EXPONENTIAL INNOVATION WORKSHOP

A crash course in technology acceleration, convergence, and the new competitive realities

VIVEK WADHWA AND TARUN WADHWA

OVERVIEW

The pandemic has taught us the incredible power of exponentials. We've seen how a small development in a far-off place can set off a series of events that quickly disrupts everything about our lives. But it's not only viruses that advance exponentially. In the coming years, a range of technologies will create the same sort of explosive and transformative changes across industry, society, and government — putting entrepreneurs at the forefront of our next industrial revolution.

What is enabling this new revolution is computer technology's exponentially increasing pace of advancement. Our smartphones now have greater computing power than yesterday's supercomputers. Every technology that is information-based is advancing on an exponential curve, including artificial intelligence (A.I.), robotics, sensors, synthetic biology, 3D printing, and quantum computing — all becoming smaller, faster, and cheaper.

At the same time, technology convergence is setting the stage for the decimation of existing industries as new ones develop. For example, Tesla has revolutionized the automotive industry by combining electric-vehicle technology, advanced battery systems, and software integration. Remote work and video-conferencing platforms such as Zoom and Microsoft Teams have redefined workplace dynamics. A.I. and machine learning have given birth to virtual assistants such as ChatGPT, transforming the nature of work itself.

For that matter, banks and financial institutions were unprepared for the disruption caused by fintech companies and decentralized finance platforms, which offer innovative financial services and products outside the conventional banking system. And telcos are not ready for the upheaval that satellite-internet providers, such as SpaceX's Starlink, will bring to the market, delivering high-speed connectivity to remote and underserved regions and challenging the dominance of established telecom providers.

This is the new nature of disruption, in which the competition comes out of nowhere and business models change. The incumbents in every country are not ready for it; as a result, the vast majority will become history. And it will occur within the next decade.

To shepherd their companies through this, business executives need to change their ways of thinking about competition — and their ways of innovating. Innovation has globalized; business models and technology developed in one country can easily be exported to another. To thrive in this era of unprecedented disruption, companies must embrace transformative changes and take calculated risks, proactively innovating and adapting their business models before external forces compel them to do so.

In this workshop you will learn how to watch for convergences, navigate disruption, and create the trillion-dollar businesses of tomorrow.

WHO SHOULD ATTEND

The Exponential Innovation Workshop combines a series of lectures, working groups, and discussions to steep leaders in new paradigms of innovation and competitiveness. It will explore how to thrive in today's era of exponentially advancing technologies. This two-day program teaches the basics of these technologies, the tools and techniques necessary for innovating in this new era, and the skills necessary in managing modern organizations—as well as the ethical issues in developing these new technologies.

The workshop has taken place in more than 25 countries and has inspired hundreds of valuable and worthwhile initiatives, products, and platforms around the world. It makes complex technology, engineering, and business subjects accessible to participants without any background in those fields. The program, providing the tools to understand the changes ahead and to update work methodologies accordingly, especially suits:

- startups and entrepreneurs seeking to understand how to fit their product to the market; how to scale up exponentially; and where the next multi-billion-dollar opportunities lie
- employees aiming to expand their careers and understand where they can grow
- government officials looking to see how the complex imminent changes in our social, legal, and civil systems can be harnessed to enhance human potential
- CXOs seeking to learn about new business models, revenue streams, and ways to grow multi-billion-dollar businesses
- corporations looking to understand how they can apply advancing technologies
- policy makers seeking to understand how to develop regulatory frameworks that enhance our abilities to keep pace with technology and unleash creative potential.

Companies and institutions whose executives have already attended include:

- the American College of Corporate Directors, an educational organization for directors of the world's largest publicly held companies
- NextEra Energy, an American energy leader
- Sime Darby, a major Malaysia-based multinational conglomerate
- Dominion Energy, a leading American energy utility
- A.T. Kearney, a global consulting firm with offices in 40 countries
- Fujitsu, a Fortune Global 500 Japanese multinational company
- TheFamily, Europe's hottest startup incubator
- Standard Bank, a pan-African finance corporation
- Nike, a major American sportswear company
- 3M, a global science company with more than $30B in annual revenue
- the Institute of Global Management, an executive academy for Korea's top C.E.O.s
- IBM Global Services, the consulting division of the world's largest tech-services provider.

Exponential technology 101: the basics and progression

By 2029, according to Ray Kurzweil's predictions, computers' exponential trajectory will lead them to exhibit human-level intelligence. Since every technology that becomes information-based also traces such exponential progress, advances have begun similarly accelerating in fields such as artificial intelligence, digital manufacturing, medicine, robotics, sensors, nanomaterials, and synthetic biology.

We will illustrate the driving forces behind related technologies, as well as what they may enable.

Artificial Intelligence

- What led (A.I.), the stuff of science fiction, to failure in the '90s, and the new methods of data analysis and the advent of the GPU that revived it
- Separating fact from fiction: the difference between today's "narrow" or "weak" A.I. and tomorrow's artificial general intelligence and superintelligence
- How A.I. can provide the cheap, reliable, industrial-grade digital smartness to transform decision-making in everything from stock trading, document review, and financial analysis to security, intelligence, fraud detection, and law enforcement
- Classes of machine-learning strategies — supervised, unsupervised, and reinforcement — and their application in business
- Cutting through the hype: the limits and practicalities of business A.I.
- Regulatory and reputational concerns arising from A.I.'s opacity and emergent properties.

Digital manufacturing

- Advances in 3D printing, and its relatively slow progress
- Uses of 3D printing: household goods, electronics, automobiles, and food
- The dream of being able to emulate nature in design.

Medicine

- Sensor-based medical devices as consumer appliances; epidermal electronics and the Fantastic Voyage into the human body; and the possibilities of telemedicine
- How we have become data and our doctors are becoming software
- Virtual psychologists, brain–computer interfaces, and robotic surgery
- Advances in bionics and prosthetics
- DNA sequencing and the dream of precision medicine
- How medicine's new frontier, the microbiome, could disrupt the very foundation of Western medicine
- New methods for exploring treatments for most cancers and many other diseases within a decade.

Nanotechnology

- The dream of nanotechnology and the reality
- Quantum effects: how properties such as melting point, fluorescence, electrical conductivity, magnetic permeability, and chemical reactivity change as a function of particle size
- New materials and the materials genome
- Nanotechnology of science fiction: molecular assembly and micromachines.

Robotics

- What exactly a robot is, and why we don't have the robots depicted in science-fiction movies in the past 60 years
- The progress of robots: what they can do today, and what we can expect in the next decade
- Robots for manufacturing, delivery, retail management, surgery, and personal use.

Sensors

- How advances in MEMS sensors — microfabricated from miniaturized mechanical and electro-mechanical elements — underlie IoT devices and the possibility of a new generation of smart cities
- Microfluidics/nanofluidics and "humans on a chip" technologies.

Synthetic biology

- The ability to "print" DNA and create new life forms and school experiments from "biobricks"
- Advances in CRISPR: how plants, animals, and humans genes can now be "edited"
- Creating drought-resistant and extra-nutritious plants, adding features to animals, removing problematic genes from humans, resurrecting the woolly mammoth and dinosaurs
- Where and how we'll draw ethical and legal boundaries.

Quantum computing

- Whether the phantom effects of quantum physics — which Albert Einstein called "spooky action at a distance" — are real and practicable
- Applications in machine learning, tumor treatment, logistical planning, ever smarter trading algorithms, airline scheduling, the search for Earth-like planets
- Breaking the world's most sophisticated cryptography system in minutes.

The solutions that technology is enabling to the problems that have always plagued humanity, including disease, ignorance, energy shortfalls, and hunger — creating many new problems but solving the oldest:

- an era of unlimited, clean, and almost free energy through advances in technologies such as solar and wind generation
- the capacity to educate and retrain almost every person on the planet though inexpensive smartphones, artificial intelligence, and virtual reality
- health care affordable to billions via inexpensive diagnostics and A.I. doctors
- unlimited supplies of synthetic meat and produce from vertical farms.

Convergence, disruption, and opportunity: how existing industries will be disrupted and new, trillion dollar, industries will emerge

Not long ago, you could see your competition coming. Management guru Clayton Christensen coined the term "disruptive innovation" to describe how competition worked: a new entrant attacked a market leader by launching low-end, low-priced products and then relentlessly improving them. Now Christensen's frameworks have themselves been disrupted — because you can no longer see the competition coming. Technologies are no longer progressing in a predictable linear fashion, but are advancing exponentially and converging.

Practically every industry will be disrupted over the next few years, including finance, insurance, health care, manufacturing, transportation, education, I.T. services, and communications. By the early 2030s, all but a very few of today's Fortune 500 companies will have fallen off that list; they will go the way of Blockbuster, Kodak, RIM, Compaq, and Nokia. This is not all bad news, because disruption creates opportunities. New industries will emerge, and the companies that lead the change will have the trillion-dollar market capitalizations.

We will explain how technologies converge and disrupt industries, and the S-curves that they form — which make it very hard to pick specific winners. And we will detail some of the technology convergences in a range of industries — all of which will affect one another.

Agriculture

- Robots have advanced to a point at which they can do the grunt work that humans do in farming.
- Breakthrough technologies can inexpensively generate Plasma-Activated-Water, Mother Nature's secret method of fertilizing and protecting the planet's flora.

- Innovative structures and designs have led to dramatic improvements in LED technology and enabled it to be optimized for plant growth. The combination of LED lamps, A.I., and sensors is facilitating rapid advances in vertical farming.
- Using sensors, A.I. drones can now monitor crop growth, watering, fertilizer application, and harvesting.
- Meatless meat, made of plants and vegetables, is now the rage in Silicon Valley, and technologies such as CRISPR will dramatically accelerate its development. In vitro cloned meat is also becoming a reality.

Communications

- AT&T, Verizon, and Sprint have seen their landline businesses disappear.
- Wireless networks far exceed the reach of landlines, and smartphones are leapfrogging PCs, tablets, and mobile broadband.
- A race is on to provide Wi-Fi everywhere, via drones, balloons, and microsatellites.
- What comes next for mobile carriers?

Finance

- How peer-to-peer marketplaces and startups are forcing a redesign of every part of the financial system
- The promise of digital currencies, and a sober assessment of where today's cryptocurrenices are heading and what makes them valuable
- How India and China have already built the cashless societies that the Western world thinks are still science fiction
- Cutting through the hype to find blockchain's killer apps
- Why tokenization and smart contracts will fundamentally transform the way we own, access, and share resources.

Additionally, this lecture will cover transformation of manufacturing, education, energy, insurance, real estate, transportation, health care, retail, and technology services.

Exponential Vulnerability: building new defenses for a fast-changing world

The rapid pace of technological change is creating unprecedented security risks for companies. Though there seems to be a new story every day of a corporation that has been hacked, such intrusions represent a small fraction of the potential vulnerabilities. Executive e-mails, employee health information, and industry contracts are all fair game in this new age of security threats.

We will provide a roadmap of what corporations can do to position themselves for success, taking concepts that everyone in business needs to know and distilling the most practical knowledge without getting lost in technical specifics. Customers, clients, and boards are ultimately holding

executives responsible for the security of their company. Executives will need to adopt proactive defense rather than maintain the status quo of reactive response.

The changing nature of breaches and attacks

- Multiplying points of failure, and the new risks that companies face daily
- Why companies will face the same threats as countries, and how they can protect their reputation and resources while under attack
- How to design security considerations and controls into every level of a company
- A new age of synthetic media, deepfakes, and targeted attacks.

Securing connected devices

- How the global debut of Ransomware simultaneously in more than 150 countries has made us rethink management of embedded computers
- The next generation of Internet of Things and what securing it will necessitate
- The new insurance products, financial strategies, and market-based remedies changing how we think about liability.

Building resiliency into corporate security

- Why everything will be breached, and the new defining question: what happens afterward
- What blockchain can and can't do to prevent data loss
- How hackers make systems stronger by exposing vulnerabilities — and how to have them work for you rather than against you.

The new realities of data collection and analysis

- The changing nature of what and how machines communicate about us
- How new architectures are enabling companies to capture user data while limiting their own exposure to risk
- Navigating regulation and changing social demands for privacy and data security.

Preparing for the next generation of cyber threats

- Preparing for the arrival of quantum computing, its threat to encryption, and the security crisis unfolding exponentially
- How offensive and defensive A.I.s will come to define the future of corporate security
- Rethinking our current infrastructure, and designing new protocols for tomorrow's technologies.

How to innovate in the exponential era — part 1

By the end of the 2020s, three-quarters of the S&P 500 list will be replaced, because today's corporate leaders are unprepared for exponential disruption.

We will cover some new factors affecting innovation, including new work patterns (we are always connected; everything is urgent; adapt or perish) and important differences between large companies and startups. We will explore which kinds of people are becoming entrepreneurs, and the implications of cloud-based information, of the instantaneous spread of knowledge, of ideas' coming from anywhere, and of the dependence of success on sharing rather than hoarding knowledge. We will illustrate the new techniques of crowdsourcing, crowd creation, and contests and discuss the importance of building an entrepreneurial culture that empowers employees.

The new constraints on corporate survival, management, and work

- Companies believing they will succeed because what they're doing has worked in the past, as against startups focusing on building new markets and fearing nothing
- Why the silos that companies organize themselves into will ultimately spell their doom
- How markets have moved power from buyer to seller; why intellectual capital and brand can no longer lock in customers, and why one-way messaging no longer works; and how companies must build loyalty through value or perish.

What works and what doesn't work

- How companies and countries have wasted billions on top-down programs and expensive R&D, merely to demonstrate that you can't buy innovation
- Why traditional hierarchies don't work for knowledge workers, and why managers must facilitate rather than control
- What makes innovation all about people and ideas, and how to make great leaps forward without spending huge amounts of time or money.

Exponential methods

- Developing minimum viable products through which early adopters can show you whether you're solving the right problem
- How to develop incentive prizes to jumpstart industries and change perceptions of what is possible
- Why ideas can come from anywhere, localization is everything, and the best entrepreneurs steal.

The Silicon Valley way

- How moonshot thinking and demands for tenfold improvement establish new mindsets, encourage lateral thinking, and challenge norms

- What makes the ideas economy truly exponential, and why data are the new currency of the information age
- Silicon Valley's enduring advantage: spreading, sharing, and collaborating on ideas.

- Making the cultural transformation from traditional linear to entrepreneurial exponential
- How to incubate ideas, invest in startups, acquire runaway successes, and partner with companies that provide strategic advantages
- Why bold leaders disrupt themselves.

How to innovate in the exponential era – part 2

Silicon Valley has invented the world's most sophisticated toolkit for fostering innovative thinking and building cutting-edge companies. How was Elon Musk able to beat Wall Street and defy the odds with both Tesla and SpaceX? How did AirBnB transform the very idea of what a "hotel" is? And what does it look like to apply these ideas to entirely new industries?

In this lecture, we will provide an overview of how to apply design thinking to business practices; what you can learn from the Lean Startup model; the methods that software startups use to constantly update their products and keep them relevant; and why platforms are the ultimate technology-enabled business model.

First principles

- The limitations of reasoning by analogy
- What reducing an industry to its core truths reveals of the process of developing innovative solutions — through outstanding examples
- How fashion and design principles can drastically improve product quality — through a case study in medical devices and prosthetics.

Design thinking

- Approaching business problems using designers' frameworks and tools, in a three-step process
- Methods and tools that technology startups employ to test concepts and learn needs
- Case studies in major corporations' major cost reductions and service improvements through design thinking.

Lean startup

- A methodology for learning as fast as possible what does not work
- How to turn anyone into an entrepreneur regardless of age, position, or industry

- The importance of metrics; examples of their successful application; and a new framework for tracking progress
- The importance of the continual cycle of building, measuring, and learning.

Platforms

- Why the fastest-growing companies own no assets, and how that is the key to their exponential growth
- What platform owners gain by giving away control; and how Apple, Facebook, and Alibaba have employed this effect to overturn industry after industry
- The power of "network effects", and how they account for the continuing success and dominance of platform companies.

Society, Law, and Ethics

As accelerating technology change overturns entire industries, it raises some very serious questions about our legal and ethical systems. Technological advances will undermine all technologies and all legal systems, on many different fronts, simultaneously. Executives need to understand what's coming and to assess the risks and issues they will have to grapple with in the near future.

Change that would otherwise take centuries and generations now occurs in a matter of years or months under the influence of new technologies. But where there is disruption there is opportunity. In this lecture, we will proceed, technology by technology, to understand how we will need to approach these new systems, applications, and business models in order to maximize their advantages but limit their destructive potential.

Transitioning to an abundant future

- Why everyone in the West can enjoy a standard of living that even in recent history was accessible only to kings and popes
- Understanding, preparing for, and preventing the serious health, environmental, and sociological harms that can arise from new technologies
- Why and how enormous social progress will continue to be made over the next decade
- How we move from a mindset of scarcity to one of abundance; and the problems that doing so brings.

The differences between laws and ethics

- Technology's prompting of law reform — steel and property; railroad and eminent domain; printing press and copyright — and what makes this time different
- Why we will have to rapidly reach consensus on issues that we used to have decades or centuries to sort out
- The differences between laws and ethics, and how one follows the other.

- The new institutions, frameworks, and systems we will need in order to cope with change
- How models' inability to predict change delays regulatory guidance on new technology
- The unavoidable truths of technology's concentration of wealth and control.

Ethics principles and scenarios:

- Where and how autonomous cars and robotics can be successfully integrated into society
- The requirements of effective government versus the ability of entrepreneurs to overturn existing systems
- How companies can defend intellectual property despite digitization of physical objects
- The ethical dimensions of creating general A.I.; and the safeguards advisable
- How societies, governments, and companies can deal with rapid job elimination
- Conditions we should impose on use of a technology such as gene editing via CRISPR, and how it will affect our humanity
- How humanity can transition to a jobless future, and what that looks like for individuals.

Assessing disruption readiness

Participants will be asked to select a business area and discuss which technologies and threats might pose a disruptive challenge. Teams will then discuss how prepared that industry sector is for the changes ahead and where the greatest disruptions might occur.

Creating trillion-dollar industries

Assuming the role of nascent entrepreneurs, participants will be asked to develop ideas for products, platforms, or services that will transform their country and create enormous value. Imagining themselves as fresh entrants into their industry, they will be asked to look past constraints and legacy considerations to locate opportunities. They will assess what government can do to remove barriers and what private industry can do to encourage development.

Incentive prize design

Participants will be asked to consider the implications of convergence for their industry or business. They will identify the technologies and business models that would create disruption or opportunity for their business. Then they will be asked to develop an incentive prize to address their most pressing needs.

Startup creation

Participants will be asked to take the role of nascent entrepreneurs. They will be asked to think and act like the Silicon Valley entrepreneurs who are gunning for Goliath by developing an idea for a minimum viable product intended to disrupt a specific line of business that the company is engaged in.

Scenarios

The exponential pace of change is going to cause upheaval in all our institutions and systems. Participants will be asked to analyse three near-future scenarios arising from new technologies; to evaluate their ethical and legal ramifications; and to develop means of addressing them.

Harnessing A.I.

Participants will learn how to train, develop, and deploy A.I. modules; the basics of how A.I. systems operate and can be used in business cases; and such systems' benefits and drawbacks in specific business contexts.

Design thinking

Participants will learn how to apply the principles of design thinking to business situations. Beginning with problem context, they will adopt frameworks for collecting information about their users' greatest problems and develop prototypes.

Rethinking security

We face daunting challenges in securing the devices we use — but there is a whole new breed of innovations that can help us protect our information. Participants will consider drastically differing approaches to digital security, ranging from deploying new technologies to engaging with the cultural difficulties of security research.

Company demolition

The companies that will overturn today's corporate giants are being created every day across the world. Participants will pick a business or industry, analyze its business model and products, and create scenarios within which new technologies and startups would disrupt it.

Designing platforms

As the most scalable business model, platforms are one of Silicon Valley's most powerful secrets. Participants will learn to build and analyze platform ecosystems by identifying their producers and consumers, their core interactions, and how and to whom they provide value — and then will turn a concept into a scalable business model.

WORKSHOP TIMETABLE

Day 1

 9:00 a.m. – 11:00 a.m. – Exponential Technology 101

 11:00 a.m. – 11:30 a.m. – Refreshment break/Q+A

 11:30 a.m. – 12:30 p.m. – Working group

 12:30 p.m. – 1:30 p.m. – Networking lunch

 1:30 p.m. – 2:15 p.m. – Exponential Vulnerability

 2:15 p.m. – 2:45 p.m. – Refreshment break/Q+A

 2:45 p.m. – 4:45 p.m. – Convergence, disruption, and opportunity

 4:45 p.m. – 5:00 p.m. – Key takeaways

Day 2

 9:00 a.m. – 11:00 a.m. – How to innovate in the exponential era – pt 1

 11:00 a.m. – 11:30 a.m. – Refreshment break/Q+A

 11:30 a.m. – 12:00 noon – How to innovate in the exponential era – pt 2

 12:00 noon – 12:45 p.m. – Working group

 12:45 p.m. – 1:45 p.m. – Networking lunch

 1:45 p.m. – 2:30 p.m. – Working group

 2:30 p.m. – 2:45 p.m. – Refreshment break

 2:45 p.m. – 3:45 p.m. – Society, law, and ethics

 3:45 p.m. – 4:30 p.m. – Working group

 4:30 p.m. – 5:00 p.m. – Key takeaways/Q+A

ABOUT VIVEK WADHWA

Vivek Wadhwa is an academic, entrepreneur, and author of five best-selling books: *From Incremental to Exponential*; *Your Happiness Was Hacked*; *The Driver in the Driverless Car*; *Innovating Women*; and *The Immigrant Exodus*.

He has been a globally syndicated columnist for *The Washington Post* and held appointments at Carnegie Mellon University, Duke University, Stanford Law School, UC Berkeley, Emory University, and Singularity University.

Vivek is based in Silicon Valley and researches, speaks, and writes about advancing technologies that are transforming our world. These advances – in fields such as robotics, artificial intelligence, computing, synthetic biology, 3D printing, medicine, and nanomaterials – are making it possible for small teams to do what was once possible only for governments and large corporations to do: solve the grand challenges in education, water, food, shelter, health, and security.

In 2012, the U.S. Government awarded Wadhwa distinguished recognition as an "Outstanding American by Choice" for his "commitment to this country and to the common civic values that unite us as Americans."

He was also named one of the world's "Top 100 Global Thinkers" by *Foreign Policy* magazine in that year; in June 2013, he was on *TIME* magazine's list of "Tech 40", one of forty of the most influential minds in tech; and in September 2015, he was second on a list of "ten men worth emulating" in *The Financial Times*. In 2018, he was awarded Silicon Valley Forum's Visionary Award, a list of luminaries "who have made Silicon Valley synonymous with creativity and life-changing advancements in technology."

ABOUT TARUN WADHWA

Tarun Wadhwa is an entrepreneur, strategist, lecturer, and writer who is working at the intersection of technological advancement, innovation, security, and public policy.

He writes for *Forbes*, and his work has appeared in *Fortune*, *CNN Business*, *Foreign Policy*, *The Economist*, *The Wall Street Journal*, *MarketWatch*, *Digital-Life-Design*, *Venture Beat*, *The Huffington Post*, and many other publications. He was previously a Nonresident Fellow at Atlantic Council's GeoTech Center, a Visiting Fellow at Emory University's Department of Political Science, and a Visiting Instructor at Carnegie Mellon University's College of Engineering in Silicon Valley, where he co-taught the popular Exponential Innovation course. He is also the author of a forthcoming book, *Identified: The Digital Transformation of Who We Are*.

Tarun was also previously co-founder and C.O.O. of AIC Chile, a private innovation lab that creates technologies aiming to alleviate poverty (acquired in 2016). He worked to commercialize the breakthrough Plasma Water Sanitation System (PWSS), a sanitation technology that is currently providing clean water to at-risk communities throughout Latin America.

One of Tarun's most exciting ventures is Day One Insights, a global technology-advisory firm he founded to address convergence, corporate reinvention, and social impact. This work focuses on trends that are overturning established industries; developments in cyber-security, privacy, and surveillance; and the impact of technological advancements on legal systems and societal institutions. He is also co-founder & Chief Strategy Officer of Rsq Labs, a consultancy focusing on cryptography, machine learning, and emerging financial ecosystems. All of this cutting-edge research has provided opportunities to partner with several of the world's best-known companies and to influence leadership decision-making that is transforming those organizations.