analogy of jazz improvisation to explain the nature of Enterprise Innovation. Linkner, the founder and CEO of five tech companies, which sold for a combined value of over \$200 million, is also the author of four books, two New York Times Bestsellers: *Disciplined Dreaming: A Proven System to Drive Breakthrough Creativity*, and *The Road to Reinvention: How to Drive Disruption and Accelerate Transformation*, as well as his latest book, *Hacking Innovation*. Keying off of the musical concept of the circle of fifths and the way John Coltrane reimagined them in his seminal Jazz wheel, the two men brought very different career experiences to the theme that connects strongly to the concept of gigonometry.

Both men acknowledge that what John Coltrane did in his composition Giant Steps was to find a way to reimagine a traditional idea, in this case the circle of fifths, originally explained by Greek philosopher and mathematician Pythagoras. But for Coltrane, the idea was to stretch that methodology, ➡

Parker's Circle of Fifths

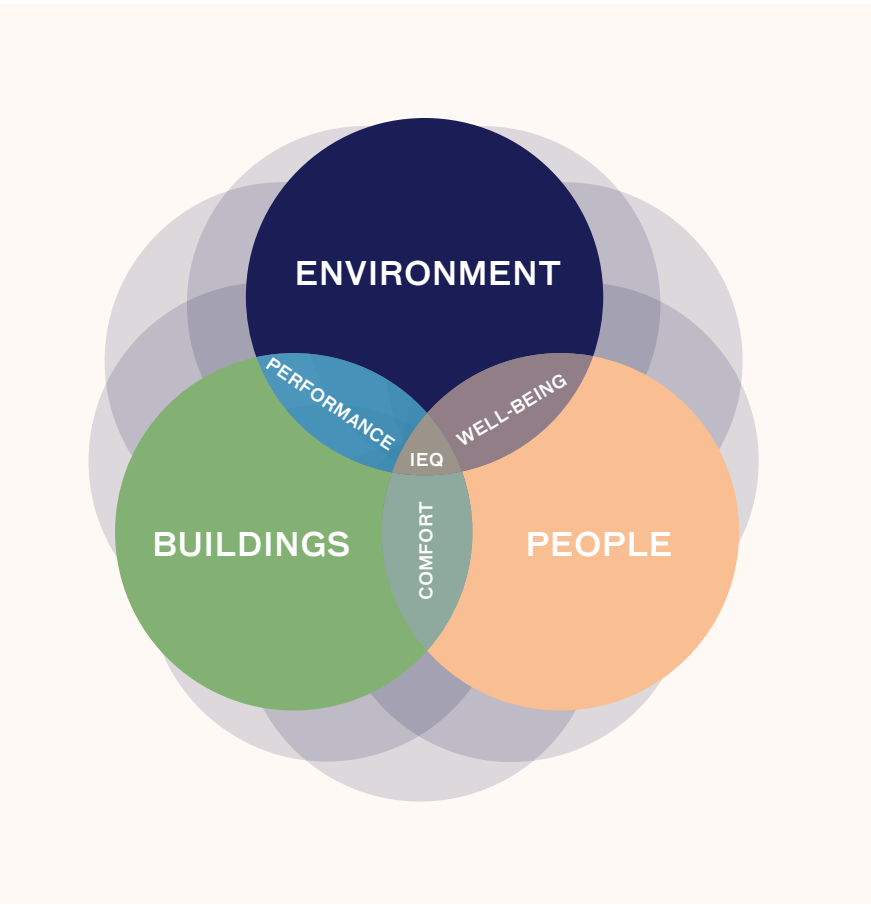


Kinisky's Circle of Enterprise Innovation

to push it to its farthest reaches to create music that bent, but never broke the logical and mathematical constructs of the notes. Linkner compared this breakthrough to entrepreneurs who marry together very different markets to create new value, while Kinisky focused on how to apply those same concepts to a large, complex corporate culture. Using five key attributes, Trust, Empowerment, Collaboration, Innovation and Purpose, Kinisky showed that any individual, with the right context, can find ways to innovate. Like Parker, he explained that by looking at a discipline differently, making unique connections and sharing the model with bandmates or colleagues, a leader can lay out a blueprint for improvisation, new ways of thinking and, potentially, breakthroughs that can drive real, sustained innovation.

That math and the need to more effectively engage the entire workforce has been demonstrated in the company’s corporate headquarters in North America, which opened in 2015. The Malvern, Pennsylvania location was designed around the company’s philosophy of “MultiComfort,” which takes into account building occupants’ overall feelings of comfort and well-being in a space. The building itself employed a wide range of Saint-Gobain products and technologies to improve acoustics, air quality, light management, collaboration and concentration. In order to evaluate the impact and efficacy of that Multi Comfort design elements in the new headquarters, Saint-Gobain partnered with a group of subject matter experts led by Dr. Ihab Elzeyadi, Director of the University of Oregon’s High Performance Environments (HiPE) Lab, to conduct an extensive four-phase comparative analysis of Indoor Environmental Quality (IEQ). In the first phase of the study, a research team inspected the existing unoccupied Malvern facility prior to its adaptive renovation and reuse. In the second phase, the team examined the former Saint-Gobain headquarters in Valley Forge, Pennsylvania, to establish a benchmark for the performance of the new headquarters. In phase three, the team analyzed the new headquarters following envelope upgrades and interior design retrofits, but prior to occupancy. Finally, the fourth phase of the study assessed the newly completed Malvern headquarters post-occupancy.

The above graphic shows how this complex geometry of concepts delivered a new, more



dynamic space. By focusing on a wide range of factors that truly impact how people feel, areas like air quality, amount of daylight, acoustics, thermal comfort and health and well-being, the company saw employees’ perceptions of productivity and happiness at work dramatically improve. These are real results that go straight to a company’s bottom line as a healthier, happier workforce leads to a more profitable company. Overall perceived productivity also increased by 38.9 percent in the Malvern facility, indicating that employees feel like their new Multi Comfort work environment contributes to their success in the workplace. In some cases, increases in productivity have been quite plainly evident. For example, during the first three weeks of occupancy, the productivity of Saint-Gobain’s Call Center increased by 140 percent, with no changes in hours or staff.

Looking Beyond Statistics

So why does that kind of math matter for today’s cities? Simple. The very definition of work is changing. The gig economy is causing massive changes in who works where, for how long and in many different ways.

IEQ Toolbox™
Framework

“
That
straightforward
relationship
between people,
buildings and
environment has
driven the evolution
of human existence
for hundreds of
thousands of years.
But today, the
formula is shifting
”

Consider this: According to Forbes, about a third of U.S. workers participate in the gig economy. That’s 57 million people. Staffing Industry Analysts (SIA), a global advisor on staffing and workforce solutions, publishes a yearly report on the gig economy and estimates the total global gig economy spending hit \$4.5 trillion in 2018.

But numbers never really tell the whole story. We have to look beyond statistics to understand the people and behaviors shaping this massive shift.

Right now, in virtually every corner of the world, there are thousands of teams at work on highly technical issues in fields as far-ranging as filmmaking, medical research, aerospace, and construction. Those fully functioning teams have members living, working, and collaborating from homes, offices, cafes, and carparks in Europe and North America, across Asia and the Middle East, India, Africa, and even Antarctica. They work “together”

via file sharing, live, virtual conferencing, teleconferences, chats, and texts. And when they succeed, those teams disband, returning to their far-flung geographies to live, work, play, learn and collaborate with a different collection of diverse experts, week-by-week, month-by-month, and year-by-year.

How then, can we expect our cities to evolve in traditional ways as work and life itself are shifting and changing in form and function, and at rates not seen since the Renaissance, the Age of Enlightenment, and the Industrial Revolution?

The short answer is: we can’t.

Cities can, must, and are changing and often for the better. Our buildings are becoming smarter, able to adapt to our changing needs not just year-to-year, but in some cases, minute by minute. Our classrooms are becoming more fluid as students are taught to explore their surrounding world as an extension of their classroom curricula. ➡



Our hospitals are transforming from places that treat disease and injury into state-of-the-art wellness centers designed, built, and run in the service of the human being, not merely to address the maladies of their bodies.

And this is where the math comes in.

The inter-relational geometry of people, places, and their evolving uses must be understood at deeper and broader levels if we want to take full advantage of this new way of working. First, people's behaviors are changing. In this emerging gig economy, the labor market is moving toward short-term contracts or freelance work as opposed to permanent jobs. That faster-moving, constantly shifting labor market is already something with which you and I are deeply familiar even if we don't realize it.

Disagree?

Well, how about this? Fifteen or twenty years ago, coffee shops were places where people drank a cup of coffee, talked to the person next to them, ate a pastry, and left. It was an experience that lasted somewhere between thirty and sixty minutes. Today, the entire purpose of a coffee house has changed. Now, they are virtual offices for thousands upon thousands of Gig workers, who access information and colleagues in cities and towns scattered across the globe, speaking languages that would rarely be heard side-by-side. People spend hours working, talking, and collaborating. We accept this behavior as fact, but in our every-day lives, most of us ignore the implications of such a fundamental change. Commerce is taking place in those cafes. You may be walking past a twenty-something millionaire, an inventor of a digitally printed manufacturing technology, or a small business owner carving out a previously untapped market. In fact, in today's information age, an innovative data-miner could create an app that charts the direct impact coffee-shop gig economy workers have on the Gross National Product of Israel, the United States, France, or Singapore.

But here is where it gets even stranger. You probably didn't notice that the design of those coffee shops has changed quite a bit in those years as well. Look around. The acoustics of these spaces have improved. Their furniture is more comfortable. Their layouts afford greater privacy and intimacy, and virtually every corner of that space has access to sunlight and the outside world.

These changes are not accidental. Architects, building scientists, designers, and business people are planning and adapting scores of different spaces, often using people actively participating in this gig economy. So, we've changed a variable. When is a coffee shop no longer a coffee shop? When it becomes a business incubator, a collaborative space, an office and conference center. The geometry of coffee shops is fundamentally different because of the gig economy. Its purpose has morphed and expanded. Get it? More facets, more uses, more needs, more opportunities.

Now, let's shift to office buildings. These fundamental places of work, where generations of people have labored in the service of a corporation, are changing because of the gig economy. Four walls and a roof just won't do it. The math has to change. People are much more likely to treat permanent positions at companies as full-time gig opportunities, jobs that they expect to change, and evolve in a much nimbler way than many traditional corporate workers may expect. Contractors, temp workers, agencies, and consultants all swirl and mingle in these spaces. Add to that the fact that Gig workers often are motivated by a greater sense of purpose, the idea that the fruits of their labors must have a positive and vital impact on the world, whether that is through sustainable practices, green technologies, a safer world or a more positive society, and you can see the geometry of offices shift even more. These new office buildings must be an expression of the company's brand — of its value to the world, and its value to those Gig team members who have the choice to work with, for, and among so many other businesses.

Because let's face it. The power is shifting. The choice, the variety, and the experience of these gig economy workers will only increase. The breadth of their work experiences across multiple companies, industries, work styles, cultures, and problems mean that the workers are much more likely to see patterns of best practices. They are more attuned to finding better ways of working or assembling new and unique solutions to a host of new or emerging issues in such disparate areas as manufacturing, digital technologies, sustainability solutions, financial services, and hospitality. What they lack in traditional corporate safety nets like pensions, 401(k) matches, and other benefits often are offset by flexibility, an ability to hold multiple jobs, and for some, the long-term prospect of venture capital investment.

“
These thinkers
and doers often
are looking to
create environments
where ideas thrive,
where collaboration
happens in a more
fluid way and where
the best and
brightest want to
spend a considerable
amount of time.
It's a world where
an improvement in
the quality of space
that helps generate
a worldclass idea
is worth its weight
in gold

”

The Impact of the VC Community

In fact, there are two very different ways to look at how the VC community impacts the gigonometry of cities. The first is the investment cycle and where and how VCs play in that sphere, where investments in gig-based businesses work and where they don't. The second is really around how VC organizations can help fund environments where gig economy businesses can meet, collaborate, and expand and/or link their models.

From an investment side, it's a volatile world. While the vast majority of participants in the gig economy are freelancing individuals, who enjoy and are committed to the personal flexibility it offers, the number of entrepreneurs who are looking to create larger companies is increasing dramatically. These thinkers and doers often are looking to create environments where ideas thrive, where collaboration happens in a more fluid way and where the best and brightest want to spend a considerable amount of time.

It's a world where an improvement in the quality of space that helps generate a world-class idea is worth its weight in gold.

One only has to take a quick peek at WeWork's IPO and that beleaguered company's efforts to provide sustainable, profitable growth projections to a market hungry for but critical of this new business construct. Bhanu Ramenani, in his article, “Is the gig economy crushing the ‘American Dream,’” offers a cautionary take on the way gig economy platforms, such as Airbnb and VRBO, Uber and Lyft undercut the traditional companies, employee benefits, and the social safety net. So the real question in the gigonometry of business is how both individuals and investors can benefit from what is inarguably a long term trend. Ramenani suggests that government regulation that protects workers' pay and benefits, coupled with a focus on shareholder value, are crucial. I would argue that there is a third factor that drives the economic side of the gigonometry equation – a unifying sense of purpose. Shareholder value, protection of workers' rights, and an integrated purpose that links those two activities sets up a wholly unique paradigm as illustrated on the previous page. ➔



“

People spend hours working, talking, and collaborating. We accept this behavior as fact, but in our every-day lives, most of us ignore the implications of such a fundamental change

”

Purpose Beyond Profit

Picture a company five to ten years from now dedicated making the world a better place. It could be a tech company, a manufacturing company, a pharmaceutical company or a consumer company. The industry isn't that important. What is important is that the employees, contractors, suppliers, and customers understand the impact that company has on the world and they share in the vision that the company will in some unique way make the world a better place. In other words, it has a purpose beyond profit. These people have an aligned passion and sense of purpose that taps into their deeper intellectual and emotional cores. Think: a system that removes plastics from the ocean, a new medical treatment that replaces chemotherapy with immunotherapy or a methodology for helping all people on the planet reduce their carbon footprint. These larger purposes, coupled with the gig economy's access to broad ranges of thinking and experience, in turn, married to that idea of self-selection of a common purpose, unlocks a level of Enterprise Innovation that could shift the nature of innovation itself. This model encourages movement, diversity of thought, experience and background, and takes into account that such teams need not be in the same neighborhood, city or continent. Instead, each urban center develops spaces that encourage and enable connectivity, collaboration and commitment in ways that are unique to their cultures and geographies, separate but interconnected.

A city with its concentrations of people, industry, resources, and infrastructure can develop in a haphazard or planned way. But when the “business” of urban development takes into account the shifting nature of work and purpose the nature of urban planning shifts as well. Instead of simply addressing the constant grind of urban growth, planners think more broadly than

economic growth, public transportation and adequate housing. They start to see their missions integrating with those other purpose, driven organizations to collaborate differently, to marry economic growth with environmental stewardship in the service of livability and comfort for all residents.

So what does that have to do with the gig economy? Quite a lot, actually. Gig economies are in constant flux. The ebb and flow of people, teams, gigs, mega-gigs, investment cycles, and evolution of behaviors itself are spawning urban ecosystems custom-designed to evolve with and in response to these factors. But here's the thing. Most of us don't see it. We are too close to the details, too wrapped up in the day-to-day activity of it all to see the larger picture. We hear about the gig revolution, but we can't see it, and the reason why is simple. We are inside it. It's only when you step back far enough to see those patterns, that the whole is revealed because it is not a simple, easily defined revolution. Instead, it is an evolution revolution. A thousand tiny turns that together drive the more significant revolution.

Evolution Revolution: Real-world Examples

Here are a few examples that show how this is happening. Do you know you can take the shoosh out of a library? There are acoustic systems that allow us to control sound and overall acoustics in space so that a librarian never has to shoosh a person again. But what does that simple solution enable? Well, it allows a study group (run by a gig economy tutor) to work together ten meters away from a community meeting (managed by a part-time community organizer), which is itself 20 meters away from someone else studying a complex text on how to become an entrepreneur. Now, that library is a much more dynamic space. Those three activities create a new gigonometric equation that redefines a library.

The same holds true for hospitals that can shift their function from injury and disease management to wellness and recovery or with reconfigurable office spaces that can go from open office to private or any combination in between. The combination of contract employees, freelance workers, or even full-time employees who also have a “side hustle,” all feed into this rethinking of the spaces in which we live, work, learn, heal and play. The fact is, the more dynamic these gig-based activities become, the more likely our urban spaces will



evolve to shift, change, and adapt in real-time. And here is where it gets fascinating. The nature of venture capital investment will likely change in similarly dynamic ways. It almost has to. The gigonometry demands it. Investment in gig-based companies like Uber, Airbnb, or Design Pickle will continue, even if they launch fewer IPOs and more companies stay private. But at the same time, there is another whole world of companies dedicated to supporting the design, management, and evolution of the actual spaces, and that world is just starting to heat up. And when those two investment worlds connect, the landscape for our cities will morph at an even more rapid rate.

A great example of that evolution revolution exists just a stone's throw from MIT and Harvard at Greentown Labs, which bills itself as the largest cleantech incubator in the United States. Located in Somerville, Massachusetts, it's an organization that clearly has taken to heart the concept that the space you operate in reflects your brand. Their new, 53,000-square-foot expansion, which opened in 2018, is a dynamic stage for some of the most innovative green technologies of the last few years in areas like energy generation, energy distribution, and storage, transportation, building technologies, agriculture, and chemicals. In fact, since their inception, they've supported more than 170 startups, with more than 86% of them still operating today. Since its inception, Greentown Labs has raised more than \$415 million in funding for the companies it supports. ➡

So what is on the horizon for these cities of the future and the gig economy participants who will inhabit them? A more livable environment. More dynamic and changing spaces. A workforce with broader, more diverse people who, in turn, have more extensive and more varied experience across multiple industries, cultures, and technologies. Remember, these cities though physical, are now connected across vast distances via real-time, instantaneous technologies. Video conferencing, immersive collaborative platforms, and access to talent in any corner of the planet mean knowledge and experience can be tapped in ways impossible just a few years ago.

That gigonometry is only now being investigated and is not well understood. The implications, both good and bad, are leading us to an exciting place. We are raising children who will work on problems created by technologies that have not yet been invented. Those same children will work in ways we can hardly imagine with people in places many of them have never heard of, let alone experienced physically. These continually changing, dynamic urban environments will generate new problems to solve and new opportunities for investment, but also filled with risk. Understanding that evolution revolution, finding ways to see emerging patterns, and responsibly investing in the gig economy, will require more than money. It will require forethought, respect for all participants, and a commitment to behave responsibly for the planet and all who live here. ■

“
When the “business” of urban development takes into account the shifting nature of work and purpose the nature of urban planning shifts as well
”



About the Author

Carmen Ferrigno has served as Vice President-Communications at Saint-Gobain Corporation since 2011. In this role, Ferrigno is a member of Saint-Gobain’s North American Executive Committee and reports to Mark Rayfield, CEO of Saint-Gobain North America and CertainTeed Corporation.

Ferrigno is responsible for overseeing all facets of internal and external corporate communications, including branding, executive positioning, crisis, and corporate social responsibility.

In addition to this role, Ferrigno serves as Executive Director of the Saint-Gobain Corporation Foundation.

The Challenge Regulating Big Tech Platforms

Eric K. Clemons¹
Professor of Operations and Information Management, The Wharton School, University of Pennsylvania

1. Motivation

Across the Western World, while new legal decisions and regulations aim to address and mitigate the disruption and harm caused by the business models of large gig economy platforms, these platforms continue to grow exponentially, amassing more power by the day. The implications of their growth as well as the continued growth of other internet giants extend to the whole of society including civil society, consumers, workers, small businesses, entrepreneurs, venture capital investors, and others.

A small set of online platforms now control virtually all of consumers’ online transactions. These firms often deploy novel online business models, with new sources of power and new forms of abuse of that power, which in turn may require new forms of regulation.

Regulation often seems like a rather abstract subject, but online abuse of power and the future regulation of Google, Apple, Facebook, and Amazon actually affects all of us.

Regulators, legislators, and the courts need to understand how today’s giant companies are different from their predecessors. They need to understand when the forms of regulatory control that were designed for the industrial economy may no longer be effective today, even if they seemed fully adequate as recently as ten years ago.

“
A small set of online platforms now control virtually all of consumers’ online transactions
”

Executives need to understand their current and future vulnerability, even if they lead companies that may appear dominant in their industries today. Walmart, Lidl, and Carrefour will be dependent upon online platforms for access to their customers as smart homes and digital assistants like Google and Alexa begin to dominate automated online ordering. Google will route orders to companies that pay the highest prices for access to consumers, duly weighted by quality scores, as they do with search today. This will increase companies’ costs of doing business. Alexa will route orders to Amazon and Whole Foods, reducing or in some cases eliminating competitors’ access to Alexa’s shoppers. Additionally, companies as diverse as BMW and GM, Walmart and Bosch will likewise be dependent upon these platforms for access to their consumers’ smart appliances. Consumers already have Alexa, Google Android, and iOS devices. We do not need another life control interface from BMW, and another from Walmart, and another from Bosch. ●



“
Entrepreneurs
need to understand
where it is currently
impossible to
compete with
existing platform
giants, and where
regulatory change
may open niches
for them
”

Entrepreneurs need to understand where it is currently impossible to compete with existing platform giants, and where regulatory change may open niches for them. Regulatory change may also create opportunities for new online entrants to replicate on a smaller scale the business models that these giants currently totally control.

Likewise, investors need to know when a new company is or is not going to be viable under current regulation, and when future regulation may dramatically reduce the value of their holdings in existing platform giants.

2. Introduction

In the Western World a small number of online platform giants have emerged as the most valuable companies in the world. Four of the ten most valuable companies in the world are the American online platform giants Amazon, Alphabet / Google, Apple, and Facebook, while Chinese online platform giants Tencent and Alibaba are included in the list as well.² Their wealth is truly astounding. Alphabet / Google’s balance sheet as of 31 December 2018 showed just over \$109 billion in cash³, which is just over the combined market capitalization of American Airlines, Delta Airlines, United Airlines, and Southwest Airlines, or significantly more than the combined market capitalization of Ford and GM. They are also among the most powerful companies in the world, with the ability to control online commerce in all countries, in all industries. The firms create enormous economic value and enormous economic benefits for their users. Indeed, this should be self-evident; if they did not create value for users they would not have been so widely adopted. They also create significant economic disruption and demonstrable economic harm to entire industries and to large numbers of these same platforms’ own most loyal customers.

Such creative destruction produces economic losers as well. We don’t mourn the loss of TV Guide now that we have online cable and online cable schedules, any more than we mourn the passing of slide rule producers and the reduced importance of the handheld calculators that initially replaced them. But we should all be concerned when new technology and new business models lead to new sources of power, new forms of abuse of power, and new forms of harm to consumers.

There have recently been calls to regulate the giant American platforms as monopolies, focusing on Google, Apple, Facebook, and Amazon.⁴⁻⁵ However, despite their size and their power, and their abuse of their size and their power, it is not apparent that traditional antimonopoly law is the most appropriate way to regulate these companies. The most frequently discussed form of regulatory relief has been the threat to break these giants into smaller competing firms. As we have discussed previously, breaking up Google Search into smaller competing MP3PP companies would not reduce the cost of keywords; paradoxically, it could actually increase the cost of keywords to companies. Recent calls for regulation of Facebook after its complicity in fake news creation and dissemination involve threats to criminalize the action of its most senior executives⁶; interestingly, while holding Mark Zuckerberg personally liable for Facebook’s actions might significantly alter the company’s behavior, breaking up Facebook would not reduce the harm created by fake news.

Regulation of companies that provide essential infrastructure needs to be analyzed very carefully. Countries should consider regulation only in the presence of the following three conditions:

- Regulation is justified in the presence of demonstrable consumer harm;
- When markets will not provide solutions, or will not do so quickly;
- And when we know how to regulate without creating more harm than good. ●

“

We should all be concerned when new technology and new business models lead to new sources of power, new forms of abuse of power, and new forms of harm to consumers

”

3.

Context — The Need for a New Look at Regulation

The problems with today’s online platform giants include monopoly power and the abuse of that power, but the problems go well beyond just antitrust and abuse of monopoly power. Indeed, the new business models embraced by today’s platform giants create new sources of power and new abuses of power. Before we seek to regulate we need to be certain that there are problems with today’s big tech companies, as of course there are.

- **Facebook** has undeniably been complicit in the effective creation and distribution of fake news^{7,8}, designed to manipulate both the Brexit Referendum and the 2016 US elections.⁹ Indeed, Mark Zuckerberg has been called an “existential threat to democracy.”¹⁰
- **Amazon** is accused of data mining online transactions and systematically destroying sellers in the Amazon marketplace.¹¹
- **Google** may be the most expensive possible way to provide search, even though it appears to be free to consumers.¹²



Are these problems unprecedented? Are they different from the types of problems that regulators had to address before? That depends on what you mean by unprecedented.

- Facebook sells an *addictive, harmful, defective product, enabled by lack of transparency*, just like tobacco companies have done for decades before mandatory product labeling. They sell harmful and unsafe products, just like the meat packing industry did in the 1890s, before the creation of the Food and Drug Administration in the US and its counterparts in developed western economies.
- Uber and Lyft and Airbnb produce *negative externalities*. Uber and Lyft increase urban traffic and urban congestion. Airbnb changes the character of residential neighborhoods, as long-term tenants are replaced by transients. These externalities look different from the pollution created by leather tanning companies and chemical companies, but they are just as real.
- Google has a chokehold over application developers who want to produce apps for Android devices and Google uses that power. The Mobile Application Distribution Agreement (MADA) of Google specifies which apps must be preinstalled on all Android devices and which must be preinstalled on the home page, which apps *may* be preinstalled, and most importantly, which apps *may not* be preinstalled. This is a critical form of *platform envelopment*,

in which a company enjoys monopoly power over a core application, in this case Android. They allow and even encourage creation of additional apps, since each new app creates super-additive value; that is just a fancy way of saying that the value of Android plus YouTube plus Google Maps plus Search is greater than the sum of their values as standalone offerings. And the owner of the core app can deliberately limit interoperability, as Google did with the MADA, extending monopoly power over Android into new forms of monopoly power in new areas. The earliest example of platform envelopment may have been AT&T’s launch of the first commercially successful radio station, WEAf, and its attempt to create the only viable broadcasting network, using its control over long distance land lines to link radio stations in cities throughout the United States. This was immediately blocked by the newly-created Federal Radio Commission, which held that broadcast radio networks were going to be too important to be controlled by a single company.¹³ The EU’s Competition Commission has not insisted that Google divest all of its apps, but it has dramatically reduced the use of the MADA by imposing record fines on Google.¹⁴

Of course there are differences between current problems and these historical precedents. Perhaps the most obvious difference is the breadth of industries that are affected when dominant platforms engage in platform envelopment strategies. The Federal Radio Commission intervened because AT&T had the ability to determine, unilaterally, who could and could not operate a radio network. Google used its platform envelopment strategy to destroy Foundem, a comparison shopping site in the UK; when Google launched a competing site it dropped Foundem from number one in its list of search results to a spot hidden five or more pages deep in its listings.¹⁵ As we have discussed, home assistants, smart appliances, and smart vehicles will extend platform envelopments’ effects even to companies that appear to have well-designed online strategies. It may not be possible for these companies to escape control by online platforms, or the charges these platforms will impose for allowing the firms to continue to access their customers. As smart homes and smart phones emerge as our new *life control interfaces*, the scope and power of platform envelopment will increase significantly. ☹

“

Why would a regulator care? Why would a consumer care? Because these very high prices charged to party 3 sellers invariably result in higher prices to consumers

”

“There are differences between current problems and historical precedents. Perhaps the most obvious difference is the breadth of industries that are affected when dominant platforms engage in platform envelopment strategies”

And of course there are new forms of problems created by giant online platforms that are without precedent in the industrial economy and that are not mitigated by current antimonopoly regulations. Perhaps the most perverse is the *reverse price war* in search, a special case of the reverse price war in Mandatory Participation Third Party Payer businesses (MP3PPs).¹⁶ The basic form is simple to describe:

- Party 2 operates a platform that enables party 1 (buyers or consumers) to interact with party 3 (sellers or service providers).
- The platform is provided to party 1 without charge and buyers quickly and nearly universally adopt the platform. We *all* use Google when we are searching for a watch or a camera or a tour operator, or before we book travel.
- After the nearly universal adoption of the platform by consumers, party 3 sellers and service providers cannot remain in business without the support of the party 2 platform.
- Once that happens, party 2 raises the prices it charges party 3 and party 3 has no choice. Party 3 pays whatever the platform demands.
- The platform operator uses part of its revenue to provide additional services to consumers, who now view the platform as more free than free!
- The presence of competition — the presence of a second platform — does not cause the first platform to lower its prices to party 3. In fact, what commonly happens is that the platform *increases* the prices it charges party 3, and uses the additional revenue to provide even more services to consumers. That is, competition increases prices that party 3 sellers need to pay for access to their customers.
- As long as the platform’s prices are not so high that they bankrupt party 3 sellers, this is stable. Party 3 has no choice; it needs to be found. Party 1 has no reason to object; it gets services freer than free.
- Key to all of this is *single homing*; how often do any of us run a search in Google and Bing? Most of us use only Google, and as a result party 3 sellers have no alternative. The presence of Bing does not reduce Google’s power over sellers.

Why would a regulator care? Why would a consumer care? Because these very high

prices charged to party 3 sellers invariably result in higher prices to consumers. The enormous profits of the party 2 platform operators are a form of tax that the platform imposes on both the sellers and the buyers, but the buyers are unaware of the true cost of relying upon the platform.

4. Will Markets Provide Solutions?

Before we recommend regulation, we need to ascertain if current problems are going to be solved by market forces. The answer is almost certainly not, and certainly not quickly!

Markets don’t solve problems caused by lack of transparency. Markets don’t even know about these problems. Most people manipulated by fake news before the Brexit Referendum or before the 2016 US elections have no idea that they have been manipulated. Almost by definition, market participants are not aware of lack of transparency and harm that they may suffer. And even when consumers are aware that problems *may* exist in their markets, the cost of verification that problems are real and the lack of viable alternatives prevent a market response.

Economists have known for centuries that **markets don’t solve problems with externalities**. As long as I don’t live down wind of a hog farm I am not directly affected by the smell, and I do benefit from buying ham. Markets do not fix problems caused by externalities because customers are not affected directly. The benefits the business creates go to its customers, and the harm goes to others. Even transparency and increasing customers’ awareness of the problems their purchases cause to others is not effective. Altruism rarely solves problems created by harmful externalities.

Markets don’t solve problems with MP3PPs. Party 3 sellers have no choice, so the high prices they pay don’t matter. Party 1 buyers are rewarded, so they actually visibly benefit from the high prices paid by part 3 sellers, even if they suffer counterbalancing harm in terms of higher prices. The rewards are visible; the higher prices are not. The credit card industry is an MP3PP because of the terms of MasterCard and Visa’s service agreements with their merchants; if a merchant accepts one MasterCard it has to accept all of them, and if seller accepts one Visa card it has to accept all of them. Sellers now hate the most expensive

cash back rewards credit cards; the cash back programs are not funded by the banks that issue the cards, but by higher fees paid by merchants on every sale. But why would a customer abandon his or her cash back credit card? The merchant or airline isn’t going to lower the price they charge the buyer, but the buyer is going to lose the 1%, 2%, or more that they receive as their reward for using the card.

And markets don’t solve problems with platform envelopment strategies. Consumers love the obvious superadditive value creation and would lose value if they switched platforms. However, successful platform envelopment strategies limit competition, limit consumers’ choices, and increase consumers’ prices. Still, when comparing the real superadditive value from the platforms they have, against the hypothetical advantages of increased choice and lower prices from competitors who do not yet exist, consumers will predictably and rationally remain with the platform providers and their platform envelopment strategies.

5. Will Monopoly Law Provide Solutions?

The problems we described above are not problems caused by monopolies. They almost certainly will not be solved by the application of traditional anti-monopoly law.

- The harm caused by the lack of transparency and the lack of awareness of the dangers of tobacco were not solved by monopoly law. The tobacco industry wasn’t a monopoly and transparency isn’t a monopoly problem.
- Polluters in chemical industries, agricultural industries, and in fossil fuel industries weren’t monopolies. Pollution is a form of externality. Externalities aren’t a monopoly problem, and externalities are not addressed by antimonopoly laws.
- MP3PPs aren’t monopolies. Google does have monopoly market share in keyword auctions and search, but prior experience with MP3PPs indicates that competition among MP3PPs actually increases the cost of the services provided to party 3. Remember how competition among MasterCard issuers and Visa issuers actually increased merchants’ costs of accepting the cards. Increasing party 3’s cost of doing business invariably increases the prices that consumers pay for goods and services.

6. Other Sources of Relief

If current competition law is not going to provide relief from the present and future abuses of Google, Apple, Facebook, and Amazon, what form should regulation take? We offer a few simple suggestions.

- Google’s Android, Apple’s iTunes, and Amazon’s Alexa are emerging as *essential facilities*. That is, they are essential to entire industries and they are too expensive to expect all retailers, or even all major manufacturers, to develop their own competing versions. Significantly, consumers don’t need three or four. Rather, what consumers need, and what sellers and service providers need, is fair and fairly priced access to customers through these platforms. *The Essential Facilities Doctrine*¹⁷ played a significant role in the regulation of Sabre and Apollo, airline reservations search engines that are the closest historical analogs for Google, and in the decision to compel AT&T to make its connections into consumers’ homes available to competitors. At present *the Essential Facilities Doctrine* no longer plays a significant role in American enforcement of competition law and it has never played a significant role in EU enforcement of competition law. It may need to become a central element of our regulation of platforms going forward.
- Facebook is a harmful product, and consumer protection law needs to be adapted to limit the worst of Facebook’s abuses. Facebook will continue to argue that it is not a media company and that it is inappropriate for private companies to censor what their users can say. I think we can all agree that some forms of private speech are not protected; child pornography, calls to ethnic violence, and other forms of hate speech come to mind immediately. Once we accept that some limitations are appropriate, it becomes acceptable to ask exactly *which* limitations should be enforced. As importantly, Facebook’s targeting of extreme forms of fake news to the most sympathetic readers within their individual bubbles is essential for the continuation of fake news; if attempted manipulation were more widely visible the backlash against Facebook and against the architects of fake news campaigns would limit the harm. So a small regulatory change that would have enormous ☹

benefits is limiting Facebook’s complicit cooperation with fake news campaigns.

Big Tech firms are among the most profitable in the world today, and they are among the largest spenders on public relations and on lobbying. It is not yet clear that any form of regulatory relief is feasible. Prior experience with the Stop Online Piracy Act / Protect Intellectual Property Act is instructive. The idea was to limit giant platforms’ abuse of material under copyright. The largest abuser at the time was Google’s YouTube, but Wikipedia felt threatened as well. The bills initially seemed certain to receive approval in the House and Senate. Google equated it with censorship, and Google’s home page had the image of **CENSORED** stamped across it. Wikipedia asked us to imagine a world without free access to knowledge and then took itself offline for a day. Seven million people signed petitions against the bills. The bills didn’t have a chance of passing after that, since the opposition involved millions of voters.

We expect that consumers could easily be rallied to sign petitions arguing that regulations would destroy the basis of the internet as free, that they would add considerably to users’ costs, and that the current regulatory regime does not subject them to any harm. It is not clear that regulation of giant platforms is feasible until the nature of the harm they cause is much more clear both to regulators and to consumers.

“It is not clear that regulation of giant platforms is feasible until the nature of the harm they cause is much more clear both to regulators and to consumers”



7. Regulation in the Context of Social Welfare Computing

Welfare Economics acknowledges that not all individuals are able to function in our industrial society at all times, and seeks to provide some form of economic social safety net.

This paper is part of an ongoing research program in Social Welfare Computing, which is being conducted with my colleagues at Copenhagen Business School’s Departments of LAW and of Management, Politics and Philosophy and at the Technical University of Munich’s Chair for Information Systems in the Department of Informatics. Social Welfare Computing specifically addresses developing societal mechanisms to mitigate the disruption and harm caused by digital transformation. It does not address using technology to address existing social problems. It does not address use of computing to improve rural access to health care or to higher education, or the improvement of government services, as important as these topics are. Social Welfare Computing addresses developing mechanisms to mitigate the harm caused by new forms of online power, or by abuse of private information, or by fake news and manipulation of elections. ■

1

This paper benefited from the insights of and from discussions with my colleagues at Copenhagen Business School, principally Jan Trzaskowski, and from work with my colleagues at the Technical University of Munich, principally Helmut Krcmar and Sebastian Hermes.

2

As of 13 January 2019, <https://fxssi.com/top-10-most-valuable-companies-in-the-world>

3

As of 31 December 2018, <https://finance.yahoo.com/quote/GOOGL/balance-sheet/>

4

<https://www.washingtonpost.com/technology/2019/09/08/facebook-google-face-off-against-formidable-new-foe-state-attorneys-general/>

5

<https://www.nytimes.com/2019/09/08/technology/antitrust-amazon-apple-facebook-google.html>

6

<https://www.nytimes.com/2019/04/03/world/australia/social-media-law.html>

7

<https://knowledge.wharton.upenn.edu/article/build-fake-news-campaign/>

8

<https://knowledge.wharton.upenn.edu/article/how-private-information-helps-fake-news-to-hoodwink-the-public/>

9

https://www.amazon.com/Mindf-Cambridge-Analytica-Break-America/dp/1984854631/ref=tmm_hrd_swatch_0?_encoding=UTF8&qid=&sr

10

<https://www.bbc.com/news/technology-41036802>

11

<https://www.washingtonpost.com/technology/2019/10/01/amazon-sellers-say-online-retail-giant-is-trying-help-itself-not-consumers/?arc404=true>

12

<http://newpatternsofpower.com/>

13

<https://www.amazon.com/Master-Switch-Information-Empires-Borzoi/dp/0307269930>

14

<https://www.npr.org/2018/07/18/630030673/eu-hits-google-with-5-billion-fine-for-pushing-apps-on-android-users>

15

<https://www.theguardian.com/technology/2017/sep/11/google-appeals-eu-fine-search-engine-results-shopping-service>

16

<http://newpatternsofpower.com/>

17

https://en.wikipedia.org/wiki/Essential_facilities_doctrine



About the Author

Eric K. Clemons is Professor of Operations Information and Decisions at the Wharton School of the University of Pennsylvania. He has worked with the most senior executives in areas as diverse as international finance, global counter terrorism, craft brewing, credit card banking, and marketing of consumer packaged goods.

More recently, Clemons studies the public policy implications of online business models.

Clemons’ most recent project integrates three decades of study into a single volume “*New Patterns of Power and Profit: A Strategist’s Guide to Competitive Advantage in the Age of Digital Transformation*,” which was published in 2018.

He has published over 100 scholarly articles and regularly publishes online in *Huffington Post*, *Business Insider*, and *Knowledge at Wharton*.



Deep Innovation Blockchain — for Better or Worse?

35

Blockchain Revolution Without the Blockchain?

Hanna Halaburda

*Associate Professor of Technology,
Operations and Statistics,
Stern School of Business,
New York University*

44

The Darker Side of Blockchain

Nouriel Roubini

*Professor of Economics and
International Business,
Stern School of Business,
New York University*

50

Blockchain as a Solution to Cyber Threats in the Smart Grid of the Future

Jacob Mendel

*Head of the Cyber-Security Track,
Coller School of Management,
Tel Aviv University*

Overview

Our *Deep Innovation* section frames questions related to technology-led transformation. In this issue, we address blockchain, and dig deep into an innovation interestingly characterized by a lack of consistent understanding about what the technology is, including related lack of consensus on potential benefits and risks.

Hanna Halaburda from the Stern School of Business, New York University, begins by summarizing the potential benefits of blockchain-like solutions. Halaburda then addresses the mechanisms and tools for our accessing and gaining benefits supposedly tied to blockchain, without the use of blockchain technology itself.

Nouriel Roubini, also from the Stern School of Business, asks us to consider that the risks of blockchain-based technologies surpass the benefits. Roubini argues that blockchain technologies, which he clearly distinguishes from distributed-ledger systems, appear increasingly connected to fraud-racked cryptocurrency trading.

Jacob Mendel from the Coller School of Management describes the ways blockchain technology may help protect cyber threats, specifically in the smart grid of the future.

Together, these three authors clarify an important emerging technology, the advantages it promises, and the reality in practice.

Looking forward, it seems clear that the tension between reality and practice, between reality and future promise, are related to many technologies beyond blockchain. Future versions of *Deep Innovation* will continue to bring together varied perspectives on such new technologies, with the aim of promoting new syntheses and insights.

Blockchain Revolution Without the Blockchain?

Hanna Halaburda

*Associate Professor of Technology,
Operations and Statistics, Stern School
of Business, New York University*

Blockchain—often called “the technology behind Bitcoin”—has attracted a lot of attention, perhaps somewhat comparable to that devoted to the Internet at the time of the dot-com boom. Many are excited about this new technology, supposedly based on a public, permissionless, distributed ledger that cryptographically assures immutability without a need for a trusted third party and allows for smart contracts. Large and small companies want to get on board, since they expect this technology to lower their costs by making transactions quicker, safer, transparent and decentralized.

However, the technology behind the blockchain is for the most part not well understood. There is no consensus on what benefits it may really bring,¹ or on how it may fail.

Optimism in the face of novelty and uncertainty of a new technology is not a new phenomenon, but it does affect the economy, for example, through optimistic valuations of blockchain-referencing startups. This optimism also appears in estimates quoted by the media that indicate large cost savings but don’t offer much detail about how those savings would occur.

A more careful look into the technology reveals that most of the proposed benefits of so-called blockchain technologies do not actually come from blockchain. What gets bundled up as blockchain technologies—

smart contracts, encryption and a distributed ledger—are separate concepts. The three may be implemented together, but they do not need to be. We analyze them separately and argue that most of the proposed benefits come from encryption and smart contracts. But encryption and smart contracts do not need blockchain.

So, while the wave of excitement may facilitate adoption of new technology solutions, the landscape after the so-called blockchain revolution may include very few actual blockchain applications. Instead, the changes could focus on encryption and smart contracts.

Confusion around what blockchain actually is

The market’s excitement about blockchain technologies is growing and is perhaps best summarized in the increasingly popular slogan “blockchain revolution.” It is estimated that the blockchain market size will grow from US\$210 million in 2016 to over US\$2 billion by 2021.² Blockchain technologies are expected to change the way the financial industry, supply chains, government record-keeping and many other areas operate. The *Financial Times*³ describes the technology as follows: ➤



A technician inspects the backside of bitcoin mining at Bitfarms in Saint Hyacinthe, Quebec

*Blockchain is an electronic ledger of transactions that are continuously maintained in blocks of records. What gets its developers, investors and fans so excited, however, is that ledgers are jointly held and run by all participants. It is meant to be cryptographically secured to prevent anyone being able to manipulate records, such as who voted for whom, or who owns a bank account.*⁴

The revolution is supported by a few forces, the most significant of which is the expectation of substantial cost savings, as described in the following quotes from the *Financial Times*:

*Blockchain is the electronic ledger originally built to underpin bitcoin markets. Promoters say it will lead to cheaper, more secure ways of settling all kinds of transactions.*⁵

*The technology—an electronic ledger with records stored in “blocks”—aims to automate the complex networks of trust and verification on which modern finance sits, potentially cutting tens of billions of dollars of costs from the financial sector.*⁶

The main sources of savings are supposed to come from increased security, faster transactions and a shared ledger.⁷ Faster transactions on blockchain are often—but not exclusively—ascribed to smart contracts (i.e., automated execution of transactions). A shared ledger is supposed to contribute to cost savings because blockchain is assumed to operate without a trusted third party and therefore to eliminate intermediaries.

However, these assumptions about the benefits of blockchain seem to confuse at least three different concepts: (1) encryption, (2) smart contracts, and (3) distributed ledger, a type of a distributed database. The three may be applied together. But they are separate tools, and not all of them are necessary in a blockchain system.

So, what is “blockchain”?

While there is no one standard definition of blockchain, the most parsimonious and commonly used is a “distributed ledger of transactions.”⁸ This is why the term “blockchain technologies” is often used interchangeably with “distributed ledger technologies.” This parsimonious definition allows blockchains to have different attributes. Specifically, not every distributed

ledger can be secure without a trusted third party⁹ or needs to involve smart contracts. More importantly, encryption or smart contracts do not require a distributed ledger (i.e., blockchain) to be implemented.

Where is this confusion coming from?

Confusion around blockchain can be traced to the origin of the term. The term “blockchain” was introduced as shorthand for a “chain of blocks of transactions,” which was part of the Bitcoin system. Therefore, in the Bitcoin context it meant a “distributed ledger of transactions.” Later, “blockchain” became an independent term in media discussions of whether there are other uses for distributed ledgers of transactions beyond Bitcoin.

Since it started in 2009, the Bitcoin system, which operates without a trusted third party, has been successful in preventing fraud on its blockchain.¹⁰ That is, Bitcoin’s blockchain has proved to be for all practical purposes “immutable.” For this reason, it is often said to be secure. Bitcoin’s blockchain is also public (all transactions are visible) and permissionless (any computer may participate in validating transactions and adding them to the ledger).

Some pundits erroneously extrapolate that any blockchain will have these properties: distributed, secure, public, permissionless and will operate without the need for a trusted third party. This extrapolation may come from an illusion that the Bitcoin’s blockchain properties come solely from technology, while they actually come from a combination of technology and an incentive system that accounts for the behavior of human participants. Yes, the Bitcoin system uses cryptographic tools: public-private key encryption, hashing algorithms. But the system is virtually immutable¹¹ because changing the blockchain’s history is too costly.¹²

Bitcoin’s blockchain has these properties because it is a part of the Bitcoin system. Other distributed systems may not be able to sustain these properties. This is because the Bitcoin system is much more than just the blockchain. The system also involves native cryptocurrency (bitcoins), mining and other elements. Changing the elements of the system, e.g., by removing the native cryptocurrency, or by changing the proof-of-work mechanism, affects the incentives of the participants and therefore may alter

“Smart contracts, encryption and distributed ledger each bring different benefits”

the properties of the distributed ledger that is supported by this modified system.

Note also that smart contracts are not a core property of the Bitcoin blockchain. The Bitcoin system allowed for additional comments along with the transactions, which provided rudimentary capability to create code that would allow for automatic execution of some transactions. Ethereum expanded on this feature, introducing a blockchain with the main purpose of facilitating smart contracts.¹³ Mainstream media’s use of the term “smart contracts” solely in the context of blockchain may have created the perception that smart contracts are native to blockchains. However, a code automatically executing a transaction can be implemented by a wide range of entities.

Therefore, smart contracts, encryption and distributed ledger are separate concepts. They may be implemented together, but do not need to be. The term “blockchain” should not be used as a catch-all aggregation of these different terms.

Why is it important to consider smart contracts, encryption and distributed ledger separately?

The broadening of the meaning of “blockchain” to include smart contracts, encryption and distributed ledger could simply reflect the evolution of a term in a living language. However, precision matters for estimating costs and benefits, or even for predicting the best uses of blockchain technologies. Smart contracts, encryption and distributed ledger each bring different benefits. And since they can be implemented independently, an optimal solution for a particular application may include only some of these tools but not others. This may matter for the future of the blockchain revolution.

Smart contracts are computer programs that automatically implement the terms of an agreement between parties. One example typically given is that of a car lease: upon a missed payment, the car would automatically lock and control would return to the lender. Since execution of a smart contract does not involve a decision or an action by a human, it may be faster and minimize the number of mistakes. Both the increased speed and reduction in errors would result in cost savings. ➡

The term “smart contracts,” and the car example, come from Nick Szabo’s 1997 article,¹⁴ published 12 years before Bitcoin and its blockchain. Some media outlets state that “through blockchain technology, smart contracts are now a reality.”¹⁵ However, smart contracts were a reality long before. An automated recurring payment that someone sets up with a bank is an example of a smart contract. Blockchain is not needed to gain the benefits from smart contracts, because smart contracts can be set up on a centralized system – a bank’s system or a platform dedicated to smart contracts used by individuals.

Encryption, which increases the security of a computer system, may also result in significant cost savings.¹⁶ Currently, encryption is underutilized in business practice. For example, until recently public-private key encryption was typically used to log into a business’s information technology system, but once users were admitted into the system, there was some, but little protection.¹⁷

Excitement about blockchain turned more attention to new developments in cryptography. Bitcoin’s blockchain uses

US\$17 million

Average annual cost of cyber crime to a large U.S. company, 2016

US\$9.5 million

Average annual cost of cyber crime to a large global company, 2016

“By looking at Bitcoin’s blockchain and the fact that it has not suffered a breach since its inception, the pundits extrapolate that any blockchain by its nature offers added security benefits beyond encryption.”

This essentially describes a paradigm shift in the approach to cyber security, and we should pay attention to it. Given the large sums currently spent in relation to fraud and hacking, this shift has potential for significant cost savings. A 2016 study of large companies estimated that cyber crime costs the average large US company US\$17 million. The global average is US\$9.5 million.¹⁹ However, it is doubtful that we need blockchain to get the benefits of encryption and to trigger these cost savings.²⁰

What are the benefits of blockchain?

The arguments above show how smart contracts and encryption can result in cost savings. But what about the benefits of distributed ledger, i.e., the blockchain itself? **Distributed ledger** allows multiple parties in the system to add transactions to a shared ledger in a way that the changes are reflected consistently across all its copies.²¹ It brings benefits in places where reconciliation of contradictory ledgers is costly. At the same time, recording transactions on a shared ledger takes more time than on a centralized ledger because of the reconciliation mechanisms (consensus mechanisms) that need to be employed. Moreover, the need to store the copies of the ledger in multiple locations may significantly add to storage and computational costs. To date, it has not been clearly demonstrated in which circumstances the benefits of employing a distributed ledger outweigh the cost of delays and duplicated storage.

Moreover, with the experience of Bitcoin, proponents of blockchain technologies expect more from the new technology than just a distributed ledger. By looking at Bitcoin’s blockchain and the fact that it has not suffered a breach since its inception, the pundits extrapolate that any blockchain by its nature offers added security benefits beyond encryption. They also expect that adopting blockchain would result in further cost savings due to disintermediation, since Bitcoin’s blockchain does not require a trusted third party to be virtually immutable. Indeed, the core of Bitcoin’s computer-scientific innovation was the security of a permissionless distributed ledger, so that there is no need for a trusted third party anywhere in the system.²²

Distributed ledgers are a special type of distributed databases, which have been ➡

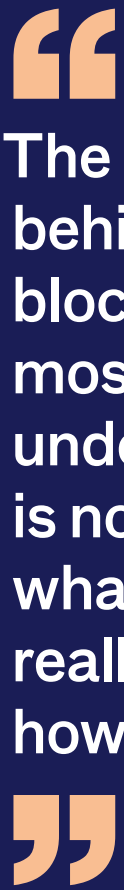


standard, well-established cryptography tools (public-private key encryption, hash functions, etc.). But novel tools developed in recent years allow for much bolder uses. The premise is to create encryption systems that would protect the information—no matter where it is stored—rather than protect a specific computer.

Serious efforts in this direction have already been undertaken by industry heavyweights, as stated by

R. Martin Chavez, the Chief Financial Officer of Goldman Sachs:

*We focused on encryption and key management, worked on these issues with AWS and Google, and now we are in a new state. Our developers are indifferent as to whether a particular data compute load will happen out of Amazon and Google [cloud computing services] or whether they will happen in our own data centers. And we assume that all the computers are hostile; it doesn’t matter whether they are at AWS or our own data centers.*¹⁸



The technology behind the blockchain is for the most part not well understood. There is no consensus on what benefits it may really bring, or on how it may fail



known and used for three decades. But while previous distributed databases were permissioned and required a third party to manage the permissions and help maintain the database, Bitcoin was the first that allowed for a permissionless distributed ledger.²³ So yes, Bitcoin’s blockchain is virtually immutable without a need for a trusted third party.

However, these benefits may be difficult to realize in a blockchain without Bitcoin. It has proven to be a challenge to create a decentralized, permissionless and secure blockchain to transfer assets other than a native cryptocurrency (for example, bitcoins for the Bitcoin blockchain).

The first major challenge is the gateway problem: the information about the underlying assets needs to enter the blockchain in the first place. For example, suppose we want to use a blockchain to record and transfer land-ownership titles. To initiate this process, a gateway needs to attest that a specific plot of land exists and to assign it to an initial owner. Whether the gateway is an individual, an institution or a consortium, it needs to be a trusted third party for subsequent users of the blockchain. Importantly, Bitcoin does not need a gateway. Since the Bitcoin currency is native to its blockchain, all bitcoins are created on the blockchain automatically and can then be transferred as per the Bitcoin protocol.²⁴

The second major challenge is assuring immutability of the ledger without a native currency. It is important to remember that

Bitcoin’s virtual immutability comes not only from encryption but also from the incentives embedded in the system. What makes the ledger immutable is the fact that adding a block to the blockchain is costly. A network participant (say, a Bitcoin miner) needs to expend significant resources to win the tournament (to be the quickest to find a solution to a puzzle), which awards that participant the right to add a new block of transactions to the blockchain. This cost also makes rewriting the history of the blockchain expensive, resulting in virtual immutability. The network participants are rewarded for their costly work with bitcoins.²⁵ Without bitcoins (or other native cryptocurrency), the network participants need to be motivated by incentives from outside of the blockchain.

In most of the currently proposed applications, both challenges have been addressed by creating closed, permissioned blockchains. This is because a blockchain without bitcoins is no longer virtually immutable without a trusted third party. In many cases, permissioned blockchains are the right tools for their purpose. We need to recognize, however, that they depart from Bitcoin’s innovation. They effectively go back to the traditional concept of distributed databases.

Moreover, if permissionless is not the goal, then we need to consider whether a blockchain, i.e., a distributed ledger of transactions, is the optimal design choice for those permissioned distributed databases. Proof-of-work is a quite ➡



It is important to remember that Bitcoin’s virtual immutability comes not only from encryption but also from the incentives embedded in the system



inefficient consensus mechanism, not only in terms of electricity, but also in terms of speed and resilience. And maintaining the entire history of transactions consumes more memory than, for example, keeping balances. We accept these inefficiencies in Bitcoin’s blockchain because they allow for a permissionless distributed database. As we see, blockchain applied outside of Bitcoin (or other native cryptocurrency) loses its desired properties. It is no longer permissionless and immutable without the need for trusted third parties. If we accept permissioned systems, the three decades of extensive research on distributed databases in computer science offer us more efficient solutions: better consensus mechanisms and memory storage strategies. Maybe they would do a better job than blockchain. One of the indirect effects of the blockchain revolution may be the popularization of traditional distributed databases. Distributed databases have been a vibrant research field in computer science for decades. Before Bitcoin, however, commercial and popular interest was mostly limited to back-office operations of large Internet companies, such as Facebook. The blockchain revolution has brought distributed databases to the forefront and may result in wider adoption and new ideas for their use. However, the benefits of distributed databases may be limited to very specific applications. And even in the context of these applications, while valuable, it is not clear that distributed databases would bring substantial cost savings.

The future of the blockchain revolution

Blockchain technologies will likely have a significant impact on many industries, not just finance. However, this may not happen in the way envisioned. Computation and communication technologies have decreased the cost of experimentation and digital entrepreneurship. This resulted in a proliferation of start-ups, creating competitive pressure and exposing inefficiencies in existing (legacy) systems. Both new and existing players are looking with interest at the properties of smart contracts and Bitcoin’s blockchain. But as they realize the benefits of different aspects of the system, it may turn out that new encryption tools and smart contracts have large and clear benefits, while distributed ledgers may have a more limited appeal. And for many applications, the most suitable will be the traditional distributed database rather than one based on Bitcoin’s blockchain. Most of all, we need to realize that outside of Bitcoin (or other cryptocurrencies) we do not have a technology that offers “permissionless distributed ledgers that cryptographically assure immutability without a need for trusted third parties.” The blockchain revolution may give us new tools and change the landscape of some industries. But since the benefits of encryption and smart contracts can be realized without a distributed ledger, the world after the blockchain revolution may well be a world without the blockchain. ■

¹

For example, some pundits point to “privacy” while others to “transparency” as a benefit of blockchain.

²

As estimated by Markets and Markets, a market research company (<https://www.marketsandmarkets.com/Market-Reports/blockchain-technology-market-90100890.html>). Market size is measured by revenues from sale of blockchain-related solutions.

³

It is worth noting that among all the media excitement, the *Financial Times*’ voice is probably the most cautious in blockchain matters.

⁴

J. Wild, “Blockchain believers hold fast to a utopian vision,” *Financial Times*, January 27, 2017.

⁵

G. Meyer and N. Hume, “Trafigura tests blockchain for settling US oil market deals,” *Financial Times*, March 27, 2017.

⁶

P. Stafford, “Blockchain consortium raises record \$100m,” *Financial Times*, May 23, 2017.

⁷

Additional expected benefits include public data and time-stamping of transactions.

⁸

Note that a “ledger of transactions” is different from a “ledger of balances.” The former keeps the history of transactions, as in the “chain of blocks of transactions.” A ledger of balances wouldn’t be a blockchain.

⁹

Alternatively, one could insist on defining “blockchain” to be a distributed ledger that is secure without any trusted third party. That is a more restrictive definition that would exclude most currently proposed applications of blockchain technologies.

¹⁰

While there have been thefts of large sums of bitcoins, e.g., on Mt.Gox, none of them occurred by falsifying the blockchain. The difference is akin to the difference between a bank robbery and counterfeiting in the realm of paper currency. While “bank robberies” have happened in the world of Bitcoin, the system has proven to be resistant to “counterfeiting.”

¹¹

Bitcoin’s blockchain is immutable with very high probability, but does not guarantee absolute immutability.

¹²

The Bitcoin system makes adding a block to the blockchain artificially costly by making verification nodes compete to solve a cryptographic puzzle. This also makes changing blockchain’s history prohibitively costly. Changing this feature, while leaving all the cryptography in place, could jeopardize the safety of a blockchain operating without a trusted third party.

¹³

See www.ethereum.org

¹⁴

N. Szabo, “Formalizing and Securing Relationships on Public Networks,” *First Monday*, September 1997. Available at <http://firstmonday.org/ojs/index.php/fm/article/view/548>

¹⁵

See, e.g., A. Lielacher, “A Cost-Benefit Analysis of Using Smart Contracts in Banking,” BTCManager.com, April 14, 2017. Available at <https://btcmanager.com/a-cost-benefit-analysis-of-using-smart-contracts-in-banking/>

¹⁶

The security of Bitcoin’s blockchain comes from two sources: (i) encryption tools, such as public-private key, using hash functions, etc; and (ii) incentives induced by the mining scheme. We focus here on encryption. As we discuss later, the incentives induced by mining are difficult to sustain in blockchains without native cryptocurrency and without a trusted third party (or parties).

¹⁷

For example, often, information is encrypted on specific drives in companies’ computer systems.

¹⁸

R. M. Chavez, “Data, Computing, and Transformation in the Financial Industry,” speech at the symposium “Data, Dollars and Algorithms: The Computational Economy,” Harvard Institute for Applied Computational Science, January 19, 2017.

Available at <https://www.youtube.com/watch?v=VF6DrXoHoUg>

¹⁹

2016 Cost of Cyber Crime Study & the Risk of Business Innovation, Ponemon Institute Research Report, October 2016. The numbers are steadily increasing. In 2015 the average cost was US\$15 million in the United States and US\$8 million globally.

²⁰

The Goldman Sachs solutions described in the Chavez quote do not rely on blockchain.

²¹

Technically, distributed databases also have other desirable properties, but this one seems to be the focus in the context of blockchain technologies and fintech.

²²

The security of the ledger is not guaranteed. However, the probability of a failure is pushed so low that the ledger is considered secure for all practical purposes. Nonetheless, there are factors that can affect this probability. Some are well known and discussed in the literature, such as the 51 per cent attack.

²³

There were earlier, less successful tries to establish permissionless ledgers, e.g., bit-gold.

²⁴

Note also that while Bitcoin is decentralized in the sense that verification and settlement of transactions occurs in a decentralized way, the issuance of bitcoins is very much centralized and controlled by the algorithm.

²⁵

Recently, alternative consensus mechanisms have been proposed, such as proof-of-stake. So far, they do not offer immutability with as high probability as the proof-of-work as implemented in the Bitcoin system.

About the Author

Hanna Halaburda is Associate Professor of Technology, Operations and Statistics at the New York University Stern School of Business. Much of Halaburda’s work focuses on competition between platforms, e.g. Apple’s iPhone vs. Android or eHarmony vs. Match. The most current theme in her research is the development of digital currencies and blockchain technologies. Halaburda’s work has been published in Management Science, RAND, American Economic Journal, Games and Economic Behavior and other academic journals. She also wrote a book (joint with Miklos Sarvary) on digital currencies, Beyond Bitcoin: The Economics of Digital Currency (Palgrave, 2016). Before her appointment at NYU, Halaburda was a Senior Economist at the Bank of Canada and an Assistant Professor at the Harvard Business School. A shorter version of this article appeared in Communications of ACM.

42

COLLER VENTURE REVIEW

43

The Darker Side of Blockchain

Nouriel Roubini

*Professor of Economics and
International Business,
Stern School of Business,
New York University.
Chairman, Roubini Macro
Associates LLC*

There is a good reason why every civilized country in the world tightly regulates its financial system. The 2008 global financial crisis, after all, was largely the result of rolling back financial regulation. Crooks, criminals, and grifters are a fact of life, and no financial system can serve its proper purpose unless investors are protected from them.

But the current regulatory regime does not capture all financial activity. Cryptocurrencies are routinely launched and traded outside the domain of official financial oversight, where avoidance of compliance costs is advertised as a source of efficiency. The result is that crypto land has become an unregulated casino, where unchecked criminality runs riot.

This is not mere conjecture. Some of the biggest crypto players may be openly involved in systematic illegality. Consider BitMEX, an unregulated trillion-dollar exchange of crypto derivatives that is domiciled in the Seychelles but active globally. Its CEO, Arthur Hayes, boasted openly that the BitMEX business model involves peddling to “degenerate gamblers” (meaning clueless retail investors) crypto derivatives with 100-to-one leverage).

To be clear, with 100-to-one leverage, even a 1% change in the price of the underlying assets could trigger a margin call and wipe out all of one’s investment. Worse, BitMEX applies high fees whenever one buys or sells its toxic instruments, and then it takes another bite of the apple by siphoning customers’ savings

into a “liquidation fund” that is likely to be many times larger than what is necessary to avoid counter-party risk. It is little wonder that, according to one independent researcher’s estimates, liquidations at times account for up to half of BitMEX’s revenue.

BitMEX insiders revealed to me that this exchange is also used daily for money laundering on a massive scale by terrorists and other criminals from Russia, Iran, and elsewhere; the exchange does nothing to stop this, as it profits from these transactions.

As if that were not enough, BitMEX also has an internal for-profit trading desk (supposedly for the purpose of market making) that has been accused of front running its own clients. Hayes has denied this, but because BitMEX is totally unregulated, there are no independent audits of its accounts, and thus no way of knowing what happens behind the scenes.

At any rate, we do know that BitMEX skirts AML/KYC regulations. Though it claims not to serve U.S. and UK investors who are subject to such laws, its method of “verifying” their citizenship is to check their IP address, which can easily be masked with a standard VPN application. This lack of due diligence constitutes a brazen violation of securities laws and regulations. Hayes even openly challenged anyone to try to sue him in the unregulated Seychelles, knowing he operates in the shadow of laws and regulations. 🚫



Blockchain — Holy Grail or Empty Vessel?

With the above, boosters have fled to the last refuge of the crypto scoundrel: a defense of “blockchain,” the distributed-ledger software underpinning all cryptocurrencies. Blockchain has been heralded as a potential panacea for everything from poverty and famine to cancer. In fact, it is the most overhyped – and least useful – technology in human history.

In practice, blockchain is nothing more than a glorified spreadsheet. But it has also become the byword for a libertarian ideology that treats all governments, central banks, traditional financial institutions, and real-world currencies as evil concentrations of power that must be destroyed. Blockchain fundamentalists’ ideal world is one in which all economic activity and human interactions are subject to anarchist or libertarian decentralization. They would like the entirety of social and political life to end up on public ledgers that are supposedly “permissionless” (accessible to everyone) and “trustless” (not reliant on a credible intermediary such as a bank).

Yet far from ushering in a utopia, blockchain has given rise to a familiar form of economic hell. A few self-serving white men (there are hardly any women or minorities in the blockchain universe) pretending to be messiahs for the world’s impoverished, marginalized, and unbanked masses, claim to have created billions of dollars of wealth out of nothing.

99%

99% of all Blockchain transactions occur on centralized exchanges that are hacked on a regular basis

In a Gini coefficient where **1.0** means that a single person controls **100%** of a country’s income/wealth:



North Korea scores **0.86**



United States scores **0.41**



Bitcoin scores **0.88**

And yet, according to one study, up to 95% of all transactions in Bitcoin are fake, indicating that fraud is not the exception but the rule.

Blockchain Greed

One need only consider the massive centralization of power among cryptocurrency “miners,” exchanges, developers, and wealth holders to see that blockchain is not about decentralization and democracy; it is about greed.

For example, a small group of companies – mostly located in such bastions of democracy as Russia, Georgia and China – control between two-thirds and three-quarters of all crypto-mining activity, and all routinely jack up transaction costs to increase their fat profit margins. Apparently, blockchain fanatics would have us put our faith in an anonymous cartel subject to no rule of law, rather than trust central banks and regulated financial intermediaries.

A similar pattern has emerged in cryptocurrency trading. Fully 99% of all transactions occur on centralized exchanges that are hacked on a regular basis. And, unlike with real money, once your crypto wealth is hacked, it is gone forever. ➡

“

No serious institution would ever allow its transactions to be verified by an anonymous cartel operating from the shadows of the world’s authoritarian kleptocracies

”



“
”

Of course, it is no surprise that an unregulated market would become the playground of con artists, criminals, and snake-oil salesmen



The symbols of Bitcoin and Ethereum cryptocurrencies sit displayed on a screen during the Crypto Investor Show in London, U.K

Moreover, the centralization of crypto development – for example, fundamentalists have named Ethereum creator Vitalik Buterin a “benevolent dictator for life” – already has given lie to the claim that “code is law,” as if the software underpinning blockchain applications is immutable. The truth is that the developers have absolute power to act as judge and jury. When something goes wrong in one of their buggy “smart” pseudo-contracts and massive hacking occurs, they simply change the code and “fork” a failing coin into another one by arbitrary fiat, revealing the entire “trustless” enterprise to have been untrustworthy from the start.

Lastly, wealth in the crypto universe is even more concentrated than it is in North Korea. Whereas a Gini coefficient of 1.0 means that a single person controls 100% of a country’s income/wealth, North Korea scores 0.86, the rather unequal United States scores 0.41, and Bitcoin scores an astonishing 0.88.

As should be clear, the claim of “decentralization” is a myth propagated by the pseudo-billionaires who control this pseudo-industry. As for blockchain itself, there is no institution under the sun – bank, corporation, non-governmental organization, or government agency – that would put its balance sheet or register of transactions, trades, and interactions with clients and suppliers on public decentralized peer-to-peer permissionless ledgers. There is no good reason why such proprietary and highly valuable information should be recorded publicly.

Moreover, in cases where distributed-ledger technologies – so-called enterprise DLT – are actually being used, they have nothing to do with blockchain. They are private, centralized, and recorded on just a few controlled ledgers. They require permission for access, which

is granted to qualified individuals. And, perhaps most important, they are based on trusted authorities that have established their credibility over time. All of which is to say, these are “blockchains” in name only.

It is telling that all “decentralized” blockchains end up being centralized, permissioned databases when they are actually put into use. As such, blockchain has not even improved upon the standard electronic spreadsheet, which was invented in 1979.

Recalibration Needed

No serious institution would ever allow its transactions to be verified by an anonymous cartel operating from the shadows of the world’s authoritarian kleptocracies. So it is no surprise that whenever “blockchain” has been piloted in a traditional setting, it has either been thrown in the trash bin or turned into a private permissioned database that is nothing more than an Excel spreadsheet or a database with a misleading name.

Of course, it is no surprise that an unregulated market would become the playground of con artists, criminals, and snake-oil salesmen. Crypto trading has created a multi-billion-dollar industry, comprising not just the exchanges, but also propagandists posing as journalists, opportunists talking up their own financial books to peddle “shitcoin,” and lobbyists seeking regulatory exemptions. Behind it all is an emerging criminal racket that would put the *Cosa Nostra* to shame. ■



About the Author

Nouriel Roubini is a professor at NYU’s Stern School of Business and CEO of Roubini Macro Associates.

Roubini was Senior Economist for International Affairs in the White House’s Council of Economic Advisers during the Clinton Administration. He has worked for the International Monetary Fund, the US Federal Reserve, and the World Bank.

Blockchain as a Solution to Cyber Threats in the Smart Grid of the Future

Jacob Mendel
Head of the Cyber-Security Track,
Collier School of Management
Tel Aviv University

The Smart Grid is one of the most critical infrastructure services of today’s developed nations, providing electrical service to consumers through two-way digital communications. The system aims to improve supply efficiency and reliability while self-healing glitches and reducing energy consumption and costs. Governments have been working to implement these systems around the world as a step in combatting global warming and for their potential to build energy resilience and independence.

Alongside smart grids and the rise of IoT (Internet of Things) in general, smart meters are becoming widespread as well – in residential, business, and industrial buildings alike. The new smart metering is the gateway between the Smart Grid and our homes or businesses, enabling dynamic pricing and information exchange with smart home devices. In its most basic consumer application, smart meters precisely track all energy consumption and send digital meter readings to energy suppliers for more accurate energy bills.

But no matter how smart they are, smart meters still represent a serious vulnerability to the greater Smart Grid, as they are mostly a kind of interconnected communications hub between the consumers and energy providers that comprise the Grid. Malware in particular is a significant threat, both for the harm it can cause and the challenges in properly addressing it.

The combination of porous devices and the sensitive information flowing through the smart grid has left open an attractive target for malicious cyberattacks. To our collective peril, this security risk is not receiving the treatment it deserves either by cybersecurity industry research or by consumers.

Blockchain as a Solution to Cyber Threats

Smart Grid cybersecurity threats in general can come from a myriad of sources, such as cybercrime, hacking, cyberwar, etc. To mitigate cybersecurity threats, utility companies will need to share and coordinate the exchange of cybersecurity information, like intelligence and vulnerabilities, with governmental agencies and probably with other public and private sector cyber research institutes. This is one of the first places blockchain comes in.

Preventing potential cyberattacks on Smart Grid communication can be done by identifying the number of attacks, of which four have been identified. These include a device attack (aims to compromise a grid device), a data attack (attempts to maliciously insert, alter or delete data or control commands in the network traffic to misguide the Smart Grid, leading it to make wrong decisions/actions), a privacy attack (aims to learn/infer users’ private information by analyzing electricity usage data), and a network availability attack (i.e. a DoS Denial of Service).

Each of the above kinds of attacks has different objectives and can often be the building blocks of more sophisticated attacks. This relates to blockchain in several ways:

1. Attacks on the Smart Grid will likely be more advanced than the traditional attacks on IT/OT infrastructures.
2. Additionally, for the offense to cause negative system impact, the attacker must also know how to control the cyber aspects to manipulate the physical system – including software vulnerabilities such as buffer overflows, integer overflows, and structured query language –injection.
3. The fact that the Smart Grid does not use reliable methods to authenticate users is also a unique part of the problem/solution, and a place where blockchain can be uniquely useful. Left unaddressed, such threats may provide an attacker with the ability to bypass the authentication and take control of the Smart Grid network.

The Smart Grid cybersecurity threats – and the ways in which blockchain can be used to remediate a particularly challenging situation – are summarized in the table overleaf. As illustrated, they revolve around knowledge-based remediation (something you know); possession-based remediation (something you have); and biometric-based remediation (something you are).

As with other essential infrastructure, blockchain is particularly relevant given that the number of attacks on critical infrastructure is continuously increasing. In this example, any deployment of a Smart Grid without suitable cybersecurity might result in severe consequences, such as grid instability, utility fraud, and the loss of user information and energy consumption data. ➡

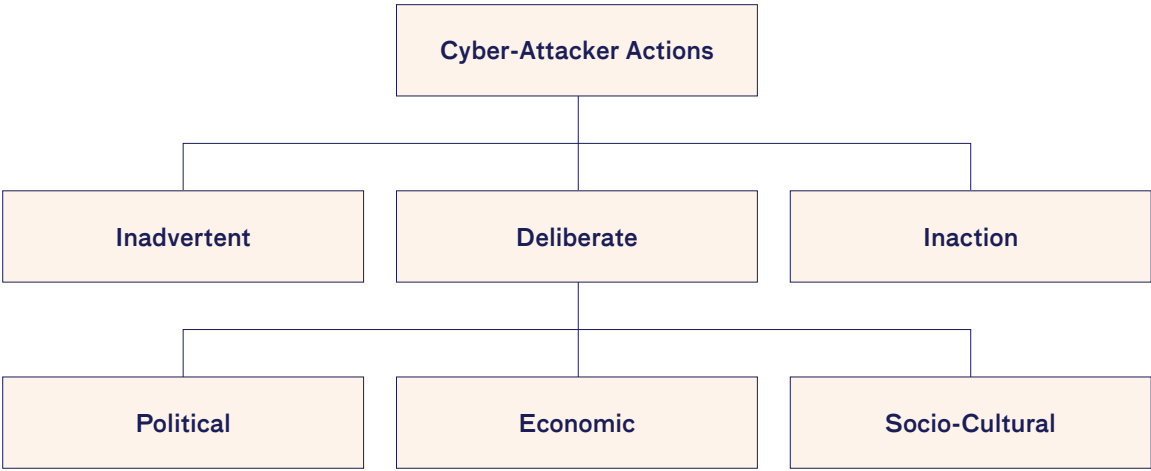


Threat	How Blockchain Can Help
Availability	<ul style="list-style-type: none">– Anti Denial of Service (DoS) (on an individual device, a group of devices or an entire subnetwork)– Anti communication hijacking/MITM attacks– Anti-jamming– Anti device theft
Integrity	<ul style="list-style-type: none">– Help against fraud, stealthy manipulation of critical data such as meter readings, billing information, control commands– Anti-tampering
Personalization requires costly, potentially time-consuming tasks	<ul style="list-style-type: none">– Privacy– Avoiding use of power usage data and customer account information– Smart meter aggregation of usage data for billing purposes and to support load-balancing and other monitoring functions– Avoiding backdoors and holes in the network perimeter– Defending database attacks– Protecting the smart meters’ data– Preventing spoofing system operators and SCADA devices– Avoiding leakage of sensitive data
Timeliness	<ul style="list-style-type: none">– Real-time needs of control systems and responsiveness aspects of the system
Human Machine Interface (HMI)	<ul style="list-style-type: none">– Fraudulent information about demand or supply which will create non-existing power flows which may result in blackouts and heavy financial losses
Software Vulnerabilities	<ul style="list-style-type: none">– Buffer overflows– Integer overflows– Code behavior analysis– Avoiding changes to the software or modifications to the software configuration settings– Changes in programmable logic in PLCs, RTUs, or other controllers
Authentication	<ul style="list-style-type: none">– Password / authentication– Theft identification– Access control

The Psychology of Cyberattacks

The primary concern of companies and organizations are cyberattacks that are deliberate actions. Economic motivation (for example theft of intellectual property or users’ private information or credit card information) is one of the most reliable motivations for attacks. By contrast, political and espionage motivations involve, for example, destroying essential web sites, DDOS (Distributed Denial Of Service) attacks, taking control of strategic or symbolic targets, blackouts or making political statements.

Given the range of the above, it is recommended that a new holistic approach be found that would automatically build a malware baseline and the corresponding detection of malicious activities, and that blockchain should be part of such a holistic approach.



A New Holistic Approach

Malware is a newly coined term for malicious software that is intentionally designed to disrupt availability, compromise confidentiality, alter integrity, and cause abusive behaviors. Research studies show that the impact of malware infection often not only leads to loss of privacy and confidentiality of data but also allows hackers to abuse the victim’s computational resources when conducting larger-scale cybercrime activities.

Genge, Rusu, and Haller suggested using anomaly detection techniques to identify malware attacks. Their approach automatically generates detection rules for the IDS (Intrusion Detection System), which relies on predictive behavior. Their anomaly detection depends upon the deviation of communication patterns from regular communication. A significant improvement can be achieved by adding network traffic visualization and device identification. Because of malware disguise, multiple layers of defense are recommended, and all ➡



“
The Smart Grid is an upgrade on the old electrical power grid, and cybersecurity issues are a real threat
”

anti-malware efforts should be fully managed and controlled, including continuous patching and updates.

Absent advance-detection, malware advanced enough to attack a smart meter may disturb or influence the smart meter’s essential rules such as periodical power consumption registration; private consumer activities, communication with the utility company, the turning of the power on or off to any electronic devices which are connected to the local grid; real-time interaction awareness and management (e.g., load balancing); and automatic switching to an alternative power source like a solar, wind, or alternative-energy storage system.

The malware may also eavesdrop on the home network traffic, which includes: pricing information, control structure, power usage, location information, and private user data.

Conclusion

The Smart Grid is an upgrade on the old electrical power grid, and cybersecurity issues are a real threat. This has led to the proliferation of industrial and academic research aimed at identifying and mitigating cybersecurity threats. This specifically includes advanced malware, which becomes a critical threat to the entire Smart Grid network, including but not limited to ICS (Industrial Control Systems) and critical infrastructures.

Adding encryption and cryptographic signatures to Smart Grid communication

“
The complexity and heterogeneity of the Smart Grid network – as with other infrastructures – mean there will not be one golden solution, which addresses all cybersecurity threats
”

protocols is essential to ensure authenticity and integrity, but it will not solve the problem of advanced malware threats. For example, the unknown malicious codes, which are probably encrypted or use various programming obfuscation techniques, can bypass signature-based detection techniques.

The complexity and heterogeneity of the Smart Grid network – as with other infrastructures – mean there will not be one golden solution, which addresses all cybersecurity threats. Blockchain can be a dominant tool in cybersecurity since it offers better methods of protection, and more flexibility, which makes it a robust tool for the changing environment. Blockchain’s built-in functions (better encryption, reliability, and traceability) position it against attackers who try to bypass the authentication and take control of the Smart Grid network. Even though blockchain may help to defend many treats, Smart Grid’s architecture is complicated and no single tool will protect all potential threats. Therefore, cyber protection in general and smart metering in particular are prominent research challenges and very fruitful research fields for the future.

For future research in the Smart Grid cybersecurity context, future research should also investigate the use of a machine learning-based malware detection system. In particular, it would be interesting to combine machine learning with malware intrusion detection systems (IDS) specially built for Smart Grids. ■

Supplementary references

FF. Skopik, Z. Maa, T. Bleiera, H. Grüneisb, *A Survey on Threats and Vulnerabilities in Smart Metering Infrastructures*, “International Journal of Smart Grid and CleanEnergy” 2012, pp. 22–28, <http://www.ijsgce.com/index.php?m=content&c=index&a=show&catid=27&id=16>, [12.12.2016].

T. Sato et al., *Smart Grid Standards: Specifications, Requirements, and Technologies*, Wiley, 2015, <http://dx.doi.org/10.1002/9781118653722>

T. Baars et al., *Cyber Security in Smart Grid Substations*, Technical Report UU-CS-2012-017, Department of Information and Computing Sciences, Utrecht University, Utrecht 2012.

E.D. Knapp, J.T. Langill, *Industrial Network Security: Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Control Systems*, Elsevier, Waltham 2015.

A. Hahn, *Cyber security of the smart grid: Attack exposure analysis, detection algorithms, and testbed evaluation*, 2013.



About the Author

Jacob Mendel is the Head of Cyber-Security study at Collier School of Management in Tel Aviv University, and former General Manager Cybersecurity COE at Intel. Mendel holds 16 approved patents in the area of cybersecurity.

Mendel’s current main research interest is on the economic perspective of cybersecurity attacks, Blockchain technology with a special focus on cybersecurity attacks, privacy issues and business continuation under cyber-attack.



Virtual Roundtable University-led Entrepreneurship

59

Virtual Roundtable University-led Entrepreneurship

Freddy Boey
*Deputy President,
National University of Singapore*

Anjani Jain
*Deputy Dean,
Yale School of Management*

Jonathan Levin
*Dean, Graduate School of Business,
Stanford University*

Stephen Spinelli
President, Babson College

Kar Yan Tam
*Dean, The Hong Kong University
of Science and Technology*

Moshe Zviran
*Dean, Coller School of Management,
Tel Aviv University*

74

Bringing Entrepreneurial Theory to Practice in the Classroom

Michellana Jester
*Lecturer and Course Faculty Lead,
MIT Sloan School of Management*

Overview

Entrepreneurs, social innovators, venture capitalists, and investors often take the lead in generating the new entrepreneurship vocabulary that allows academicians to ask new questions and develop a variety of contemporary approaches to entrepreneurship education. To contribute to the literature and the advancement of the world of entrepreneurship, among our goals at the Coller Institute of Venture is to develop new ways to bring theory into practice as well as support the translation from practice to theory.

With that, we welcome you to our first Virtual Roundtable on University-led Entrepreneurship. Together with leading university presidents and business school deans, we explore university and department-led efforts that focus on entrepreneurship education. We talk about internal institutional changes, student-driven initiatives, and the changes that are inspired by the external entrepreneurial, cultural and social milieus our institutions find themselves in.

Our participants, listed on the left, share their personal perspectives as well as the institutional perspectives of their universities. Together, we hope to promote the beginning of a provocative new way to think about entrepreneurship education at the intersection of theory and practice.



Leslie Broudo-Mitts —

Welcome everyone to this extraordinary roundtable we are fortunate to hold. Today's topic is two-part: One is the transformation that business schools and MBA programs are undergoing, and one the context and the ecosystems within which we, the leaders of these programs, find ourselves.

Let's start with the first. These days, a lot of people are talking about combining business with engineering and computer science. Thinking about this but extending more broadly, what are your thoughts in terms of how collaborations within the university context has changed, and how it might change going forward?

Tam —

Allow me to begin. We started to bring in the entrepreneurship element into our teaching and also into our research mission about twenty years ago. We received a lot of initial attention. About six or seven years ago, some of our student startups turned out to be very successful and they invested in us. So, at this point, we have a university-wide entrepreneurship minor, so any student from any school, if he or she is interested in entrepreneurship, can enroll in this entrepreneurship minor program.

There are a lot of experiential learning opportunities for those students taking the minor. We also have a master's degree program. So, this is again a program that joins engineering, science and business. To support them we created an incubator, allowing students to spend six months or even nine months working full time to turn their ideas into something more tangible.

We are also going to build a new campus in China later this month, expanding out our footprint from Hong Kong. The new campus is twice the size of the Hong Kong campus,

and we are thinking about a new academic model based, again, on the intersection of engineering, science, and business.

Boey —

That is impressive. I'd say that the push for entrepreneurship in Singapore is slightly different. There has been a very substantial amount of funding from the government to the University, a lot of emphasis on translating money from research to impact. So, really a question of translating investments to achieve economic and social impact. That's the question that we are working on for the last couple of years.

We are sending undergraduate students around the world; today, there are 300 of them: from Stockholm to Munich, Tel Aviv, Haifa, Beijing, Shanghai, Shenzhen, Vietnam, Indonesia, Silicon Valley. Over the last two decades, the way the students learned about entrepreneurship was rather more selective. It was not across the whole university but students who desire and apply to a specialized program. We call this program NOC: NUS Overseas Colleges (NOC).

Results have been very positive: The likelihood of a NOC graduate being in a start-up is higher than you see on average. The other thing that we have started to promote is incubation facilities, not just in Singapore, but in a few key places around the world. Silicon Valley is one, Indonesia is one. Moving ahead, we will be developing ➔



Babson College

our graduate students. For example, the Brady Research Innovation Program generates applications from graduate students and postdocs and the University invests the first hundred thousand dollars in Singapore. We started 41 startups in the last 10 months. We are really focusing on people who are very zealous, and then move them really fast. My sense is that if you come here from anywhere, you have a good shot at creating a start-up company immersed in deep technology.

Of course, when you are moving so fast, you need several pieces — the right team, a good financial model, whether the ability to harness the technology. But the idea is that we can move them to bring those elements together faster. And sometimes it's not us, it's outside investors. We had a company, in just a few months, that achieved a pre-money valuation of more than five million dollars. But we didn't see it – the investors saw it, they were Japanese investors.

Spinelli —

I'd say ours is a highly dynamic environment. There are a couple of initial questions that I've asked myself and my colleagues. The first is, "What is the nature of the stress in higher education today"? Is it that we have oversupply? There are a lot of people who believe that. And if you look at the trajectory of demographics, especially in the United States, you see that the traditional-aged student population is diminishing. And if you can

get down to the regional environments, if you look for five or six years out in the Northeast of the United States, you see a dramatic decline in 18 to 22 year-olds.

Colleges and universities are saying that we have to look elsewhere and there's this great fear. But there need not be. Instead, I ask, "Is there a greater need for learning and knowledge and synthesis of information today than there was yesterday? And I almost mean that literally — today versus yesterday. And the answer is "yes." Talk to me about change, and knowledgeable individuals will say invariably there is an increasing pace of change in the marketplace that equals an increased need for education. At the same time, we've seen that colleges and universities have failed. It tells me that the delivery system is failing, not that the market has less demand.

As an entrepreneur, I always start by the nature of opportunity as market driven. If market demand is increasing and I'm having a difficult time surviving, I've got to look at myself in the mirror. And higher education needs to take a look at itself in the mirror. If I can say anything to higher educational leaders and higher educational students, it is to stop thinking about transferring information and data and to start creating better problem solvers. Now, traditional college and university systems – are they capable of that change? That is a really interesting question but that's where entrepreneurship really plays

“
The just-enough, just-in-time, just-for-me model is a millennial education philosophy. And we have to understand that and understand how to deliver it in a more flexible way. I'm not jumping on the bandwagon. I want to redesign the vehicle
”

President Stephen Spinelli
Babson College

an important role. And how do I put together a business model that can effectively and with economic benefit solve the problem? If we think about this, then I think we have a chance to do something really special. The fact is that knowledge is also being obtained in smaller quantities and more just in time.

Here is what I think. The just-enough, just-in-time, just-for-me model is a millennial education philosophy. And we have to understand that and understand how to deliver it in a more flexible way. There are in fact very few colleges and universities in the world that can array the competency required to do just-in-time, just-enough, just-for-me education. So, colleges and universities have to begin to see themselves as having defining competencies.

I would ask the people to look at the future of education as an educational ecosystem that looks to you for special competitive advantage competencies that can create problem solvers over a long period of time. This ultimately enables a much longer income stream, at a less painful point, delivering the kind of value proposition that serves a student's needs on time. So, we said okay, let's put a curriculum together that solves that problem.

Levin —

That's what we strive to do here at Stanford as well. About 20% of our MBAs are dual degree students while at Stanford. And I think that's a great thing for the students themselves. But it also turned out to be a great thing for the school because those students then become the glue that brings the campus together. The business students meet students who are engineers, in medical school, law school and humanities and sciences, and education and introduce them to colleagues in the business school. They are the connective tissue. Students going back and forth have turned out to be the key in getting the campus more connected.

I'll give you an example from our long-range plan. The first initiative that we launched from our planning processes was an Institute on human-centered artificial intelligence. We asked ourselves, how can machine learning data be used in different areas: medicine, education, business and so forth? It's also about thinking through what the societal effects on the future of work are. And depending on what the exact

problem is, of course, the natural expertise lies in different places: On the frontiers of the science, it lies in engineering, and maybe in neuroscience; on the policy and social front, it lies in business, in law and in social sciences. And so, it's about bringing together lots of different faculty and students, and that's what we strive to excel at in our business school.

We've been running events on the future of work that bring together technologists, but also humanists. We come at a problem from all different angles and our aspiration is to really make a difference. For the students and the faculty as well. I arrived here 20 years ago; all these years we've been really focused on trying to lower barriers between schools and disciplines. It's with the students that take the most chances that change happens most of the time. When students take chances, that's when change happens.

Jain —

I think that the entire intellectual fabric of the university is a sort of canvas upon which students and faculty develop their ideas. It is often helpful in entrepreneurial pursuits that students be exposed to a wide range of ideas and perspectives. We place no limits on how many elective courses in the MBA program the students can take outside the business school. If they wish, they can take all of their courses in other faculties. The way we enable access to specialized pursuits is through a great deal of flexibility. This flexibility also makes it attractive for many students to go beyond taking courses and pursue joint degree programs, which we offer with essentially every other graduate program at Yale. Typically, up to 15-16% of our students are in joint degree programs with other programs in our University. It is not surprising that many of the most successful entrepreneurial ventures have emerged from partnerships between our students and faculty and their counterparts in other disciplines and schools of the university.

It is also important that we give our students a deep appreciation of the irreducible interconnection of ideas across the various subdisciplines of management and impart an integrated approach to management problem solving. This has been a long-standing quest at business schools. In the early 90s, I was involved in a very ➡

earnest quest at my previous institution to integrate across management disciplines. My experience was that it was difficult to sustain it because faculty are ultimately specialists in their own disciplines and their proclivity is to view management issues from their disciplinary lens. And it was only after coming to Yale that I realized that an integrated curriculum requires both a substantial, ongoing commitment of faculty to the quest for integration, and a much larger allocation of faculty resources than in delivering a conventional curriculum. In Yale’s MBA core curriculum, many courses are designed from the perspective of an important stakeholder or entity, such as the customer, the investor, the innovator, the competitor, or even the state and the wider society (to mention a few examples), and specific topics covered in these courses draw upon various functional or disciplinary domains of knowledge. These courses, accordingly, draw upon multiple faculty in the teaching of each course and thus this ‘orthogonal’ design requires a greater commitment of faculty resources than a conventional curriculum would. We believe that this approach serves all MBA students well, but it is especially important in my view for entrepreneurs who need to make decisions from the perspective of the whole organization and the competitive context in which the organization takes ideas to the marketplace.

Zviran —
As with most leading business schools over the last 50 years, we centered on the core functional areas such as finance, marketing, accounting and the like. We did this to address the market needs of the time, with the addition of course that we had a very strong track of Management of Information Technology. About twelve years ago, we took stock and conducted a comprehensive strategic planning process that examined our historical strengths and looked ahead to anticipate new opportunities. One of the major recommendations was to focus on the management of venture, innovation, and entrepreneurship.

A core underlying assumption – which remains to this day – is that you cannot teach someone to become an entrepreneur. Either you have the appropriate instincts and the character of an entrepreneur, or you do not. But, at the same time, we know that having an entrepreneurial spirit is not enough.

Ninety-five percent of new ventures fail, and a common reason is not a lack of spirit, but a lack of management skills – a lack of understanding how to turn an idea into a product, a lack of knowledge about how to actually take a product to market. So, this is where we decided to focus – to take entrepreneurs and give them the knowledge as well as practical tools to succeed. We worked very hard to establish this connection in our internal ecosystem, between natural capability and tools which translate from vision to execution.

It’s also worth noting of course that our ecosystem of entrepreneurship and innovation includes a sizeable and hugely connected network of successful entrepreneurs, accelerators, incubators, VCs . These entrepreneurs partner nimbly and fluidly with our students. We are also connected to Tel Aviv’s hundreds of incubators and VCs where most successful ideas get seed money and start to materialize.

For us, our larger plan, at the University level, is to combine together and harmonize all entrepreneurship initiatives across all disciplines on campus into one solid ecosystem of entrepreneurship, innovation, and new venture creation. We have already brought together our MBA program together with our engineering and biomed programs, with the technology transfer office, with TAU Ventures – Tel Aviv University’s incubator and VC, and we strive to create new such collaborations constantly. We think this is where the future is and, consequently, we are working hard to bring previously siloed disciplines into multi and inter-disciplinary new ventures, prepared together to lead new markets.

Spinelli —
For university-centric collaborations, all of our operations faculties tell us that a key to increasing efficiency and impact is to eliminate redundancy. At least partially as a result of this insight, we are likely to see continued consolidation among business schools globally, and among business schools seeking to merge and integrate with other faculties to gain differentiation. These will likely bring new collaborations to market, new students and, eventually, fundamentally change the traditional business school landscape.



National University of Singapore

Broudo-Mitts —
This is all very interesting. I remember when I did my studies, finishing in 1990, we learned through silos and almost always in the classroom. But it’s different now. How do you or your staff look at curriculum differently today? How are we institutionalizing new forms of learning, not just in the classrooms?

Boey —
I think of it as teaching yesterday, learning today, and innovating tomorrow. Today technology makes learning a lot more powerful than the teachers can teach. But I think the ultimate mode of learning will be experiential. Even for that I feel that sooner than later examinations will have to move aside. It’s one thing to get a lecture and then examine the alternatives. It’s quite another to actually get down to it. For example, in the curriculum for our NOC college students, there are no exams. There is no grading. They come back with a business plan. We are focused on helping them to get moving. In a nutshell, this is how I see things moving. More hands-on experience than anything else. We let the students explore. I would call it innovative learning. ➡

“ ... I think the ultimate mode of learning will be experiential ... in the curriculum for our NOC college students, there are no exams. There is no grading. They come back with a business plan. We are focused on helping them to get moving ”
Deputy President Freddy Boey
National University of Singapore

“

Then there are the skills that are complementary to technology — skills that can’t be automated like leadership skills, communication skills, collaboration skills. These are the ones that will probably have the highest return

”

Dean Jonathan Levin
Graduate School of Business,
Stanford University

Tam —

I would say this type of experiential learning will become even more and more important. It’s a tremendous experience for a student. And they learn a lot during the period, and we can tell the difference before and after. The student needs to know how to apply the techniques, the efforts, and the theory that they are learning in the classroom in real life. We will continue to scale up our initiatives in this area.

Zviran —

I think that innovative or experiential learning is almost mandatory in today’s environment. The way we are using the board is gone now, especially when we talk about entrepreneurship. If we want to establish a worldwide reputation on the one hand, and make sure that our graduates succeed, on the other, we need a combination of several building blocks. One is the collaboration with industries. The other one is experiential learning. Another one is collaboration with other schools around campus, especially with those with a special focus on engineering and computer sciences. We are expanding our international collaborations as well. Because at the end of the day our students understand that, with all due respect to Israel, we are basically an island, not necessarily geographically, but in terms of where the markets are. So, we must understand the ecosystems in other nations. If we can take all of these together,

we will probably have a unique value proposition, based on our own unique sources of competitive differentiation.

Spinelli —

We will add curriculum, we will add instruction, we will add knowledge at each point where we get stuck. But we are considering the idea that, with certain students we are instructing, they almost never have to stop, and they almost never have to keep going. They get to make decisions as long as there are problems to solve. And they take the problems to a different level, and then it is incredibly dynamic.

At some level, as long as I’m willing to, as long as I have the stomach lining and the fortitude and the organizational will, I will continue as long as it takes to get the business models that really work. This includes adjusting along the way but also giving more of the choice and responsibility to the learner. We’re taking student-centric to the most absurd level I can figure out because I want to have a real impact. I’m so excited I can barely stand it. I’m not jumping on the bandwagon. I want to redesign the vehicle.

Tam —

The MBA degree that we have right now is very different from the MBA degree we had 24 years ago. The content, the curriculum, the learning experience, the technology, are all very different.



The technology out there and also in education has developed in such a way that as educators we have to be really adaptive.

**Graduate School
of Business,
Stanford University**

Levin —

You can’t do everything, you have to pick. And in that sense, we are focused on preparing people for what they’ll need in the longterm, not just what’s the latest thing. That means we want to strengthen the way we educate students to be data-literate; how to use it; and how to interact with people who are technologists.

Then there are the skills that are complementary to technology — skills that can’t be automated like leadership, communication, and collaboration. These are the skills that will probably have the highest return. So, in a sense, the need to prioritize can lead you to double down on some things that aren’t the latest thing, but which have renewed value because of what’s going on in the world.

We have picked out a set of topics that we think are going to be very important for the world and in the University over the next 10 to 20 years: data science, artificial intelligence, the biomedical revolution, ➔



Yale School of Management,
Yale University

sustainability and social problem-solving, bringing people together to solve social problems. We selected those topics by addressing the biggest problems and challenges and opportunities in the world, and then asking: Where can we bring people together from different backgrounds and with different expertise to really do things that are meaningful?

Jain —

I find myself resonating quite a lot with what Jon just said and let me offer perhaps a slightly broader perspective based on my pathway into American institutions of higher education from a distant part of the world.

I think what makes American schools of management intellectually vibrant and tremendously influential around the world is that their academic culture is shaped in

the same crucible or cauldron of research-based scholarship that has shaped American higher education for the last several decades. This has led to the creation of path-breaking ideas and knowledge that have shaped business practice in a profound way. This influence has given rise to the American business schools’ extraordinary global prominence, and in turn continues to be a magnet for bright students and scholars from every part of the world. The intellectual predispositions and knowledge creation of the faculty are reflected in the subject matter we teach in our courses.

Boey —

There are also the outside influences. Ups and downs. There is always initially a lot of hype followed by a period of time, that all around the world can be called an “entrepreneurship winter.” And then it comes back in a big way. We’ve seen this happen more than once already.

Broudo-Mitts —

Not many people would say that we were ever in any kind of entrepreneurship winter. Are we doing something at the student level to help them build the resilience that it takes to get through such winters? What are your thoughts on that in terms of giving them the grit and the resilience to keep going?

Tam —

Resilience, and building resilience in our students, is always critical. I think we encourage the students to try ideas. Give them opportunities, provide some guidance, and let them know that it is okay to fail. I think this is a very important mindset for the students. We have to help them understand that we provide a lot of experience, opportunities for them to try things out. It takes some time but it’s working out so far, I think for us and them.

“
Equally important is the culture of the institution. What students pick up in terms of ideas and sensibilities both in and outside the classroom
”

Deputy Dean Anjani Jain
Yale School of Management,
Yale University

Boey —

I think of myself as a hatchery. I need lots of little fish. I know only some of them will hatch. And that’s ok.

Zviran —

Even if students fail, they are already familiar with building the team. Maybe they found the team for the next idea.

Boey —

The difference today is that there are needs that we don’t know. I don’t know when Society 5.0 will come but I have this thought. It can be the right technology at the wrong time, or the right technology at the right time but with the wrong team. Anything can happen. But I do know one thing. If I don’t encourage them in number, I won’t eventually get the big fish. So, the last couple of years in Singapore we strive to produce good and meaningful numbers; that’s how we try to measure the fruits of our work.

Tam —

I think that success is in bringing research from the lab into the real world. And another thing that I would be proud if we can accomplish, is if our students go from start-up to scale-up. So, these are two dimensions that we are currently playing with.

Broudo-Mitts —

Looking forward, how do you think your unique ecosystems will influence your institution?

Spinelli —

We have folks in Boston who are actively engaged. And we are saying, you can be scrambling for grants the rest of your life because you are really really smart or you can create real wealth by understanding what ownership means. The marketplace needs really smart scientists to be more fully integrated ➡

into the capitalist ecosystem. We should be playing a role in that. It's insanity not to.

Levin —

This is a very interesting discussion. How the world is changing in terms of the expectations for businesses and businesspeople, these changes have significant consequences for business schools. We have to be out in front because we are shaping the next generation of business leaders.

Boey —

I think two things are unique to us in Singapore. First is that we already have a whole reservoir of IT and hi-tech. In our region, Vietnam has an incredible number of young entrepreneurs. Some of them are amazing, high-energy people but they are limited in technology whereas we have a whole reservoir. Our problem is that our market is thin. At the end of the day we go to China or to the U.S., they don't come here. So, I would say that we train our entrepreneurs in managing technology and accessing new markets. And the market has to be overseas, not in Singapore.

Zviran —

One of the major issues in Israel is that we have tons of startups looking for an exit. And it is not by accident that 400 multinationals have offices in Israel and are looking for new technologies. But the question is, and we are definitely struggling with it, what do we as a university need to do in order to encourage our students to build larger companies, unicorns that will create more jobs in Israel.

Jain —

Moshe, I should mention that that's a tremendous process. I have great admiration for what you have created in Israel – a world-class system of higher education including

business education. And then, as a nation of only 8 million, an extraordinary culture of innovation that is described as a Start-up Nation – there is a lot of justification for the label. It is quite extraordinary.

Zviran —

Thank you. So what we are trying to do now is expand the ecosystem, where all the critical components respond to each other. We must continue to cultivate and sustain this culture. Say five years down the road, let's see what more can happen if as a university we act much more proactively.

Jain —

We, in the U.S., especially at this time, can't take anything for granted going forward. What's going to sustain this sort of magnetism of the university to attract talent from all parts of the world will be how creative and innovative we will be, how much new knowledge we will create within our institutions, and how congenial the broader climate will be for our graduates to create new enterprises.

Levin —

Fifty, sixty years ago, we were a regional university. When I applied to college 30 years ago, and came to Stanford, it was unusual coming from the East Coast of the United States and study on the West Coast. So much has changed since then.

I think about organizational renewal, actually, and personal renewal as well. The point is, if you have things that you're great at doing, of course you want to continue to be great at doing those things, but you should not be afraid to try some new things. ➡

Coller School
of Management,
Tel Aviv University

“

It is not by accident that 400 multinationals have offices in Israel and are looking for new technologies. The question is what we as a university need to do in order to encourage our students to build larger companies, unicorns that will create more jobs in Israel

”

Dean Moshe Zviran

Coller School of Management,
Tel Aviv University





The Hong Kong University of Science and Technology

To have the institution moving in different directions, experimenting, and taking some risks, is a big weapon. It's one of our advantages being in Silicon Valley. The mentality here is that it's okay to try some things and maybe not have them work out. Because some of them might really work out and that can become a really big game changer.

Broudo-Mitts —

These are all great insights. Any thoughts on your business schools' relationship to social responsibility before we end our roundtable?

Jain —

This lies at the very core of our school's mission, which is to educate students for business and society. The mission reflects both a broader sense of purpose for business and the recognition that the most vexing problems we face on the planet will require the best ideas from both for-profit and not-for-profit organizations, from governments as well as entrepreneurs. First, perhaps obviously, both businesses and policy makers have to think in very careful, comprehensive ways about how a company or institution affects

society at large. So, manufacturers must understand deeply the full environmental impact of their supply chains, investment managers must understand their fiduciary and ethical obligations to stakeholders, financial institutions and regulatory agencies must know how to manage financial crises when they erupt.

The second aspect of the sensibility is that the effectiveness of social enterprises and public sector organizations derives from many of the same principles and conceptual ideas that make businesses effective. Similarly, profit-driven business enterprises can and should be a force of social good. So leaders in social and governmental sectors also need to acquire the same rigorous understanding of both competitive markets and effective organizations. The work of our faculty and the research centers of the school, I think, reflects both facets of this mission.

Levin —

One thing that's just terrific is that we're opening up all these really fundamental questions about corporate governance. What is the purpose of the corporation? Who should have control in corporations? Those are questions, of course that we've argued about for a long time, but sometimes you see the conversation going dormant for a while and then, for whatever reason, with different triggers and different circumstances the same questions come back. I think that's exactly what students want us to be doing. They want to be able to be successful in their own lives and feel they're going to be making important contributions to the world.

So, how do you do that through a career in business? How do you think about issues like corporate responsibility, the purpose of corporation and, so forth? What are the opportunities for students? We started with a very focused purpose of trying to educate Californians, so that they would stay in California and create businesses. And then, over time, because of Silicon Valley and the rise of it in terms of innovation ecosystem here, the school became very focused on the broad innovation lens and started thinking a lot from the entrepreneurial perspective.

How do you do social innovation, social entrepreneurship, or new ventures that are socially minded or focused on solving

social problems? That's now a huge part of the student experience and the school. And I think that's where we are right now.

Jain —

Perhaps MIT is the other role model for many of us. It is such an engine of innovation. And I was thinking that because of the larger, cultural milieu that you referred to, a lot of our innovative students and innovators are actually working with the socially more impactful ideas and ventures. And, and it's not surprising that Stanford's students too gravitated to those ideas.

Levin —

We're moving in a direction based on what's going on in the world, which is of course a continuing process. The role the students can play is not just in starting social ventures, but in guiding large organizations or industries or in public leadership. I'm very excited about this positive evolution.

Broudo-Mitts —

Thank you everyone for your contribution to our first virtual roundtable. We look forward to further discussions, and thank you for your time. ■

“We encourage the students to try ideas. Give them opportunities, provide some guidance, and let them know that it is okay to fail”

Dean Kar Yan Tam
The Hong Kong University of Science and Technology

Biographies

Freddy Boey



*Deputy President,
National University of Singapore*

Freddy Boey is Deputy President (Innovation & Enterprise) and oversees the University’s initiatives and activities in innovation, entrepreneurship and research translation at the National University of Singapore.

An alumnus of NUS, Boey was Deputy President and Provost at Nanyang Technological University (NTU) from January 2011 to September 2017. From 2004 to 2010, he was the Chair of NTU’s School of Materials Science and Engineering (MSE), during which it became known as one of the world’s foremost and largest MSE schools.

Boey has filed 118 patents. He was conferred Singapore’s highest scientific award, the President’s Science & Technology Medal, in 2013. He was also awarded Singapore’s Public Administration Medal (Gold) in 2016.

Boey received an honorary doctorate from Loughborough University and holds honorary professorships from the University of Indonesia, the Nanjing Postal and Telecommunication University, and the Nanjing Technological University. ■

Anjani Jain



*Deputy Dean, Yale School of
Management, Yale University*

Anjani Jain is Deputy Dean for Academic Programs and Professor in the Practice of Management at the Yale School of Management. He joined the faculty of the Wharton School of the University of Pennsylvania in 1986 and served for 26 years before joining Yale.

In 1993, Jain became Director of Wharton’s MBA Program. He served as Vice Dean and Director of Wharton’s Graduate Division and as Vice Dean of Wharton’s MBA Program for Executives.

Jain has won teaching awards and taught courses at Hebrew University in Jerusalem, the Interdisciplinary Center in Herzliya, and the Indian School of Business in Hyderabad and Mohali. He has served on the International Advisory Council of the ISB and as its co-area leader in operations management.

Jain holds a B.A. in Physics and Mathematics from Indore University in India, an MBA from the Indian Institute of Management, and a Ph.D. in Operations Research from UCLA. ■

Jonathan Levin



*Dean, Graduate School of Business,
Stanford University*

Jonathan Levin is the Philip H. Knight Professor and Dean at the Stanford Graduate School of Business. Levin joined Stanford as an Assistant Professor in 2000. He was the Holbrook Working Professor of Price Theory and served as Department of Economics Chair from 2011 to 2014.

Levin received the American Economic Association’s John Bates Clark Medal. He is a fellow of the American Academy of Arts and Sciences, a fellow of the Econometric Society, a former Guggenheim Fellow, and the winner of several teaching awards.

Levin has consulted widely in the private and public sectors. He was part of the expert group that designed the first vaccine Advanced Market Commitment and helped to design the FCC’s broadcast incentive auction.

Levin earned a B.A. in English and B.S. in Math from Stanford University, an M.Phil. in Economics from Oxford University, and a Ph.D. in Economics from M.I.T. ■

Stephen Spinelli



President, Babson College

Stephen Spinelli Jr. is the 14th President of Babson College. Spinelli spent 14 years at Babson as a faculty member, vice provost for entrepreneurship and global management, and director of the Blank Center.

In 2007, Spinelli became president of Philadelphia University. He led the merger of Philadelphia University and Thomas Jefferson University, and was named chancellor of the new Jefferson in 2017.

Spinelli co-founded Jiffy Lube International and was Chairman and CEO of American Oil Change Corporation. He has served as a consultant for several corporations as well as a member of board of advisors. He has co-authored eight books.

Spinelli earned his Ph.D. in economics from The Management School, Imperial College, University of London, his MBA from Babson College, and his B.A. in economics from McDaniel College. In 2016, he received the honorary degree of Doctor of Letters from Ulster University in Northern Ireland. ■

Kar Yan Tam



*Dean, The Hong Kong University
of Science and Technology*

Kar Yan Tam is Dean of the Hong Kong University of Science and Technology (HKUST) Business School and Chair Professor of Information Systems, Business Statistics, and Operations Management. He joined HKUST Business School in 1992 as a founding member and served as the dean of students and associate provost.

Tam is the chairman of the Curriculum Development Council and the AACSB Asia Pacific Advisory Council. He serves on the boards of AACSB and EFMD.

Tam is a member of the Hong Kong Productivity Council, the Banking Review Tribunal of the Financial Services, the Anti-Money Laundering and Counter-terrorist Financing Review Tribunal of the HKSAR, and the Certified Banker Steering Committee of the HKIB. He was the President of the Association of Asia Pacific Business Schools in 2018.

Tam is an information system scholar specializing in fintech and data analytics. He plays an active role in promoting academia-business collaborations. ■

Moshe Zviran



*Dean, Collier School of Management,
Tel Aviv University*

Moshe Zviran is Dean of the Collier School of Management at Tel Aviv University and a Professor of Information Systems. He is the Isaac Gilinsky Chair of Entrepreneurship, Technology, Innovation and Management, and serves as the Academic Director of the Collier Institute of Venture and the Eli Hurvitz Institute for Strategic Management. Zviran held academic positions at the Naval Postgraduate School, California, the Claremont Graduate University, California, and Ben-Gurion University, Israel.

His research interests include entrepreneurship and innovation, information and cyber security, and information systems planning and policy. Zviran has published numerous articles and authored two books in information systems. He has consulted widely for public and private organizations in Israel and serves as a board member in several companies and organizations.

Prof. Zviran received his B.Sc. degree in Mathematics and Computer Science and his M.Sc. and Ph.D. degrees in Information Systems, all from Tel Aviv University, Israel, in 1979, 1982 and 1988, respectively. ■

The Evolution of Entrepreneurial Instruction: Action Learning at MIT Sloan

Michellana Jester
Lecturer and Course Faculty Lead,
MIT Sloan School of Management

US Business Schools: Seeking a New Approach to Instruction and Learning

Starting as early as the 1950s, business schools have faced numerous criticisms, the most notable leveled within two reports funded by the Ford and Carnegie foundations, respectively entitled *Higher Education for Business* (Gordon and Howell, 1959) and *The Education of American Businessmen: A Study of University-College Programs in Business* (Pierson, 1959). The reports noted that while the field of business yielded the new practice of management science, there was no consistency or standard curricula across programs. In response to these reports and other external pressures, business schools moved to gain greater legitimacy within the broader university context by hiring faculty from the arts and sciences and increasing their emphasis on rigor and theory. While the shift was initially viewed as productive in elevating the scholarship of business schools and introducing important management theories, after various programming and curriculum redesigns, scholars noted that over the years the gap between the skills acquired within MBA programs and those managerial competencies linked to job performance persisted, despite various curriculum redesigns by business school leaders.

As the critiques of business schools have grown more intense, scholars and industry leaders have pushed business schools to

reconsider their approach to management education. To address an increasingly dynamic and globalized business environment, business schools have adopted an approach to assist students in managing and leading within a dynamic globalized environment by incorporating experiential learning opportunities such as project-based learning into their MBA program design.

A Shift Towards Experiential Learning

Experiential learning, a philosophy of education based on what John Dewey (1938) called a “theory of experience”, draws on the work of prominent 20th century scholars who place experience at the center of theories regarding human learning and development. These thought leaders included John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, Ed Schein and David Kolb. Over time, business schools have synthesized their insights from experiential learning to frame an approach for incorporating project-based learning into their curricula.

MIT Sloan has sought to enact their interpretation of project-based learning with a model it calls *Action Learning*, one of its primary methodologies for learning and instruction. A significant investment of faculty and staff time and attention, MIT Sloan has utilized this approach to develop a portfolio of learning opportunities that challenges students to draw from and apply their learnings from

previous professional, education and personal experiences, as well as their Sloan classroom work, to help real organizations address real business management challenges. Students draw profound insights from these real-world experiences, enhancing their academic experience and further preparing them for their professional life after graduation.

Action Learning in Management Education

Management education scholars, as well as industry executives, recognize Action Learning as an effective method for developing an individual’s willingness, ability and capacity to manage real-world organizational issues. This is accomplished through the challenge of addressing complex managerial issues with a focus on crafting concrete, practical solutions. The classical (or original) Action Learning design involved a small group of employees within an organization, called an *action learning set*, who work together on a work-related problem. Their collaboration, it was believed, would generate novel and innovative ideas through an open dialogue and trust, building on their prior knowledge and experiences. Creating an environment where assumptions and beliefs could be challenged, it was felt, would stimulate ideas for action, which could be tested in practice. Key to the design was that individuals would also be able to identify personal challenges while drawing on the experience of others ➡

“

Through this process, students develop skills in critical thinking and problem-solving; integrated problem framing; assessment and integration using incomplete information

”



to create viable solutions to the presenting issues. Thus, action learning was designed to support individual learning about the business challenge as well as about oneself.

Over the past few decades, Action Learning has been adopted, modified and expanded by business schools to fit the needs of their relevant stakeholders, most notably the students. However, the key elements of the approach remain the same: to advance managerial learning and development. MIT Sloan’s interpretation of the classical action learning approach draws from its engineering roots of “learning by doing”, using engagement with external organizations and their real-world business challenges as a vehicle for learning that challenges students’ assumptions and transforms their mind-set.

On the Ground at MIT

MIT’s motto “*Mens et Manus*,” Latin for “*Mind and Hand*,” reflects the education principles of MIT’s founders who espoused a belief in the practical application of education. Drawing from its motto, MIT has emphasized “learning by doing,” including, since its founding in 1865, the blending of applied science and engineering. Starting in 1914, the first business training – Course XV – was Engineering Administration. The Sloan School, conceived and funded by MIT alumnus Alfred P. Sloan, Jr. in 1952, (Class of 1895), was specifically designed to solve the complex problems of modern industry and management through the application of a scientific and technical approach.

MIT Sloan Action Learning blends the key constructs of educational institutions (such as scholarship and research) to provide a more robust and relevant learning experience for students. Action learning in management

education begins with the notion of the learner at the center of learning. Student work is supported by an instructor whose role is more like that of a facilitator than an expert providing prescriptive solutions. In addition, the model utilizes the power of small peer groups, where self-directed learning and reflection are key components to acquiring new knowledge. Learning is thus structured around real-world complex and ambiguous business challenges.

Through this process, students develop skills in critical thinking and problem-solving; integrated problem framing; assessment and integration using incomplete information. Students also gain a greater global perspective; creative and innovation skills; advanced written and oral communication skills; a stronger ability to assess risk; an appreciation of ethical and moral boundaries; and an understanding of the complexity of business roles and responsibilities.

The Launch of Entrepreneurial Instruction – The Evolution of Action Learning at MIT Sloan

While there are no formal records of the first Action Learning course at MIT Sloan, it is notable that as early as 1964, Professor Ed Roberts created an elective course on the Applications and Implementation of Industrial Dynamics, in which student teams worked with local companies to build System Dynamics models of company problems for senior business leaders.

The modern MIT Sloan Action Learning model first emerged in 1992 with the launch of Entrepreneurship Lab (E-Lab), an elective course offered in partnership with MIT’s Entrepreneurship Center (now known as the Martin Trust Center for Entrepreneurship).

The course was designed to provide teams of management, science, and engineering students with an intensive, on-site experience working with metro Boston area high tech start-ups on critical business challenges.

E-Lab laid the groundwork for the launch of Global Entrepreneurship Lab (G-Lab) in 2000, which has become MIT Sloan’s largest Action Learning offering, with class sizes that have ranged from 120 to 180 primarily second year MBA students. MIT Sloan’s “labs” (the school’s shorthand for its project-based learning courses) have grown to include a portfolio of more than fifteen different opportunities for students who seek to explore different regions of the world (e.g., China Lab, Israel Lab, USA Lab) or specific disciplines (e.g., Healthcare Lab, Operations Lab, Analytics Lab).

Most Sloan labs have used G-Lab as the model for their own course design.

MIT Sloan’s Flagship Action Learning Offering: Global Entrepreneurship Lab

The Global Entrepreneurship Lab (G-Lab) was launched in 2000, when Professors Simon Johnson and Richard Locke sought to design a course that would draw attention to emerging market economies. Johnson and Locke believed emerging markets were largely being ignored by economists and business schools, as their focus tended to be on multinational organizations based in Western countries. They surmised that by working directly with entrepreneurs in emerging markets, students could gain first-hand insights about the structural characteristics that support business development, those constructs that make doing business challenging, and the innovation designs that help bridge the gap of bringing sellers and buyers together. ☺

482

Over the past twenty-years, G-Lab has worked with 482 companies

643

G-Lab has worked on approximately 643 projects

54

G-Lab has been in 54 countries

2,437

In that time 2,437 students have participated



Furthermore, Johnson and Locke felt that connecting students and emerging market entrepreneurs would result in mutually beneficial learning, as the entrepreneurs would, through the students, have access to the broader burgeoning MIT entrepreneurial ecosystem.

Over the past twenty years, G-Lab has worked with 482 companies, on approximately 643 projects in 54 countries. More than 2437 students have participated in G-Lab since its inception, significant given the size of the business school. Over this time, one of the key goals of the course has remained the same: Provide concrete, realistic, actionable recommendations to address a company's most significant business challenge.

G-Lab targets start-ups and fast-growing scale up companies in emerging markets as hosts in order for students to be able to connect with key decision makers during their project work. Most hosts are approximately five to seven years old, at a strategic or operational inflection point or poised for significant growth, looking to scale, have approximately \$1 to \$15M USD in revenue, and 5–8 people in senior management. Many G-Lab hosts are on the cutting edge of

business trends, such as mobile apps, fintech, cryptocurrency, edtech, agribusiness, ride-hailing, and clean energy. Projects tend to fall into one of the following categories: New Market Entry, Strategic Growth, Fundraising/Venture Capital, Marketing, Pricing, Financial Modeling or Human Resource. The diversity of company types and business challenges allows for a wide range of learning opportunities for MIT Sloan students, as well as for the faculty that support their project work.

Through this collaborative and highly interactive project engagement, entrepreneurs in emerging markets gain access to the most current and evidence-based scholarship via the students' research. The students provide their sponsoring entrepreneurial hosts access to MIT's extensive library resources, as well as faculty research. This makes the students' final deliverable- which is fully defined by the host-extraordinarily valuable. After almost a decade of tracking project outcomes, between 92 and 96 percent of host companies indicate they have implemented student recommendations or plan to do so within four to six months.

“

Through collaborative and highly interactive project engagement, entrepreneurs in emerging markets gain access to the most current and evidence-based scholarship via the students' research

”

The Structure of G-Lab

The experiential design of G-Lab means that the course is constantly evolving. Surveys of sponsoring host companies, students, participating faculty and other stakeholders contribute to a reassessment each year to understand what works and areas for improvement.

During the months before the course begins, students are asked about their expectations and learning objectives. This information assists the faculty in understanding how to best support the students when the course officially begins in September. Students are also supported in forming diverse teams of four, where different professional and personal experiences lead to stronger teams that are more equipped to tackle the ambiguity of project-based learning and provide deep insights during inevitable peer learning interactions.

Submitted host company questionnaires are viewed by students when classes begin. Faculty meet with each student team to offer guidance as they work to develop a list of projects they feel best meets their teams' interest and skill strengths. In mid-September, G-Lab faculty will review the host company questionnaires and student team application project request, to match host companies with the best qualified teams. At Sloan, student teams conduct research, interviews, and analysis, and connect with other MIT faculty not associated with G-Lab to assist with their project work. While strategic thinking and analysis is the foundation of G-Lab, teams are tasked to place a strong focus on creating tangible “leave-behinds” so host companies can put the team's concrete recommendations to work immediately. Teams deliver tools such as go-to-market roadmaps, financial models

and spreadsheet templates, pitchbooks, HR manuals, potential customer or investor pipelines and screening filters, and M&A and valuation toolkits.

The Benefits and Challenges of Action Learning in Management Education

The perceived benefits of incorporating action learning instruction into management education curriculum extends to students, participating institutions, and the companies that work with the student teams. For the students, they have the opportunity to test their knowledge in a real-world situation. In addition, they develop leadership skills as issues of ethics, project management, negotiation and team building are prominent features of project work with external host companies, particularly where institutional structures that support businesses are emergent or under-developed. Working with an external host naturally lends itself to ambiguity; therefore, students must be self-directed, willing to learn through and with others, and focus on developing their problem definition and scoping skills in order to help the organizations with whom they are working move to action.

For participating companies, they are able to forge direct and indirect relationships with the university and participating faculty and learn the newest business practices. They have the opportunity to work with talented students who provide usable recommendations and other deliverables. Hosts also build a network of (or access to) potential employees or, as in the case of several of our former G-Lab hosts, invite former students to serve as company board members. ➡

“

Through its design,
G-Lab looks to place
the student at the center
of the learning process

”

The challenges presented by action learning adoption in management education tend to be linked to programmatic objectives, staffing, and sponsoring host company engagement.

Unlike traditional classroom lectures, using a project as a vehicle for learning can make articulating course learning objectives with specificity and intentionality difficult since faculty must work with the issues each unique project brings. Even finding the right faculty to work with students from managing the entire course to supporting specific teams, is subject to this uncertainty. It is working with the unknown, and by extension the work involved with developing new material in real time to meet students’ needs, that makes faculty hesitant to take on this work. The traditional model for instruction in higher education is for the faculty to be the expert; having a course that asks faculty to be a vulnerable and engaged learner along with the students, is not a position that most want to take on.

Project work generates many variable projects, location, sponsoring host, team dynamics, faculty engagement which must balance many different interests and desired outcomes, which are not always aligned. Further complicating matters are the hurdles that emerge when faculty try to develop academic content in advance, since the progression of each project is situated in the real world, impacted by real world events. When working with entrepreneurs, this can be particularly challenging as their companies lack the stability and infrastructure to withstand even small shocks to their businesses.

Institutional resistance generally comes in the form of challenges to the resources needed to execute this type of program. Intense staffing demands and the high outcome

variability, make some institutions resistant to offering this type of programming to their students. Many business schools may have a limited action learning initiative to minimize costs, while others have developed creative funding streams that charge host companies fees to cover overhead.

Most business schools identify resourcing projects as their biggest challenge. While many rely on word of mouth, alumni, previous sponsors, personal networks, and more recently, vendors that identify companies for schools, the real issue is not necessarily finding companies to participate but finding the right companies that will develop a project that meets the needs of the school, the course or initiative, and the student teams. In finding the right fit, business schools must find companies that understand the project is part of the students’ learning; the students are, in fact, still students with many other demands on their time and attention. From the host company’s perspective, the work with student teams can feel like a traditional consultancy engagement in terminology, design and expected impact. Students working on these types of projects take on a significant role as they are often welcomed into these companies as trusted partners and given access to confidential information.

They walk a fine line between one setting where they are fully known as a student; and in another, working closely with a company decision maker, expected to manage this relationship and make decisions regarding their work that can have a significant impact on the business. Faculty, students and host companies must resist the temptation to frame the project work experience as purely a consultancy engagement as this may marginalize the impetus of the course or initiative to support student learning.

Preparing Business School Students for the Future

Students come into these project-based learning course primed to advance their knowledge of key management tools and analytics. Learning is then focused on particular content areas (e.g., entrepreneurship) during the classroom component of the lab courses. Learning is amplified when students put their knowledge into action by taking on experiences working with organizations to solve real-world management challenges. Students reflect on their experience throughout the project process, gaining greater insight of management theory and practice as well as understanding their own leadership skills. In short, this approach to learning is integral to providing students with the theoretical and practical skills they need to be successful management and industry leaders.

While the traditional lecture and case study method can offer an opportunity to discuss and reflect on the practical application of management theory, MIT Sloan’s Action Learning approach extends this idea to provide a forum for students to actively link their classroom learning and prior experience with the knowledge gained through their project.

What’s Next?

We continue to evolve as we recognize the increase in complexity and ambiguity facing leaders in our business world. We continue to emphasize integrating knowledge between disciplines, faculties, theory and practice. Through its design, G-Lab looks to place students at the center of the learning process, to assist them in critically examining their insights, becoming more self-aware and enhancing their academic experience as they prepare for their professional life and a life of impact. ■



About the Author

Michellana Jester is a lecturer and course faculty lead at MIT Sloan School of Management. Jester came to MIT Sloan with more than fifteen years of management consulting, human resource, and organizational development experience.

At MIT Sloan, Jester draws from her private and non-profit sector experience to assist students link theoretical management concepts to real world business challenges. She leads the design and delivery of MIT Sloan’s largest project-based course, as well as recruiting host company partnerships that align with the program’s goals and Sloan’s mission.

Jester has been featured in Financial Times, Fast Company, The Smart Manager and the Boston Globe. She has a Master’s Degree from Harvard University and Doctorate from Columbia University.

iv

Trends in Venture Opportunities in the Investment Future

Overview

85

Democratizing the World of Venture Capital

Jonathan Medved
Founder and CEO, OurCrowd

Our *Trends in Venture* section addresses change in a new venture creation over the last twenty-five years. This issue considers a visionary's practical perspective on leading change and sharing wealth.

Jonathan Medved, Founder and CEO of OurCrowd, considers not global risk but ways to reduce risk for individual investors. Medved's democratization of the venture capital investment process helps us to consider how private and traditionally hard-to-access financial markets can be made accessible equitably, and how even small investors can participate in a future of transformative and profitable new venture creation.



Democratizing the World of Venture Capital

Jonathan Medved
Founder and CEO, OurCrowd

Since its inception in 2013, OurCrowd has been committed to democratize access to venture capital while maintaining best venture practices for a new class of investors.

The opportunity and time for OurCrowd's innovations are driven by a number of factors. These include consistent high returns in the asset class, which nevertheless have benefitted only a small subset of investors; increasing difficulty in accessing the best deals, as top deals stay private longer and then IPO at extraordinary valuations. On top of the above, all but the most sophisticated investors have not been granted standard economic preferences, which are critical to offset risk and preserve upside.

Opportunity and Differentiation

Compared to other seemingly similar "crowdfunding" platforms, the OurCrowd platform is distinguished in a number of ways. Testimony to its vision and success in education, it currently has 40,000 accredited investors from over 180 countries who access highly curated individual venture deals and venture capital fund. The emphasis is on investing relatively large amounts from aggregated individuals and institutions via an LP/GP structure. Median check size is \$3.5M per portfolio deal, with many companies raising amounts beyond \$10M. ➡

“ If growth opportunities have shifted — not all the way, but to a substantial extent — into private markets and ordinary investors don't have access to them, that's not good... It's hard to give individuals access to private markets. Can we have a fund structure to ensure that ordinary investors are getting the same deal? **”**

Jay Clayton
Chairman US Securities and Exchange Commission
September 19, 2019

OurCrowd has already invested in over 200 portfolio companies and 19 funds, and has had 36 portfolio exits to date, including leading companies such as Beyond Meat (BYND), JUMP Bikes (sold to Uber), Wave (sold to H&R Block), and Argus (sold to Continental).

OurCrowd often leads its deals; invests alongside leading venture funds; gets Board seat representation in a majority of its deals; purchases preferred stock; and receives anti-dilution protection, pre-emptive rights and liquidation preferences – just like traditional venture investors.

The model has proven successful thus far. OurCrowd has been recognized by Pitchbook since 2014 as the most active venture investor in the highly competitive Israeli venture market, achieving this status only one year after its launch.

OurCrowd – and the idea behind it – might have reached the market at the right time.

Comparative Returns by Asset Class

Asset	5-Year	10-Year	15-Year	20-Year	25-Year
Venture Capital	13%	13%	11%	21%	31%
Private Equity	12%	14%	13%	12%	13%
Real Estate	11%	8%	7%	7%	8%
Large-cap Equity	10%	13%	8%	7%	10%
Bonds	3%	3%	4%	5%	5%

- Venture capital (VC) involves investment in start-ups, often with new business models and products, which have potential for significant growth
- Average returns (IRR) for venture capital have historically exceeded those for other asset classes

Source: Pitchbook. Notes: 1. Cambridge Associates Global Venture Capital, Global Private Equity, and Global Real Estate Benchmarks Return Report. Private equity asset class excludes venture capital, 5-,10-, 15-, 20-, and 25-year returns representative of average pooled IRR for vintages dating back from 2014. Top quartile returns for all asset classes shown. Large-cap equity proxy is Lipper aggregated US large-cap equity fund performance. High yield bond proxy is Lipper aggregated high yield bond fund performance. Aggregate core bond proxy is Lipper aggregated core bond fund performance. Returns as of Dec. 31, 2015. Sample size for each asset listed is as follows: venture capital: 91–440; private equity: 174–630; real estate; 71–207; large-cap equity; 62–674; high yield bonds: 30–421; and aggregate core bond: 22–385.

Democratizing Access to Venture Investing – and Offsetting Risk

Venture capital as an asset class has performed well for its investors over the decades, in fact generally outperforming all other asset classes. And yet, it has been the most esoteric, most inaccessible asset class even for many large institutional investors. The number of institutions that have significant commitments to venture is actually rather limited; accredited and ordinary investors can only dream. Yet, particularly as fast-growing companies stay private longer and seem to take forever to go public, it is clear that the need to open up access to this closed club of venture investing is becoming imperative. The question is how to execute on this “democratization” in a way that will both benefit the venture ecosystem and the companies it serves, as well as provide compelling returns and protections for a broad range of new investors.

Jay Clayton’s galvanizing call to democratize access to venture is understandable given the history. As the table below shows, the 25-year IRR for Venture top-quartile performance averages 31%, far exceeding Private Equity’s 13%.

“Increased commitments to venture capital and the formation of mega funds – like the \$100B Softbank Vision Fund – have driven dramatic growth in venture capital investments globally

”

JUMP Bikes – aquired by Uber in April 2018



Yale University Endowment, a leading institutional investor led by the legendary David Swensen, over the years has “captured great value from the illiquidity premium of alternative assets” and made outsize commitments to Venture Capital as part of a fundamental core of its asset-allocation strategy. In fact, Yale has announced that it is upping its commitment to Venture Capital to a whopping 21.5% as target for 2020.

Yale’s endowment allocation to venture capital continues to grow

	2018 Actual	2020 Target
Absolute return	26.1%	23.0%
Venture capital	19.0%	21.5%
Leveraged buyouts (Incl. PE)	14.1%	16.5%
Foreign equity	15.3%	13.8%
Real estate	10.3%	10.0%
Bonds and cash	10.3%	7.0%
Natural resources	7.0%	5.5%
Domestic equity	3.5%	2.8%
Total	100%	100%

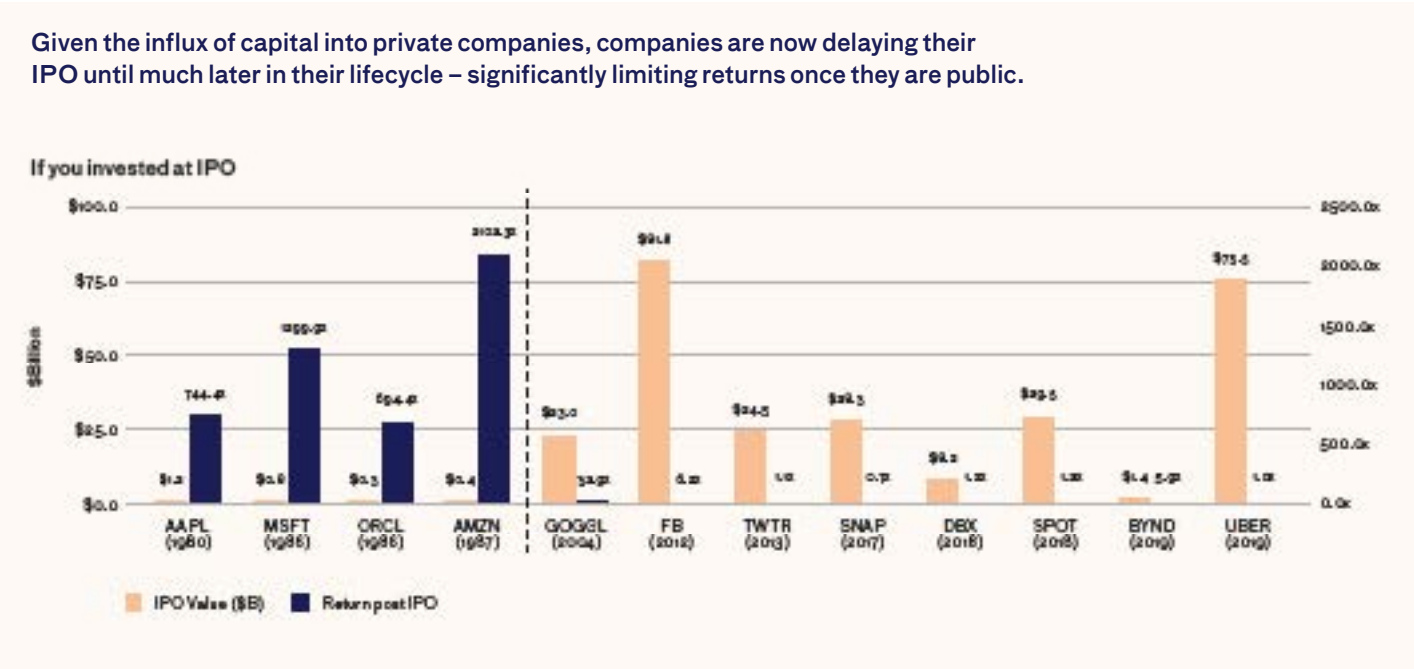
Yale’s Endowment Allocation, considered one of the premier endowment models, continues to maintain a well-diversified, equity-oriented portfolio with a growing share allocated to Venture Capital.

Surpassed \$30B mark as of June 30th 2019

These increased commitments to Venture Capital and the formation of mega funds – like the \$100B Softbank Vision Fund – have driven dramatic growth in Venture Capital investments globally, rising from \$175B in 2017 to over \$255B in 2018. In Israel, one of the world’s Venture Capital hotbeds, the growth rate in venture investments has been even more impressive, rising from \$2.4B in 2013 to \$6.4B in 2018, with more than \$8B projected to be invested in 2019.

This funding bonanza has led companies to stay private longer and put off their eventual public offerings until they have long crossed over into “Unicorn” status (start-ups with a valuation of at least \$1B). This extended Unicorn runway reduces the eventual returns offered to investors who buy the IPOs when they ultimately go public.

As an example, the number of Unicorns significantly increased in just 14 months, from 279 in February 2018 to 452 in May 2019, and had a combined valuation of \$1.6T. This was demonstrated in a striking manner by renowned venture investor Mark Andreessen when he compared the returns offered to public investors in the “good old days” when they invested in the IPOs of Microsoft, Apple, Amazon, and Oracle vs. today when IPOs such as Uber already had an \$82B offering value (since down over 30%) and investors refuse to support the prices of over-inflated IPOS, famously tanking the planned public debut of WeWork at \$47B. Frustrated investors, both individual and institutional, are asking why ➡



Source: OurCrowd, as at June 13, 2019

they were not able to invest together with the lucky few in Uber’s \$1.3M angel funding round.

Net net, the problem is that unless one is lucky and well connected enough to be “invited” to join such a round, getting into quality Venture Capital deals and funds is very difficult. As an individual, participation in angel funding is totally dependent on who one knows, and is very localized. If you live in Silicon Valley and are a VC or senior member of a Google or Facebook team, you may get shown angel deals. But if you are a wealthy dentist in Peoria, Illinois, your chances are pretty much non-existent. Even the wealthiest individuals or family offices who are willing to pay the usual minimum \$5M LP entry ticket and get into quality Venture funds have a very tough time getting allocation. The waiting list to invest in Benchmark, First Round Capital and others is akin to an infinite loop.

Institutions also have to build teams of investors to hunt these funds and fight for allocation often only to settle for a \$5M–10M LP piece in an untested fund, which needs to be multiplied by 20 other different fund commitments in order to invest a \$100M–\$200M amount representing only 1%–2% of a \$10B corpus. The need to rinse and repeat this allocation hunt every three-four years according to each fund’s launch and funding schedule proves daunting to all but the most committed asset allocators, thus leaving many wannabe institutional venture investors left out in the cold.

Increasing the Investment Public’s Access to Venture Capital

There have been a number of initiatives launched over the past several years to address this limited access to venture capital. AngelList is a popular site that allows individual accredited angel investors to join with other angels in syndicates formed to back deals listed online. AngelList splits a carried interest (typically 20%) with the lead angel (syndicate leader) and, generally, no ongoing management fees are charged. While some of the angels and their deals are of good quality, there is no overall supervision or curation of deals, and the quality of some listed deals is often spotty. Moreover, the angels are not necessarily taking board seats, nor always buying preferred stock, nor focused on providing added value to the company, or even allowing for follow-on investment opportunities.

Several sites that were promulgated in response to the JOBS Act of 2012 (Regulation Crowdfunding sites, or Reg CF, according to the SEC regulations), allow for even non-accredited investors to join in online venture deals. However, the amount of capital that Reg CF sites can invest is limited to \$1M per company and the sponsors of the sites make their money as a kind of junior broker dealer, being paid by the companies a percentage of capital raised. Stock is directly owned by the individual investor so, potentially, hundreds of investors are added to a company’s cap table.

“Even the wealthiest individuals or family offices... have a very tough time getting an allocation. The waiting list to invest in Benchmark, First Round Capital and others is akin to an infinite loop

”

Crowdfunding Platforms

Platform	Curation	Stock type	Board seats	Follow on	Fees
AngelList	By Angel	Generally common	Generally not	Generally not	20% carried interest
Regulation Crowdfunding	Little or none	Common	None since regulations prohibit	None	Slotting/broker fees from companies
OurCrowd	Standard Venture Diligence	Preferred	In majority of cases where available	In most cases	2% management, 20% carry

The stock purchased is generally common shares, without anti-dilution or pre-emptive rights, no platform supervision, no board seat, nor follow-on investments. These Reg CF investors are the first investors to be hurt if there is a “down round” (financing at a lower valuation) and the first to be left out if there is an “up round” (financing at a higher valuation).

Given that companies must pay the Reg CF to be listed and upon success, and that sponsors do not invest their own capital in the portfolio companies, the companies selected are subject to a negative selection bias, with Reg CF generally choosing companies that can’t raise money from recognized Venture Capital investors. Clearly, an alternative for individual investors, which rewards rather than penalizes their participation, is necessary. OurCrowd seeks to provide such an alternative. (See table opposite)

OurCrowd’s financial model employs the standard 2/20 Venture manager profit share (2% management, 20% carried interest), thus aligning interests between investors and the platform. However, minimum investment sizes are modest: \$10,000 for individual companies and \$50,000 for venture funds. Aggregated LP checks for funds already exceed on average \$10M per fund.

OurCrowd and Funded Companies: Challenges and Further Opportunities

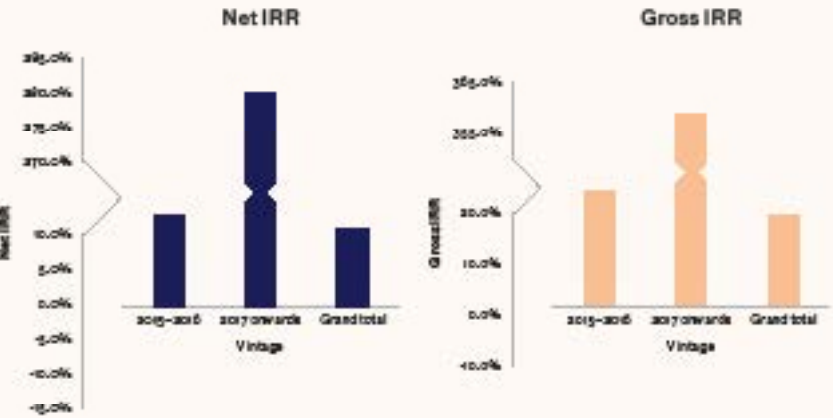
OurCrowd deviates from regular venture practice in several key areas. First, the companies must help with the fundraising by appearing at face-to-face investor events and roadshows, online webinars and participation in personal calls and meetings with significant investors, family offices and institutions. This creates a linkage between the companies

and the LPs that is different in kind and intensity from the traditional Company-VC-LP relationship. This differentiated approach becomes a force multiplier factor for portfolio companies because the global investor network can be leveraged to provide strategic introductions, hiring, local distribution and joint ventures, and assistance with follow-on funding. The OurCrowd global network is engaged in real partnership with the companies and thus, paradoxically, OurCrowd is perceived by many of its portfolio CEOs as the company’s most active venture investor.

One of the key challenges faced by platforms that raise funds for individual venture deals the way OurCrowd does, is the general inability to give a firm and hard commitment on the amount of capital to be invested in the company. This, of course, is subject to the success of the funding effort and campaign. However, given overall performance and transparency in the process, this obstacle has been largely overcome (though not yet completely). OurCrowd is hard at work on several new methods to bridge these gaps.

One positive surprise with the OurCrowd funding approach has been the general success of providing follow-on funding to those companies making steady progress, and even in some cases where down rounds occur and trouble needs to be worked out. While this was not at all assured in early plans and discussions, it turns out that in many cases OurCrowd has built its position in subsequent investment rounds, growing from an initial investment of only \$1M–\$2M in some cases to over \$10M as a result of participation in several follow-on rounds. Moreover, since investments are not limited to a single, hard limited fund with issues of reserves and fund lifetime, the potential for follow-on is actually quite significant, especially if the global LP network is engaged with the company. ➡

OurCrowd’s Returns based on 51 concluded investments (i.e.: Exits & Write-offs) – IRR



Returns have been calculated internally by OurCrowd, based on IPO prices as at 6.30.19, and have not been independently audited.

OurCrowd is also different in its approach to Corporate Venture partners that are registered on the platform in order to engage with portfolio companies; perform Proof-of-Concept testing (POCs); and even contract for paid scouting and other innovation services, including Corporate VC as a service. Over 1,000 multinationals are registered on the platform, thus providing additional value to the portfolio companies and funds.

OurCrowd is both a direct investor in companies and in funds and, therefore, also has a different scale than most Venture organizations. These funds are either built by teams hired by OurCrowd, or as theme- or strategy-driven portfolios selected from among its direct investments, or as partnerships built with other venture funds that allow OurCrowd to invest as an LP in their funds. Leading funds such as USVP, Maniv, Proof, OXX, and others have received significant LP funding from OurCrowd. The ability to choose from a menu of leading Venture Capital funds, which at any given time includes five or more that are currently funding, is a unique offering to both individual and institutional investors who are writing checks and making commitments ranging from \$50,000 to many millions of dollars. The fact that there is no “fund of funds overage” (a standard additional 1% management fee and 10% carried interest fees tacked onto the 2/20 model in most fund of funds) is unique and allows OurCrowd investors to build their own diversified venture fund portfolios.

Looking into a More Democratized Future

The key factor that will ultimately make or break democratization of Venture Capital is performance. Can the new platforms bringing new investors to the asset class deliver the results needed to justify the inherent risk and illiquidity of venture investments? While it is still early and much work and analysis need to be done, OurCrowd’s initial results are promising.

Overall performance in certain key performance criteria such as DPI (distributions as a function of paid-in capital) are already exceeding top-quartile benchmarks from Cambridge Associates. For the sake of analysis, we looked at all investments in company SPVs in aggregate as three-year funds (2013 and 2016 funds) and both exceed the DPI measurement needed to enter the coveted top-quartile cohort.

Moreover, performance is improving over time as the model continues to prove it can deliver for companies and investors. Earlier company cohorts in the 2013/2014 time frame were not the best performers, but the quality of deal flow has improved markedly as value is added consistently to the portfolio and performance is delivered for investors. Analysis of the performance of “completed investments,” including all exits and write-offs, shows dramatic improvements since inception.

OurCrowd has launched a fund called OC 50, which is a kind of Venture Index fund consisting of a portfolio of 50 different companies. For each \$50,000 fund increment, an equal amount of \$1,000 per company was invested in a multi-vector diversification strategy. The 2017 vintage portfolio was invested across sectors, stages (from early to late), and geographies. The performance to date has been striking with five exits (two from Israel, two from the U.S., and one from Canada) and top performance across several key metrics.

This kind of performance is bringing attention from institutions that now wish to broadly distribute these products to their clients who otherwise have no access to the Venture Capital asset class. On Oct 16, 2019, Stifel, a leading U.S. diversified financial group that is the 7th largest U.S. broker dealer and has the country’s largest equity research platform, announced a strategic deal with OurCrowd.



The OurCrowd Global Investor Summit 2019

The deal includes an investment in OurCrowd and a decision to distribute OurCrowd products to its over 1 million clients through the firm’s 2,200 financial advisors. This is the first time a major U.S. financial institution has announced an intent to broadly distribute Venture Capital products and will have major ramifications on both OurCrowd’s business and reach, as well as the broader financial markets.

It seems that the democratization of access to Venture Capital is already taking shape. Let us hope that these are the first of many moves that will allow broader and successful access to Venture Capital among both institutions and the individual investor. The advantages to these investors, as well as to the companies they invest in, will be a game changer. ■

“Looking forward, I think you’re going to see a whole bunch of initiatives to bring more and more people into the asset class.”



About the Author

Jonathan Medved is a serial entrepreneur, one of Israel’s leading high tech venture capitalists, and was named one of the world’s “50 most influential Jews” by Jerusalem Post.

Medved is the founder and CEO of OurCrowd. He was the co-founder and former CEO of Vringo; the founder and general partner of Israel Seed Partners; a founder and executive VP of marketing and sales at MERET Optical Communications, Inc.; executive VP of marketing and sales at Accent Software.

Medved has served on the Boards of Ma’aleh Film School, Michael Levin Lone Soldier Center, Artists and Musicians for Israel, Bnai David Eli, and served on the Board of Governors of the Jewish Agency and the Jerusalem College of Technology.

Medved is a frequent guest and commentator on television and was featured in several documentary movies. His writing has appeared in the Wall Street Journal, USA Today, The Jerusalem Post, and Townhall.com.

V

Industry Analysis Fashion Technology

102

The Impact of Technology on the Global Fashion Supply Chain

Jacqueline M. Jenkins

*Executive Director of Strategic
Planning and Innovation,
Fashion Institute of Technology*

Overview

Our *Industry Analysis* section draws on one of the most essential tools for analyzing a commercial ecosystem. The tool, conceptualized and then refined over decades, facilitates an understanding not just of what is, but of future transformation within an industry and, often, across industries.

In this issue, Jacqueline Jenkins, the executive director of Strategic Planning and Innovation at the Fashion Institute of Technology (New York), presents fashion technology as an industry at the cross currents of technology-driven change. Drawing on her work with world-leading manufacturers and technologists, Jenkins guides us to understand how fashion is being transformed by innovations in fields ranging from blockchain, supply chain management, and big data analysis. While the change is perhaps stealthier than what is occurring in financial services and healthcare, it is clearly no less profound.

Looking forward, the *Industry Analysis* section in future issues will similarly be written by industry leaders addressing the transformation within and across once-disparate industries, including technology-driven innovation in the industry chain from distribution to end-user analytics.

The Impact of Technology on the Global Fashion Supply Chain

Jacqueline M. Jenkins

Executive Director of Strategic
Planning and Innovation,
Fashion Institute of Technology

“As consumers continue to expect shorter production cycles and personalized products with an elevated consciousness for sustainable and price-sensitive fashions, being on trend is no longer enough. Fashion brands must harness the power of technology to innovate the global fashion supply chain.”

The concept of a supply chain, an ecosystem of suppliers and business processes working toward the creation, production, and distribution of goods or services, appeared in publication form as early as the *Art of War*, written in 1838 by Baron Antoine-Henri Jomini. While the idea was referred to as “procurer logistics” and applied to a single market, the concept is the same today and can be generalized. Among the critical changes is a good or service that evolves today from the design phase to being a consumable good or service has been dramatically transformed by the power of technology.

Technological advancements have always played a major role in the evolution of fashion and related industries. This includes the revolutionary 1850 invention of the sewing machine that extended garment production beyond the capabilities of handsewn items to the 1956 innovation of consistently-sized crates eventually leading to standard steel shipping containers for price-efficient global distribution. As we fast forward, it is undeniable that Microsoft’s release of Internet Explorer 1.0 in 1995 laid the foundation for the e-commerce fashion boom that has forever changed the way in which consumers engage

with fashion. Less than twenty years later, 58% of the global online population has made an online purchase in the last twelve months, with approximately half of the items falling into the fashion (clothes or footwear) category.

What has changed, and where is this changing leading us?

It is impossible to truly address this question without unpacking the individual technology drivers. And it is interesting to note that fashion is one of the industries that is being transformed, with significant impact on society, and yet without deep exploration such as exists in Healthcare, Education, and Environmental Sustainability. How in fact is fashion changing the use of technology? And conversely, how are 3D Printing, Artificial Intelligence, Blockchain, and Advanced Materials changing fashion, including the way we live and work?

3D Printing

This process utilizes 3D modeling data and rapid prototyping to produce objects by layering polymers, a flexible and durable plastic material. Since the introduction of 3D printing into the supply chain, the polymers have advanced to enable the creation of garments that are able to be worn. These garments resemble properties of actual material, and can be produced within a vastly compressed time period (hours rather than days or weeks). ➔



Traditional Garment Construction	Additive Manufacturing: 3D Printing
Scraps and waste left at the end of the process	Zero waste
Limited construction capabilities	Able to achieve complex garment construction
Personalization requires costly, potentially time-consuming tasks	Personalization achieved with the ease of programming

The impact has been abetted by the fact that the price of 3D printers has also dramatically decreased, enabling increased reach and sophistication, including new forms of specialization and sub-specialization on the supply side. On the demand side, we notice that the “zero waste” that is a hallmark of 3D printing is attracting new consumers, as is the personalization of customization of size, fit, and design. From this perspective, the addition of 3D Printing to clothing can almost be thought about as an external signal of identity, not too different from the tattoos used by some people to signal their interests, affiliations, and values.

Meeting the social change that is both cause and effect of the personalization phenomenon, commercial drivers include brands such as Adidas AG, ECCO Sko AS, New Balance, Nike Inc, and Under Armour Inc., who are incorporating 3D printing design elements into their production as a way to differentiate (in this case, based on fit). Nike, for example, produced its Vapor Ultimate Cleat American football boot using 3D printing to meet the specific needs of the individual athlete.

Artificial Intelligence

As we think about the effects of AI on the global fashion supply chain, there are revolutionary implications to critical areas of fashion, such as inventory management, design selection, merchandise planning, and the consumer experience. Based on research from McKinsey & Co., for example, an AI-based forecasting approach could reduce planning errors by up to 50 percent, while overall inventory reduction of 20 to 50 percent is feasible. Analyzing key data points which reveals heretofore invisible data as to what a consumer buys, how, and where, the use of AI enables brands to develop customer profiles and inventory management parameters that support a brand’s ability to get the right product to the right consumer at the right price and time.

As a practical level, the Fashion Institute of Technology (FIT) in 2018 partnered with IBM Watson and Tommy Hilfiger to produce a sweater of the future. The project utilized the analytical capabilities of IBM Watson, including computer vision, natural language understanding, and deep learning techniques to evaluate consumer preference trends for



IBM’s Watson computer



15,000

A product library of 15,000 images

600,000

600,000 publicly available runway clips

100,000

Close to 100,000 pattern samples

sweaters. The trend information came from the Tommy Hilfiger product library of 15,000 images, some 600,000 publicly available runway clips, and close to 100,000 pattern samples. Imagine the volume of data. And yet, from this data – accessible for among the first times – FIT students were able to develop AI-generated insights to create sweater designs that were reflective of the brand’s heritage brought down to the level of the individual.

In addition to inventory management capabilities, AI also is being used by brands to support customer service functions based on planning and learning from previous mistakes and selections concerning an individual’s likes and dislikes. A level deeper, chatbots enable brands to deliver a cost-efficient, white-glove service instead of the disappointment often felt when speaking with a call center that is relying on customer data with a time and information lag. For example, H&M uses chatbots as a concierge service that helps shoppers with styling selections, remembering previous purchases, and sharing their favorite looks on social media. Of course, the chatbot is available to service a shopper’s need on a 24-hour basis without the requirement of a break. As of 2018, industry data drawn

suggests that nearly 2/3 of millennials – 67% – prefer to purchase from that brands that use chatbots. This is but one indicator of a transformative trend in terms of labor and impending shifts in the labor force, consumer behavior linked to consumption patterns, and the implications for rising demand in the face of more accessible and “authentic” supply.

Blockchain

Due to the fragmented nature of the logistics industry, the existence of numerous supply chain-related legacy systems that are often incompatible, coupled with the complexities of managing multiple relationships, there are a ton of inhibitors that work against an efficient flow of supply chain information.

Among the areas of potential change is the counterfeit fashion market. And yet, blockchain provides a reasonable means to address this problem in a cost-efficient and highly accurate manner.

Blockchain’s value is its ability to increase the speed, accuracy, and access to the complexity of managing information throughout a global supply chain that includes factory labor, logistics providers, insurance agents, trade attorneys, and brokers. For example, the shipment of a refrigerated good from East Africa to Europe potentially encounters approximately 30 people or entities, with more than 200 unique interactions and communications.¹ Each touch by an intermediary is an added cost, a period of time, and a possible point of handling error.

Given its collaborative nature, a blockchain’s value is of course highly dependent upon the adoption of other industry players to the platform. The world’s largest diamond producer by value, De Beers, has launched Tracr, a diamond industry blockchain that has the potential to bring onto the platform 60% of India’s informal diamond industry. Tracr will have the ability to manage the entire diamond product process for the precious stones with weights between 5 and 10.8 carats.² ➡

Three Examples of Advanced Materials:

- 1 Sustainable — textiles that reduce the negative environmental impact of fashion products by means of using recycled materials or materials that are easily biodegradable.
- 2 Novel Technical — materials with benefits such as being stretchable, moisture wicking, and temperature controlled.
- 3 Embedded with Sensors — capable of connecting with other devices, collects body and environmental information, and able to change color and/or appearance.

Applications range from tracing (and ideally preventing) human labor violations to eliminating counterfeits as the diamond is tracked, beginning with the mining phase.

Advanced Materials

The research lab is not limited to fields like neuroscience and computer science. Due to advancements in textiles that include wearables, also known as smart textiles, material sourcing is being transformed through the control of external stimuli such as stress, moisture, electric or magnetic fields, light, temperature, pH, or chemical compounds. This growth is being spurred by the adoption of these textiles in sectors such as healthcare, sports and fitness, the military, and automotive. As consumers continue to gravitate to garments and products that go beyond traditional usage of fashion, the smart textiles market is expected to reach \$4.72 billion by 2020.

At a practical level, wearable garments made a big introduction into the commercial market by Ralph Lauren during the Opening Ceremony of the Rio 2016 Olympic Games. The Team USA flag-bearers wore classic Polo styled

blue jackets that included electroluminescent panels. While this is just a first step, without much societal, health, or lasting social significance, the jacket represented Ralph Lauren’s continued commitment to being trailblazers in fashion by means of design and innovation. And innovation continues – by the 2018 Winter Olympics, Ralph Lauren had dressed the USA flag-bearers with adaptable heat technology that could be controlled by a smartphone app.

The Fashion Institute of Technology is actively driving research and working to commercialize products in this area. The school is a member of the Advanced Functional Fabrics of America (AAFOA), a non-profit institute located near its host organization, the Massachusetts Institute of Technology. By partnering with US member organizations that design, model, measure, supply, or integrate fibers, yarns, fabrics, and textile products, AAFOA lives out its mission to transform fiber materials and manufacturing processes that have barely changed in over a thousand years.

Most recently, as part of the educational focus of the organization, AAFOA supported a student immersion program between FIT

Tracr’s model for tracing diamonds



and MIT where design and engineering students collaborated on the creation of advanced material products to solve the performance issue of sneaker design while also designing an environmentally friendly sneaker made out of a disposable material for the sole. Initiatives such as the MIT and FIT student project are training the future workforce on the benefits and capabilities of the application of advanced materials.

Looking Forward

A consistent theme, in fashion as in other leading industries, is that successful supply chains can get the right product to the right consumer at the right price and time. As we look at the growing demands of consumers, such as the trend for customization over mass-production, the concept of a seasonless selling cycle that replaces the traditional windows of production with an ongoing design process, and the continuous focus on sustainable goods, it is clear that fashion and the fashion supply chain will continue to evolve to meet the ongoing demands of the consumer. On the supply side, technologies such as 3D printing, artificial intelligence, blockchain, and advanced materials are supporting a more sustainable manufacturing and distribution process. They are creating a change and an opportunity that are – unlike healthcare and education – uniquely global. ■

¹ McKendrick, Joe, “5 Reasons to Blockchain Your Supply Chain,” *Forbes*. March 19, 2018

² Sharma, Manoj, “De Beers to Launch the First Diamond Blockchain; Here’s How it Will Work,” *Business Today*. August 3, 2018



About the Author

Jacqueline M. Jenkins is the Executive Director of Strategic Planning and Innovation for the Fashion Institute of Technology (FIT). In this role, Jenkins oversees the development of the school’s strategic plan and the fulfillment of FIT’s commitment towards innovation.

Prior to joining FIT, Jenkins was the former Dean of Graduate Studies at LIM College. She was the founding Dean of the Global Fashion Supply Chain Management degree.

Jenkins earned her B.A. in Economics from Spelman College and her MBA in Finance from the Wharton School of the University of Pennsylvania.

In theory, theory and practice are the same. In practice, they are not.

Albert Einstein

The Editorial Board

Editor-in-Chief

Prof. Moshe Zviran
*Dean, Coller School of Management
Tel Aviv University*

Managing Editor

Dr. Leslie Broudo-Mitts
*Head, Coller Institute of Venture
Coller School of Management
Tel Aviv University*

Editorial Advisor

Prof. Josh Lerner
*Jacob H. Schiff Professor of Investment Banking
Harvard Business School
Harvard University*

Editorial Offices

Coller Institute of Venture
Coller School of Management
Tel Aviv University
Tel Aviv 6997801, Israel

Email: CollerVentureReview@tauex.tau.ac.il