

INFOSYS INSIGHTS



TRENDS. PERSPECTIVES. IDEAS.

Volume 4, 2016

SERVICES IN THE TIME OF BEING DIGITAL

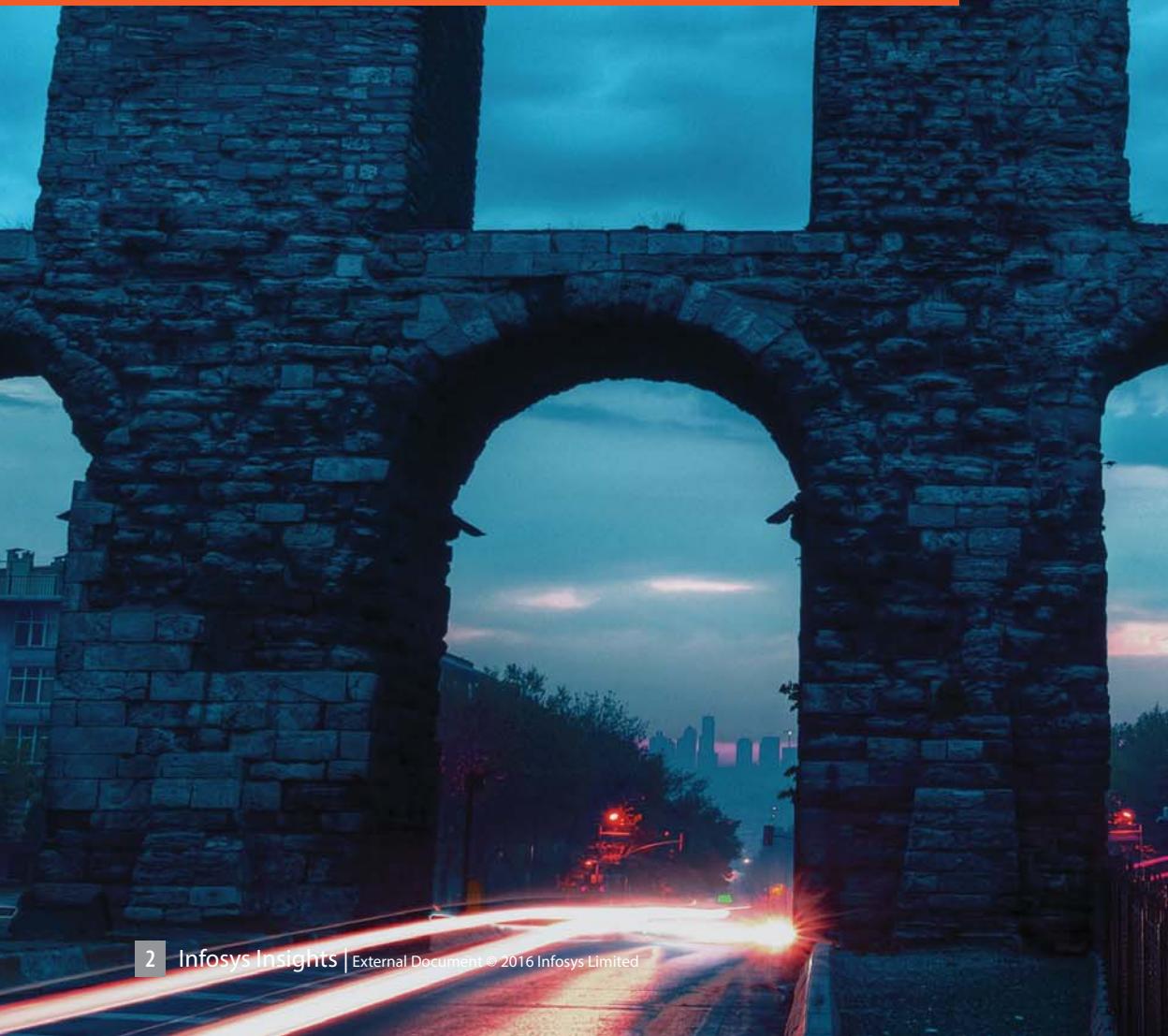
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with 3D Printing



Cover image: Roman engineering to this day stands as a testimonial to humankind's need for progress and desire for simplification. The Roman aqueducts weren't just structures that automatically channeled water into Rome; they were one of the first physical establishments of humanity's prowess in using technology as a means to making life easier. And much like how Roman engineering did, services in the times of being digital are set to forever change how people use their time, how they realize their potential, and how they achieve their dreams.



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THE TIMES THEY ARE A-CHANGIN'

Pravin Rao
*Chief Operating Officer,
Infosys*

The era of services, marked by differentiating experiences, is already upon us, and the pace of change is not letting the smartest among us sleep. Recently, the young founder of AirBnB, the start-up that shook the hospitality industry, announced that this company worth US\$30 billion will soon transform itself to become a platform that will also sell offbeat excursions, and different kinds of experiences. A magazine quoted him as saying: "If we don't grow past what we originally invented, what led to your success leads to your death." This example, in many ways, captures the spirit of our times. Incessant innovation is becoming indispensable to succeed, spurred on by rapid technological advancements and deep-rooted connectedness – both among individuals and different industries. The reference in the title to the anthem of change is not only a tribute to the Nobel prize-winning musician Bob Dylan, but also a shout-out to our times.

As an experienced global technology services company, we have a vantage point from where to keenly understand these massive changes and make them work for organizations. In this issue of Infosys Insights titled 'Services in the Time of Being Digital', we bring you glimpses of servicification of some key products and technologies and the new paradigm in which these will thrive, as well as their collective potential to truly transform our lives in the near future.

On the cover, we present an enterprise roadmap to successfully chart this digital journey, elucidated by President and Chief Delivery Officer of Infosys Ravi Kumar S. In the 'Ideas and Beyond' section, senior Infosys leaders interview two industry experts – Peter Sany, CEO of TM Forum, and Michael Haag, Senior Vice President at KUKA – to discuss the kind of amazing opportunities that are opening up for the telecom industry and robotics, respectively. In the third article, a senior Infosys business leader explains why artificial intelligence (AI) will soon define our everyday experiences, citing three industries where AI is making headway. You'll find a couple more AI-focused discussions in the final sections of the journal. In the next article, Scott Sorokin, Head of Digital at Infosys, refers to the phenomenal success of Pokemon Go to explain how brands can benefit from gamification.

In the 'Tech Talk' section, we bring you insightful perspectives on some emerging technologies. Senior experts from GE enlighten us on the

'Digital Twin', the living models of physical assets, systems, or processes, which embody asset memories and group consciousness, and can transform the operations and management of industrial systems. In the next article, a senior Infosys consultant explains how the revolutionary blockchain can be standardized for application across industries. And if you think augmented reality and virtual reality, mesmerizing as they are, will flourish only in gaming and movies, then get ready to have your perception shattered in the next article by Vishwa Ranjan, Head of AR / VR at Infosys. These two technologies, slowly but surely, are becoming an everyday reality. The next article, by a senior business consultant of Infosys, details the recent AI-driven developments in financial services, which could also address many issues challenging the industry.

In the 'Renew-New' section, we bring you articles focused on renewal of a few key industry trends that will help us embrace the new. Learn how 3D printing is making a comeback, or getting ready to live up to its true potential today, in the article by N. Vijay, Head of Manufacturing (Americas) at Infosys. In these interesting times, it is imperative to reinvent oneself professionally – Holly Benson, senior leader at Infosys Consulting, drives home this point while referring to the WEF list of the top skills of 2020. I would definitely keep this article handy. Next, Pankaj Kulkarni, Global Head of Insurance at Infosys, elaborates the whys and hows of digital transformation in the Insurance industry. And the final one in this section, draws the big picture of a changing investment landscape. Alex Gorelik, Founder and CEO of Waterline Data, member of the Infosys global partner ecosystem, further explains why collaborations between large and small enterprises are mutually beneficial.

In the final section, 'Research Unraveled', Principal Analyst and founder of Constellation Research, Ray Wang, lists out exclusively for Infosys Insights, the seven essentials for an organization to succeed with AI in digital initiatives.

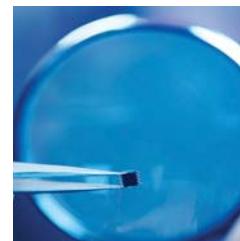
With such a line-up, I hope you will find this issue thoroughly enriching and relevant, irrespective of the industry you work in, or the expertise you have built over the years. For the times they are a-changin'.

Pravin Rao

Chief Operating Officer, Infosys

SERVICES IN THE TIME OF BEING DIGITAL

What will it take to succeed in a services economy? What is the role of a services company in helping organizations navigate the digital revolution and the paradigm shift toward services? This article answers these and more.



The digital revolution is sweeping across industries. While traditional focus areas such as customer experience, supply chain, and knowledge management are undergoing rapid transformation; new entrants are disrupting traditional business models by leveraging technology in unexampled ways, enabling them to manufacture cars and watches and invent new kinds of transportation, hospitality, banking, and more. The rules of the game are becoming dynamic with economic value being created through enhanced and unprecedented services that are based on the tenets of sharing and subscription, rather than of ownership. This shift towards a services economy calls for a mindset that understands multichannel relationships, customer behavior, and the value of scalable technology platforms, often the pivots for most of the new business models.

All things around us — products, solutions, and even technologies themselves — are becoming services. For instance, the autonomous car of the future will serve as your personal concierge and emergency assistant, as well as provide rich data to your car manufacturer and your auto insurer, who in turn will provide more personalized and improved services.

Traditionally, we tend to think of many products,

solutions, and technologies as static, frozen in time and space. But these are constantly activated, thanks to the Internet of Things (IoT) and a host of developments such as rapidly shrinking hardware sizes and an exponential rise in computing power. Things that we previously thought of as products — software packages, airplane engines, printers, and so many other complex machines — are now becoming available as services.

Experiences will differentiate services

An important catalyst that is spurring this change of increasing 'servicification' are the millennials. They believe in spending on experiences, not on owning things — experiences driven by hyper-personalization, intuitiveness, and purpose. So, while they are happy to use public transport, they are satisfied with nothing short of a seamless experience while on route, of say ordering dinner — in terms of the restaurant and cuisine options, the speed of the app and quality of its content, and even how impeccably the food is prepared and delivered on time when they reach home. The question is: Who can take the responsibility of ensuring a great experience for this consumer? Here lies a grand opportunity

Today's products, solutions, and technologies are no longer static, frozen in time and space, thanks to the Internet of Things (IoT) and a host of developments such as rapidly shrinking hardware sizes and an exponential rise in computing power. A modern day microchip as big as a fingernail, packs as much processing power as a room-sized computing machine in the past.

for a company with a strong digital backbone to bring together other players, as collaborators, and serve up a superlative experience to millennial sensibilities.

As enterprises ponder their future in these times of being digital, there is a dual burden on them — one of managing costs and the other of innovating. We believe there is a way to navigate this duality successfully. Design Thinking, with its tenets of desirability, feasibility, and viability, offers a useful approach. If you think about it, all the transformation happening around us is about empowering the end user. Whether you consider Uber, Airbnb, or any other digital experiences and services powering our lives, it's all about being more relevant and desirable to the end user. Today, there is also an extreme scale of cost performance that has become available in the computing infrastructure with the emergence of increasingly intelligent and automated systems that can execute more and more sophisticated tasks. So, technically, it is feasible to realize all that we can imagine. From an economic viability perspective, the distance between producers and consumers has disappeared with digital disintermediation. The middle layers and all their complexities have dissolved. This can drive down costs significantly as well as enhance experiences.

With this as the context, it is clear that the opportunity presented by the physical world turning into bits is a truly exciting one. This has deep implications for enterprises: One, to meaningfully and exponentially optimize and improve the way they work, and thereby be able to fund the second priority — to disrupt, become more relevant, and grow by bringing in new consumer experiences through the creation of digital experiences where there were otherwise only the physical, and work to digitize physical things so that they can pack in greater value as services.

Role of services companies in this digitization-led services journey

Today, given the staggering digital transformation of our world, the traditional services industry in which companies like ours compete to do the same work cheaper but with world-class quality, must also transform. A services company must be more, and we as individuals and as a team, must also be more — to deliver value and innovation.

Arthur Koestler in his 1964 book 'The Act of Creation' said, "The essence of creativity lies in two self-consistent but habitually incompatible frames of reference – the incremental improvement plane, and the paradigm shift plane."

The digital transformation of companies, which calls for creativity (imagination), expresses itself across these two dimensions. The first is the renewal of existing landscapes (incremental improvement plane) through transformation of legacy mainframe systems, cloud and mobile enablement, integration of sensors, simplification of the landscape to modern infrastructure, renewal of processes and operations, and the like. The other priority is to build new (the paradigm shift plane) kinds of applications and systems and explore new business models that are necessary for the times we live and work in. IT services companies must especially help businesses simultaneously pursue this duality of renew and new.

The third and pivotal aspect of this Renew-New approach is a culture of learning, creativity, and purpose. The magnitude of the change impacting us is so enormous that our minds cannot entirely comprehend them. So, a foundation of lifelong learning, which involves unlearning many ways in which we did things in the past, becomes supremely important. In fact, lifelong learning will determine if you are being disrupted or if you are weathering disruption. Such learning requires us to unfetter the uniquely human qualities of imagination and curiosity, which no machine, no matter how advanced, can substitute. As technologies enable automation and take over menial, repetitive tasks in order to deliver them with enhanced efficiency and speed, people are freed to accomplish higher value and more purposeful work — whether it is to achieve an organization's business goals or collaborate with others to solve the bigger problems facing humanity, such as hunger, disease, or inequitable access to power and education.

At Infosys, we have embarked on this journey of Renew-New. In the words of our CEO, Dr. Vishal Sikka, "A company of our size and scale could easily set up a lab somewhere in some exotic place in the world where there are innovators. But the main point of being innovative — of becoming a company that helps businesses evolve in this time of tremendous digital disruption — is not to have a small lab

One strategy for all

**RENEW THE
CORE BUSINESS**

**INNOVATE INTO
NEW BUSINESS**

**A CULTURE OF LEARNING,
ENTREPRENEURSHIP,
AND PURPOSE**

**Our business | Our industry
Every business | Every industry**

somewhere and say that our innovators are there, but to have everyone in the company be an innovator; and that is what we are after."

We want to deliver services that equip our clients to take advantage of the best opportunities of our times, especially in areas such as automation and artificial intelligence. Whether it is capturing the know-how of retiring engineers in knowledge-based AI systems to facilitate smart

maintenance through generations of making, building sensor-enabled connected automobiles that 'care' about driving safety, renewing legacy landscapes with knowledge-based automation, or enabling predictive maintenance of mission-critical equipment, we want to be able to create a new future. A future where businesses can harness intelligent and open platforms, software, and services to innovate and realize the true potential of digital transformations.

About the Author



Ravi Kumar S.

President and Chief Delivery Officer, Infosys

Ravi leads the Infosys global delivery organization across all global industry segments, driving digital transformation services, application development and maintenance, independent validation services, engineering services, emerging technology solutions, business intelligence and analytics, cloud and infrastructure, and enterprise package applications service lines. In addition, he oversees Infosys Business Process Outsourcing (BPO) and is on the board of Infosys BPO Ltd. He also oversees Infosys operations in Japan. He is the Chairman of the Board of Infosys China and is also on the board of Infosys Public Services, Infosys Consulting Holding AG, Panaya (an Infosys company), and McCamish Systems (an Infosys company).

Ravi has over 18 years of experience in the consulting space, incubating new practice lines, driving large transformational programs, and evangelizing new business models across industry segments. He is an Honorary Founding Board Member of the Technology Advisory Board at MIT Forum (launched in 2012); Advisory Board of the Global Supply Chain Center at Marshall Business School, University of Southern California; Oracle's Enterprise Project Portfolio Management (EPPM) Board; and many other industry forums.

Ravi has a master's degree in business administration from Xavier Institute of Management, Bhubaneswar, India.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

IDEAS AND BEYOND

WITH TODAY'S TECHNOLOGY,
WE NO LONGER PREDICT
THE FUTURE BUT CREATE IT. WHAT
WAS THE STUFF OF FICTION AND
MOVIES, TILL NOT THAT LONG
AGO, IS TODAY THE WORLD WE
LIVE IN – A WORLD THAT IS ALSO
ON THE CUSP OF A GREAT HUMAN
REVOLUTION.

HERE'S HOW INDUSTRY
THINKERS ENVISION ARTIFICIAL
INTELLIGENCE, ROBOTIC
AUTOMATION, AND GAMIFICATION
REDEFINING THE FUTURE OF
HUMANITY AND USHERING IN
A NEW ERA OF EXPERIENCES.





A TELECOM DNA WITH A DIGITAL PERSONALITY

Digital services may make or mar the prospects of telecom companies. With the industry at crossroads, we bring you a conversation between **Peter Sany**, President and Chief Executive Officer (CEO), TM Forum, and **Avi Kulshrestha**, Industry Head – Communications, Media & Entertainment, Europe, and Global Head, Telecoms OEM, Infosys. This discussion elaborates on how telcos can reinvent their offerings to morph into digital enterprises.



Q Avi Kulshrestha

A Peter Sany

Q: Welcome Peter. Telecommunication companies have witnessed trying times in the last fifteen years, yet they have managed to survive. They have transitioned from analogue to digital in fixed telephony, adopted mobile technology, and allowed people to connect their computers to the copper wire network, enabling them to exchange data with one another. On every occasion, telecom operators have risen to the challenge and successfully connected millions of people, adding them to their client lists. Now, however, the biggest disruption of all times, the digital disruption, is forcing a shift in the telecom operator's value

chain. This is not like anything we have seen before in this sector. With your vantage point as the President and CEO of TM Forum, what do you think the future holds for the telecom industry?

A: Our industry is a continuous work-in-progress. Every shift in technology makes living and working more inclusive. For instance, we have experienced several revolutions in our lifetime — from fixed line to wireline to wireless. Now, we are seeing boundaries blurring between the physical and the virtual worlds.

The emergence of completely new digital native enterprises will rattle the right of existence of many traditional players. The winners will be those CSPs who can successfully morph from being vertically oriented players to becoming horizontal players, providing a value-added digital backbone of high-security, low latency network, and ecosystem-topical platforms to enable a rich applications bouquet at every customer touchpoint.

If we step back in time, the end of telecom monopolies paved the way for healthy competition. The Internet provided a level playing field for companies, which helped spur the proliferation of Internet telephony. Now, we can brace ourselves for the next big leap, with technology companies such as Microsoft, Google, and others investing in fiber optic networks. It is a fascinating game between incumbents and disruptors. The horizon brims with fascinating possibilities because we have a robust infrastructure that needs to be monetized.

While the future looks promising, we need to be cautious about the sustainability of certain stakeholders. The communications industry has witnessed capex investments on an unprecedented scale in every successive generation of network technology. However, the changing, competitive landscape between traditional players, new entrants, and asymmetrical regulations increases the risk of not receiving fair returns on investments. As we speak, the European Commission is setting the framework for a unified digital market, allowing free Wi-Fi access and unlimited roaming across the European Union.

We now live in an era of digitalization of everything. Barriers between traditional industry verticals are breaking down and a set of globally and locally interconnected ecosystems are emerging, ranging from 'smart cities' to completely overhauled global manufacturing and supply chain models based on 3D printing or telemedicine, to name a few. We will soon see the emergence of completely new digital native enterprises that will rattle the right of existence of many traditional players. This transformation brings great opportunities for those communication service providers (CSPs) who successfully morph from being vertically oriented players to 'L-shaped' digital service providers (DSP). An 'L-shaped' enterprise will offer its own vertical products and also become a horizontal player, providing a value-added digital backbone of high-security, low-latency network, and ecosystem-topical platforms

High-quality, real-time video streaming coupled with augmented reality (AR) may just be a game changer.

that enable a rich bouquet of applications at every customer touchpoint.

On the 'vertical' side, video and augmented reality hold a lot of promise. These applications may well become ubiquitous for personal, interpersonal, and business purposes. High-quality, real-time video-streaming coupled with augmented reality (AR) may just be a game changer. If we look into a crystal ball, we can see this video and AR medley raising the bar in healthcare via telemedicine, for timely and accurate medical intervention. Also, the interplay between video and AR applications not only lends a new dimension to the field of entertainment and gaming, but also to industrial production and service management.

So let me summarize what lies ahead — I believe that the disrupters challenging the incumbents will ensure that the industry remains in the best of health and renews itself. All said and done, enterprises embracing a digital ecosystem will thrive with a compelling lifetime proposition. No one is

better placed than the telecommunications / communications service provider (CSP) industry to become the major provider of the digital backbone for any industry and some of the emerging ecosystem-specific platforms.

Q: Very true! In India, Reliance Jio is investing over US\$20 billion to create a digital marketplace. The start-up offers data tariffs as low as US\$0.7-per-gigabyte and has an ambitious target of reaching 100 million customers within four months of commercial launch! All of this makes a robust digital backbone, a business imperative. The operators are looking to create new revenue streams and differentiated experiences for their customers. They like to offer more than just connectivity, and would be targeting lifestyle-based experiences, aspirations, and needs of the customers, especially with the advent of the API and platforms economy. In this context, how would a telco differentiate itself from its peers, in order to engage and retain customers?

A: Your examples show the significantly different production cost point that is

becoming the entry ticket to play in the new digital world. Our industry needs to make massive improvements in terms of costs, flexibility, speed, and agility in order to remain viable. An open, standards-based, and highly granular architecture will provide the basis for quickly and infinitely reconfigurable digital services, products, and businesses.

Let me dwell on the granularity in our industry, which started with legacy carriers who developed their own technologies, software, billing systems, and customer platforms. In the next phase, these companies implemented more modular, best-of-breed application stacks. Mobility services now demand even greater granularity to deliver on-demand, orchestrated applications, which can be delivered more efficiently using APIs for accelerated development and rollout. DevOps plays an important role in improving the time-to-market or new applications and digital services.

Yet another area that demands attention is open architecture. Enterprises need to collaborate with enabling partners in order to break down monolithic blocks into smaller modules. Service-oriented architecture (SOA) allows you to co-create and accelerate application development with partners and even ‘frenemies’ within the ecosystem. All of this is the need of the hour to deliver a seamless, connected user experience. You need to be at the heart of the customer journey and influence the end-to-end customer experience decisively.

Let me illustrate this with an example. When I order dinner to be delivered home from my smartphone, as I drive back from work or travel by train, I expect more than just a clear and uninterrupted call from ‘origination’ to ‘termination’ from my service provider.

Remember, I could be zipping in my car on a motorway or entering a tunnel on the metro rail while I make the call, so the reception and coverage may be average, at best.

However, I expect my service provider to transcend the ‘hygiene’ factor of 99.99 percent completed calls. Can I go a step further and pull up another app on my phone and select a cuisine, then drill down and order a couple of dishes, and then pair the cuisine with a bottle of wine? Can I make an informed choice from a range of dining options by distilling

reviews from social media? Can I estimate the time taken for dinner to be served at my table from the live traffic updates on my cell phone? From my point of view, as the consumer, I don’t care who is providing and integrating all of these services. I care that my experience is simple and seamlessly end-to-end, and that my dinner arrives home when I do, still hot and ready to eat.

If you think I am setting the bar too high for service providers, you need to at least meet, if not exceed, the expectations of the millennial demographic. If enterprises need to serve the critical mass of the digital generation, they need to have the building blocks in place to integrate services for delivering a compelling customer experience.

Q: *The Internet of Everything is already making an impact on our lives. I became a father a couple of months ago. My newborn son arrived at our home, which has about 20 connected devices for just three co-inhabitants. By 2020, the world's population is estimated to be 7.5 billion, whereas there will be an estimated 50 billion devices connected to and communicating with each other. Our everyday patterns of behavior have already changed — from how we buy things and consume them, to how we interact with each other via social networks and how we interact with machines. What kind of experience can customers look forward to in this hyper-connected environment?*

A: Congratulations, Avi. Your son is the newest member of a rapidly growing digital club. He belongs to a generation that will navigate the journey of life from a smartphone. In Estonia, for instance, every newborn enjoys free broadband as a birth right. ‘Digital’ is a way of life, with the state providing 600 e-services to citizens and 2,400 services to businesses.

While I closely follow the animated conversation about a hyper-connected environment, I believe the industry and its lead players need to focus on ‘open’ standards and interoperability to deliver a seamless customer experience. Conventional wisdom suggests that we are moving from a ‘talking heads’ paradigm to an ‘interacting devices’ one. So, billions of devices will be connected and will interface with each other, but the ecosystem of devices and users is more nuanced and provides a reality check for stakeholders.

Let me take a step back from this discussion about connected devices. Do I really want my smart watch to connect with my refrigerator to replenish groceries? I'm afraid not. We need to see the intrinsic value of connectivity and extrapolate the value for users. Global supply chains, automated production, and power grids can capitalize on 'interconnectedness.' Let me add a caveat: We are talking about critical applications that need to be supported by secure and reliable connectivity. Thus, as a service provider, I need to ensure near-100-percent availability for users to manage and control their domain.

Q: *Brilliant! What's the payback for industry players? Will OTT service providers cannibalize revenues further? Or will it be an opportunity to explore new revenue streams and innovative business models for incumbents?*

A: Let me elevate this conversation by several notches. If our industry stakeholders provide a smart, integrated customer experience, one or a couple of these companies may well rule the world. Imagine a scenario where a digital service provider has a robust digital backbone, enriched with a bouquet of services and visibility into customer insights, to cross-promote and monetize services in near-real-time. So, if every conceivable service

that I require is available at one megastore on my cell phone, I would turn to my service provider to enjoy an omnichannel experience.

For enterprise users, digital service providers can support mission-critical applications such as surveillance of deep sea oil and gas field assets or enabling robotic surgery via best-in-class, always-on, secure video capabilities. Such a bespoke service can be eminently monetized if the service provider is acutely cognizant of the latency and security of the network.

We are looking at different horses for different courses. Some players may leverage telemedicine in niche areas of healthcare. In the Netherlands, one company uses AR to help cardiac patients or their attendants locate automated external defibrillators all over town. Other players can focus on platforms for smart cities. Governance can be smooth only when digital becomes a part of the social fabric. Did you know that Jun, a town in Spain, has zero bureaucracy? The residents of Jun use Twitter for almost everything — from booking a doctor's appointment to reporting petty crimes.

The future is waiting to be seized by a new breed of digital service providers. If you



Today's children are part of a rapidly growing digital club — a generation that will navigate the journey of life from a smartphone.

allow me to indulge in some more crystal ball-gazing, I predict that leaders will emerge from traditional telecom companies that have made the transition to communication services providers and then morphed into digital service providers. Having said that,

I do not rule out a rank outsider disrupting the pecking order!

Avi Kulshrestha: *Thank you Peter. We live in interesting times!*

About the Participants



Peter Sany

President and Chief Executive Officer, TM Forum

Peter orchestrates the day-to day operations of TM Forum. He is a respected industry thought leader and a senior international business executive and entrepreneur with a unique wealth of experience. For 14 years, he has successfully performed across the sales, marketing, and general management functions of a large multinational ICT company. He also has 12 years of experience as a business-oriented CIO and as a member of executive boards in large multinational companies in the pharmaceutical, telecommunications, and finance industries. Among his numerous career accomplishments, Peter was named the CIO / IT Executive of the Year by Computerwoche, an IDG publication. Peter also founded, successfully ran, and then sold itcps Management Consulting AG, a provider of business and technology consultancy services for all industries. He is based in Switzerland, speaks several languages fluently, has conducted business globally in developed as well as emerging markets, and has lived in a few different countries. Additionally, Peter is a seasoned non-executive director on various boards.



Avi Kulshrestha

Industry Head – Communications, Media, & Entertainment, Europe, and Global Head, Telecoms OEM, Infosys

Avi heads Infosys business for Communications, Media, Entertainment, and OEMs for Infosys Europe. He is responsible for creating strategy and driving business growth through four sub-verticals for Europe. He is responsible for helping CSPs, media businesses, and OEMs 'renew' their existing business while adding 'new' capabilities and revenue streams. Avi has worked extensively in the European Telecommunications and IT industry for the last two decades. He also sits on the Communications Industry Council of Tele Management Forum (TM Forum). The Advisory Council is appointed by the board of TM Forum to shape and drive the Forum's strategic work programs for the global communications industry.

Avi lives in London with his wife, Nikoleta, and son, George.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

AMPLIFYING HUMAN POTENTIAL WITH ROBOTIC AUTOMATION

Industry 4.0 is the holy grail of manufacturing. As we brace ourselves for an impending revolution, **Nampuraja Enose**, Principal Consultant – Industry 4.0, at Infosys, reached out to **Michael Haag**, Senior Vice President, Research and Development, KUKA Roboter GmbH, for insights into the future of manufacturing, the paradigm of digital services, and the role of robotics automation in bringing about the next industrial revolution.



Q Nampuraja Enose

A Michael Haag

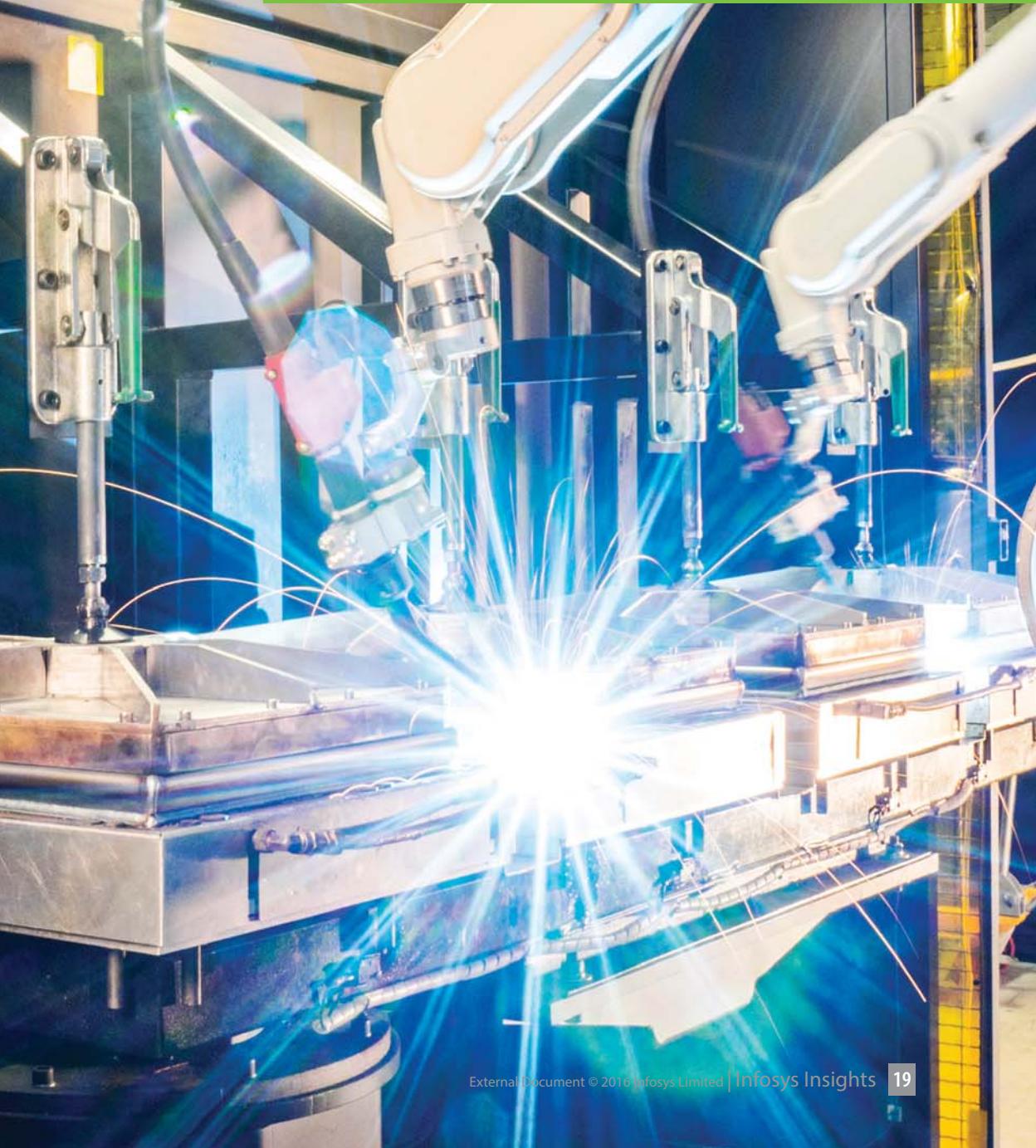
Q: Welcome, Michael. Let me begin by shining a light on how business-to-consumer (B2C) industries such as media, retail, and financial services have been transformed by digital technologies in the last decade. How do you see core engineering industries being influenced by digital technologies, more so in the context of Industry 4.0, over the next 10 years?

A: Very true. Let me first set the B2B context in the light of the B2C landscape. We have seen disruption in the areas of music, movies, and books by digital transformations. Let me, for a moment, shift your attention to the music industry. It has been turned on its

head — across recording, storing, sharing, and commercialization — music is a stellar example of innovation via digital.

The manufacturing industry, on the other hand, operates in a parallel universe; except that the physical product itself cannot be completely digitized like music, but can be ‘enhanced.’ With a digital underpinning, manufacturing enterprises can streamline processes, ensure flexible operations, incorporate automation to deliver unmatched quality, and boost productivity on the edges of the supply chain.

The manufacturing industry operates in a parallel universe; the physical product itself cannot be completely digitized like music, but can be 'enhanced.'



Digital technology will therefore determine the trajectory of Industry 4.0 in a profound manner. A digital thrust will influence how machine intelligence and automation shape the assembly line. Only manufacturers with robust digital capabilities will be able to sustain their competitiveness and ensure that production is flexible as well as cost-effective.

If I have to contextualize this ecosystem, we see an interesting scenario where technologies unveil production paradigms in a milieu of digital services. Take, for instance, robots. Mobile and sensitive robots interact directly with humans to ensure smart and flexible production. This human-machine interaction and collaboration provides a stimulus for a nimble assembly line, which is an imperative in industries such as mobile phone manufacturing, where new phones have a shelf life of barely six months. Now, add a digital layer and it accelerates the journey towards lean and smart manufacturing.

Q: Michael, you therefore allude to OEMs having an important role to play in industrial digitalization. Do you also see a new business model emerging, characterized by a shift from 'product innovation' to 'service innovation'?

A: I foresee new business models emerging with the confluence of technology, smart production, and digital services. Let me explore this paradigm by charting the evolution of industrial robotics.

On the surface, a robot manufacturer provides systems to ensure modular, predictable, and sustainable manufacturing. However, fundamentally, a robotics major continues to be a key stakeholder in ensuring productivity of the factory floor.

Technically, a robotics enterprise can easily manage the production facility of an automotive company, end-to-end. But rather than selling a commoditized product, the robotics manufacturer can now adopt a business model where it is paid for each

automotive component and part of the vehicle that is produced.

You can go further and explore another model, wherein the robotics company is tasked with driving efficiency and productivity on the factory floor. In this business model, the automotive major continues to own the manufacturing side of the business. The robotics company, on the other hand, is a stakeholder with a mandate to enhance quality and boost productivity. It is an opportunity to alter the dynamics of manufacturing by incorporating automation and machine learning into the assembly line. This would essentially be similar to how cyber systems enable systematic innovation, from

products to services to outcomes.

Q: *It is a fascinating premise where OEMs gravitate towards selling uptime, availability, and performance! In this context, what is the role of technology, and more specifically, what is the role of software platforms?*

A: True, platforms provide us with an opportunity to create ecosystems. Software platforms will better facilitate data capture,

aggregation, and exchange across an ecosystem. We can develop interfaces on the platform that allow stakeholders to join and enhance the platform's capabilities. However, let me temper my enthusiasm for platforms with a word of caution: You need a stable and scalable platform — Apple iTunes comes to mind — that is architected in a robust manner and is agile enough for partners to build on a strong foundation.

There are several dimensions to the enormous amounts of data collected through such platforms. You can use machine learning and artificial intelligence to solve very complex problems which you otherwise cannot model in an explicit way. In many cases today, 'production' is so complex that the relationships between all the variables require dimensions of statistics, so that they can learn from 'behavior' instead of explicitly 'modeling.'

You need a stable and scalable platform — Apple iTunes comes to mind — that is architected in a robust manner and is agile enough for partners to build on a strong foundation.

Q: *Indeed, software platforms are better placed to facilitate the capture, aggregation, and exchange of data. In a sense, this marks a shift towards open source. What are your thoughts on the adoption of open source?*

A: I believe that the adoption of open source is becoming more widespread because technology is evolving at a fast clip. If I invest in a technology today, it may become a hindrance for my enterprise in a matter of months because the technology might become obsolete. Therefore, even if I need to leverage a new technology, I should be able to incorporate it by making changes to the platform. This way, it spares the enterprise from having to make course corrections and saves it significant effort, as well as the cost of migrating to new systems and technologies.

Additionally, the efficacy of platforms lies in the fact that they provide open interfaces that can help develop complete ecosystems. There is not one company that can solve all of the industry's problems on its own. However, companies can rely on various partners, who can together address extreme complexity on the production floor, where there are several moving parts and inter-relationships today.

Q: *You touched upon a broad range of topics: Artificial intelligence, machine learning, robots interfacing with human beings, and more. Does it all open up a new paradigm where 'pure play' engineering enterprises will be able to deliver a new genre of products from a digital marketplace?*

A: Let me address your queries by making two points: Firstly, we need to adroitly manage the interface between the physical and digital spheres. In the digital universe, you have ample flexibility in the methodology of the software program and its outcome. The physical domain, however, is more complex. You need the right tools to manage a process. For instance, you need a welding gun to perform welding. Similarly, you require a host of tools and machines to accomplish diverse engineering tasks.

Therein lies the efficacy of the robot. It is a versatile machine that can perform multiple tasks. You only need to attach the right tool to the robot for it to undertake one task after another. The robot offers you the flexibility to serve as the interface between the physical and digital worlds.

Now, let me address the crux of your question: If the robot is expected to perform tasks that are beyond its capability, it needs to learn new skills. How about the ability to download these skills from a digital marketplace to enhance the functionalities of a robot?

A digital marketplace can address a broad spectrum of requirements. For example, clients can seek critical support in diagnostics and maintenance of industrial equipment. When systems malfunction, they can access an expert database that offers a solution to mitigate issues based on historical events.

Similarly, a digital marketplace can enhance availability when production is on a downward spiral. Clients can access an expert database to arrest downtime and resume production at the earliest. This service can also facilitate predictive maintenance and condition monitoring.

Q: *Interesting perspective. You are making a case for the software platform offering value-added services that go beyond the plain vanilla service that is the norm.*

A: Yes, there will be a distinct shift from engineering services to a knowledge-based engineering services model. Remember, a machine builder possesses a rich repository of knowledge about production. The domain knowledge can be exploited to optimize production and enhance process integrity, and all of it can be delivered as a digital offering in order to create customer value.

Q: *So, will product development become increasingly digital-centric? How do mechanical, electronics, and software engineering fit into this digital landscape?*

A: I believe that mechanical engineering will never lose its importance. Let me use the example of a robot to illustrate my point. A robot has an inherent capacity to operate without interruption, in a safe manner, while consuming minimal energy. It embraces a mechatronic philosophy, which blends mechanics, electronics, and software.

At the same time, product development cannot operate in silos. You need robust mechanics, electronics, and smart software working together. Significantly, you need engineers in these disciplines to collaborate for the development of a successful product.



Q: *In such a services revolution, what and when is the next inflection point?*

A: Looking at the industry from the inside out, I reckon that it is still evolving. It is a continuum of subtle as well as seismic shifts that are transforming the manufacturing landscape.

In the previous industrial revolutions, there have been key technologies that boosted productivity to the next level; technologies like steam power, electrical power, and the computer. In retrospect, it turned out that these technologies really caused the industrial revolutions.

In my view, as compared to the previous industrial revolutions, Industry 4.0 with cyber-physical production systems as the key technology is predicted *a priori*, which means that the potential use cases and the future archetypes are just evolving. This provides various opportunities for innovative companies and research institutes to actively shape the future.

Q: *How should clients and OEMs respond to this services revolution?*

A: Machine builders should capitalize on the opportunities that data provides them.

They should unlock the value of data and extract insights from machines embedded with sensors. Being data custodians, machine builders should also capture and digitize the knowledge of professionals across the enterprise. Clients, on the other hand, will become more digital-centric enterprises when they experience the productivity gains from this services journey.

Q: *We are also seeing robotic applications extending beyond the factory floor. How do you see the union between robots and humans evolving?*

A: A robotics company should realize that humans have a central role to play alongside robots, in manufacturing. When professionals work with robots, both partners bring in complementary skills and capabilities that amplify the potential of this human-robot dynamic. A human being brings creativity and problem-solving skills to the production environment, while a robot can achieve precision and automate tasks that are repetitive and unergonomic.

Q: *You discussed how robotics automation can deliver the promise of Industry 4.0. On the flip side, what are the gray areas and challenges in realizing this vision?*

A: I think the lack of uniform standards is a barrier to realizing the potential of Industry 4.0. Let me provide an example, in the context of the interface between cyber and physical systems. Multiple devices can interface with each other, only when communication protocols are aligned with each other at protocol as well as semantic levels. It is imperative for engineers to design devices so that they integrate with the ecosystem. The industry also needs to ensure that the standards evolve to global levels in terms of

application. Remember, the telecom industry touches billions of lives today because telephony protocols have been standardized globally, since the invention of the humble telephone.

Nampuraja Enose: *Michael, thank you for your time and insights.*

About the Participants



Michael Haag

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Michael Haag studied Computer Science at the Karlsruhe Institute of Technology (KIT) from 1990 to 1995. In September 1997, he received the Springer 'Best-Paper-Award' during the 21st German Conference on Artificial Intelligence. In 1998, he received his Dr.-Ing (Doctor of Engineering) in automated video sequence evaluation at the Institut für Algorithmen und Kognitive Systeme (Prof. Dr. H.H. Nagel). In 1999, he started his career as assistant to the chief technology officer (CTO) of IWKA Aktiengesellschaft, Karlsruhe. In 2004, he joined KUKA Roboter GmbH, Augsburg, and was responsible for innovation management, headed a team for robot applications in logistics, and managed Planning and Technology within R&D. He coordinated the development of the new robot control generation KR C4. Currently, he is Senior Vice President, R&D, at KUKA Roboter GmbH and Head of the Competence Centers. He also gives lectures in robotics at the University of Karlsruhe - Technology and Economics (University of Applied Sciences).



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Nampuraja has 15 years of research and industry experience. He currently manages the innovation opportunities focusing on the adoption of emerging technologies in the asset-intensive industries, which also involves co-creation engagements with the clients and academia. This includes the focused initiative on Industry 4.0, enabled by the convergence of IT and OT (operation technology) in cyber-physical systems, where Infosys has strategically partnered with FIR (Institute for Industrial Management) at the RWTH Aachen University in Germany. He is an active participant in conferences and forums, and focuses on efficient management of assets and their associated performance.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

UBIQUITOUS AND COGNITIVE AI WILL REDEFINE OUR EVERYDAY EXPERIENCES

Enterprises are using Artificial Intelligence (AI) to craft solutions that make smart decisions, amplify human creativity, complete high-precision operations, optimize costs, and much more. This article explores what AI is doing for the world, and how it will transform the future.



Is artificial intelligence (AI) finally ready for prime time? I don't see a day go by where I don't hear of AI and its profound impact — part beneficial and part detrimental — to humans. To be sure, AI isn't new — ask anyone who has flown an airplane if they haven't turned on the 'autopilot' function during long flights. As it exists today, AI detects patterns and guides enterprises in making optimal decisions for workers, management, and shareholders alike.

I like to think of AI as the result of a knowledge worker's relentless pursuit of

automating mundane tasks, exponentially improving productivity, and capturing and disseminating knowledge effectively, such that machines can amplify the worker's creativity and sustain competitiveness. Competition is key here. In the Knowledge Economy, we live in a global village where practically everyone can communicate and collaborate with each other. So in every industry, the use and sophistication of AI is what gives an enterprise a distinct advantage to amplify business services and products.

In the near future, AI will be available



In the near future, AI will be available everywhere — even if we're unaware of its existence while performing tasks on the floor of a retail outlet, or in the operating room of a hospital, such as this minimally invasive robot-assisted surgery with the da Vinci surgical system.

everywhere — even if we're unaware of its existence while performing tasks on the floor of a retail outlet, or in the operating room of a hospital. Predictive analytics, for example, is helping retailers make extremely targeted promotions and advertisements based on a customer's buying behavior. We've all heard of (and maybe used) products like Google Assistant or Siri that constantly learn more about our desires and expectations. Software is learning about human behavior and predicting what our next actions will be. To this end, computers ask for permission sometimes, before making the next move; other times, they don't.

Have you heard about a program called 'DeepText' coming out of Facebook's laboratories? It is a type of AI that can detect subtleties in human communication and actually display a level of common sense otherwise thought to be unachievable. For a social network, a platform like DeepText can anticipate what a consumer wants by analyzing their communications. It can perform tasks proactively rather than when told what to do, because it learns 'with near-human accuracy,' according to Facebook. We are now at a point where enterprises are writing algorithms so sophisticated, so advanced, that they can mimic human cognitive tasks.

An American company called Agilent Technologies has developed an electrocardiograph that can estimate the probability of a patient experiencing acute cardiac ischemia, using its ability to learn more about the condition after every diagnosis. Better still, this smart device is 'time-insensitive,' meaning it has the power to predict whether the patient could develop ACI down the road and not necessarily during the moment of the test. Also, with nearly one billion people being either diabetic or prone to diabetes, AI-powered mobile devices will monitor glucose levels in the blood, and should they be too high, recommend courses of action with virtual physicians.

Another medical breakthrough that is proof of such progress comes from ATL

Ultrasound Inc. in Seattle. The company has developed a range of diagnostic ultrasound systems for imaging and monitoring cardiac tissue structures and their activity. How? By leveraging a machine-learning algorithm that studies millions of parameters during an examination and eliminates frequencies that the doctor deems irrelevant. The patient's visit is thus far more efficient than it was before ultrasound systems could accumulate data and learn from each parameter.

Thanks to strides in the field of artificial intelligence, computers now accumulate data and learn from us. Indeed, the act of building upon each day's accumulated experiences is the key to success in the Knowledge

Economy, where growth is now dependent on the quantity, quality, and accessibility of available information. It is an economy in which artificial intelligence helps us leverage all that information in order to amplify whatever product or service an enterprise offers to consumers.

In the Knowledge Economy, growth is now dependent on the quantity, quality, and accessibility of available information.

A sixth sense like no other

AI is a tool that is becoming so useful and ubiquitous that it will soon become a kind of sixth sense. According to the creator of the 'SixthSense' technology — the scientist, Pranav Mistry — this latest incarnation of AI is a wearable, gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information.

"Although the miniaturization of computing devices allows us to carry computers in our pockets, keeping us continually connected to the digital world, there is no link between our digital devices and our interactions with the physical world," writes Professor Mistry, who works out of the Massachusetts Institute of Technology. He observes, "Information is confined traditionally on paper or digitally on a screen. SixthSense bridges this gap, bringing intangible, digital information out into the tangible world, and allowing us to interact with this information via natural hand gestures. SixthSense frees information from its



Machine learning is the method by which a computer is programmed to detect patterns, and as a result, is able to predict actions. It requires human guidance to help it learn the rules and the information that it is expected to know.

confines by seamlessly integrating it with reality, thus making the entire world your computer."

Unbolting robots from the factory floor

A significant change in how we view AI-enabled devices is evident in how they are now being 'unbolted' from the factory assembly line. Machines equipped with AI software can serve as roving healthcare companions for elderly people, delivering medications in their correct dosages, and reminding them about their daily schedules. As a sixth sense, AI can simplify business processes and amplify the best in the human spirit. From deterministic automation to cognitive machine learning and software code corrections, today's businesses can use AI to identify new experiences as well as new products or services.

A closer examination of the world of healthcare and transportation demonstrates just how profoundly AI is transforming the world around us. In both industries, AI is quickly evolving from 'machine learning' to 'deep learning.' Machine learning is the method by which a computer is programmed to detect patterns, and as a result, is able to predict actions. It requires human guidance to help it learn the rules and the information that it is expected to know. However, it is limited by a finite number of possibilities. Remember the computer that took on a chess champion around 20 years ago? Human programmers had the arduous task of programming every possible chess move and consequence into the computer. It couldn't learn chess on its own, and by all accounts, it took the programmers an unbelievable amount of time to prepare the computer.

From the factory floor to the operating room

Today, AI is becoming so smart that it even plays a role in decision-making. In the field of image interpretation, a doctor can receive scores of different medical images that can be simultaneously identified by a single AI-enabled scanner. What used to take hours and even days in front of expensive X-ray devices, can now be accomplished within minutes. Think about how useful a complete assessment of a patient can be if a doctor receives everything from angiograms to MRI scans. This is certainly a situation where technology is amplifying human potential.

Context-aware intelligence is ubiquitous and getting better with every passing day. A study, cited by Morgan Stanley, reports that 47 percent of jobs in America alone could be automated over the next two decades. It then goes on to state that at 98 percent, bank loan officers have the highest probability of seeing their job automated (which is really ironic, given that Morgan Stanley helped to disseminate the paper). The lowest? Elementary school teachers and doctors — both with a probability of 0.4 percent. Whatever the industry, AI-enabled cognitive machine learning is making its presence known.

Just think of a medical school student, studying to be a surgeon. Although the study predicts that there exists only a 0.4 percent chance that AI-enabled cognitive machine learning will completely replace her job in 20 years, my opinion is that there is a 100 percent chance that the technology will amplify her professional talent. Even for a student, AI can anticipate the progression of skills a would-be surgeon needs. That's what we call 'deterministic automation' — technology that learns from (in this case) a medical student's academic progress and helps with both the physical and mental aspects of the training.

Surgeons, for instance, must know how to access and repair the human body. There's no

reason why they can't be aided by computers that get smarter with every operation — not unlike how a student first becomes a resident in surgery and then advances to become a full-fledged surgeon after years of assisting in the operating room. Just think of the efficiencies gained by a complex operation requiring only one human surgeon instead of a team of four. The other three medical experts can thus be freed up to operate on other patients.

The journal, *Science Translational Medicine*, reported how researchers programmed a robot surgeon to carry out a procedure called 'intestinal anastomosis.' This is a remarkable feat because the robotic arms that we've known for decades typically weld metal together on assembly lines. This medical robot, however, took a piece of intestine that had been cut open and stitched it back together with the utmost precision.

Driving smarter cars

Transportation is another industry perfectly suited for machine learning and purposeful automation. Just about every automotive company in recent times has announced a self-driving car development program. While some companies have arranged joint ventures with

technology companies, others are confident of their own technological capabilities (alongside knowledge of what car buyers want and their extensive dealer networks) and have decided to go it alone. Google remains one of the non-car companies with longstanding intentions to build and market an AI-powered vehicle, with no steering wheel, accelerator, or brake pedal.

The reason that it could build a vehicle with such a spare dashboard is because of its confidence in its deep learning technology — the same technology that helped Google's AlphaGo program beat the world champion in the complex game of Go. That computer never required constant human input when it played the human Go Master, which is vastly different from past computers of other companies, which had to be programmed

A closer examination of the world of healthcare and transportation demonstrates just how profoundly AI is transforming the world around us. In both industries, AI is quickly evolving from 'machine learning' to 'deep learning.'

with information in order to compete in chess or on game shows. The advantage of a neural network is that it's not unlike the human brain — becoming smarter and learning what it needs to as it continues to play a game or drive a car.

Other self-driving programs take a different approach, outfitting cars with dozens of sensors that help a human behind the wheel. These are more like advanced cruise control features, rather than deep-learning neural networks. Car makers also know something that technology companies can't seem to grasp — people love getting behind the wheel of their cars and driving. It's a fun activity that allows for independence and escape from an otherwise ultra-connected world.

What's certain is that when it comes to AI, everyone seems to be making strategic moves. According to the research firm CB Insights, large companies have purchased 31 AI start-ups since 2011.

The consultancy, PricewaterhouseCoopers, has determined in a study with different metrics that companies have bought 29 AI start-ups this year alone, a trend that will eventually eclipse the 37 such deals that

took place in 2015. Even Intel is moving away from its decades-long microchip specialty in order to focus its energies more on building data centers. In fact, the company recently acquired an AI start-up called Nervana Systems. The Intel executive who is spearheading its data center development wrote in a corporate blog post: "[Nervana's] IP and expertise in accelerating deep learning algorithms will expand Intel's capabilities in the field of AI." Not to be outmaneuvered, Apple, too, has acquired Turi Incorporated — another AI company.

In a seminal work by two Oxford University researchers, — a paper titled 'The Future of Employment: How Susceptible are Jobs to Computerisation?' — the very pace of cognitive machine learning's advancement is presented as an issue that all industries must address. For example, the paper cites another study from 2004 that makes the case for the makers of driverless cars having difficulties mimicking human reactions and thought processes. According to the 2004 paper, "A left turn against oncoming traffic involves so many factors that it is hard to imagine discovering the set of rules that can replace a [human] driver's behavior...." Today, however, many companies pursuing driverless cars





Nowhere does AI have more potential than in the world of retail.

have developed fully autonomous vehicles that do indeed learn much like how humans learn to drive.

When the computer brain of a driverless car is indistinguishable from the actions and reactions of a human, we have the software engineer to thank. In the past, if the computer were a 'contestant' vying against humans on a televised game show, an engineer had to program a mainframe with every potential question and every correct answer. Now, AI itself possesses the cognitive talent of identifying and fixing software code; so, engineers can use their intelligence to identify new experiences and new products or services. AI is, incontrovertibly, on its way to become an incredibly useful tool that will amplify human potential.

Commercial success

Finally, let's not forget that AI has serious commercial applications. While the technology is the stuff of Oxford dons, it also helps enterprises of all stripes make money. I can think of nowhere AI has more potential than in the world of retail. In every facet of merchandising — from a pair of jeans in a showroom to a container ship crossing the Pacific Ocean with tons of the latest fashion

apparel — AI can see the smallest detail and the biggest picture simultaneously and roll all that data into simple, easy-to-use instructions about how to keep stores filled with just the right amount of merchandise as well as information about what merchandise will sell the best next season.

For centuries, merchants have attempted to perfect the supply chain, but it is a complex affair! The world of fashion depends on the ever-changing tastes of consumers, alongside fuel costs to transport the merchandise, labor costs to sew garments together, and raw material costs involved in manufacturing apparel. AI has all these steps covered so that a human can be a warm and helpful greeter in a brick-and-mortar store. When it comes to online commerce, shoppers won't even know that they aren't dealing with humans. 'Life-like' is the goal of every software engineer as well as every retail client.

AI needs governance

There will come a time when cognitive machine learning becomes so advanced that computers will become more than tools — they will, as experts have said, indeed become our sixth sense. They will be a part of us, of our daily existence. That is why, we will see

communities coming to a consensus about how AI progresses. After all, humans have had rules for living together in a society for tens of thousands of years.

We will, likewise, make regulations that govern the behavior of AI, spelling out what types of consequences there will be if those regulations are broken. The CEO of the Google-owned AI research lab DeepMind, recently said that the global community should have control over AI-powered machines that learn for themselves.

I completely agree because setting up protocols for any new and increasingly advanced technology is a smart move for everyone involved.

The establishment of guidelines is what we humans do when we want to focus and advance ourselves and our technologies even further. Artificial intelligence is going to amplify our talents and abilities in ways we haven't even imagined yet — much to the delight of a growing enterprise.

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Vijay has over 22 years of experience in the IT industry and manages some of the largest clients of Infosys. As a thought leader in the retail, CPG, and logistics sectors, he understands how technology trends and digital consumers reshape the business landscape, blur the lines between industries, alter the way people work / live, and redefine business partnerships. Through his valuable experience and leadership that is result-oriented, inclusive, and content-driven, he navigates enterprises through the challenges of the digital era.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

GAMIFICATION: BUILDING NEW, MEANINGFUL EXPERIENCES

I Gamification is the go-to idea today for making consumers love brands, buy products, and stay loyal. We analyze this trend through one of the most resounding gamification success stories the world has ever witnessed — Pokémon Go.



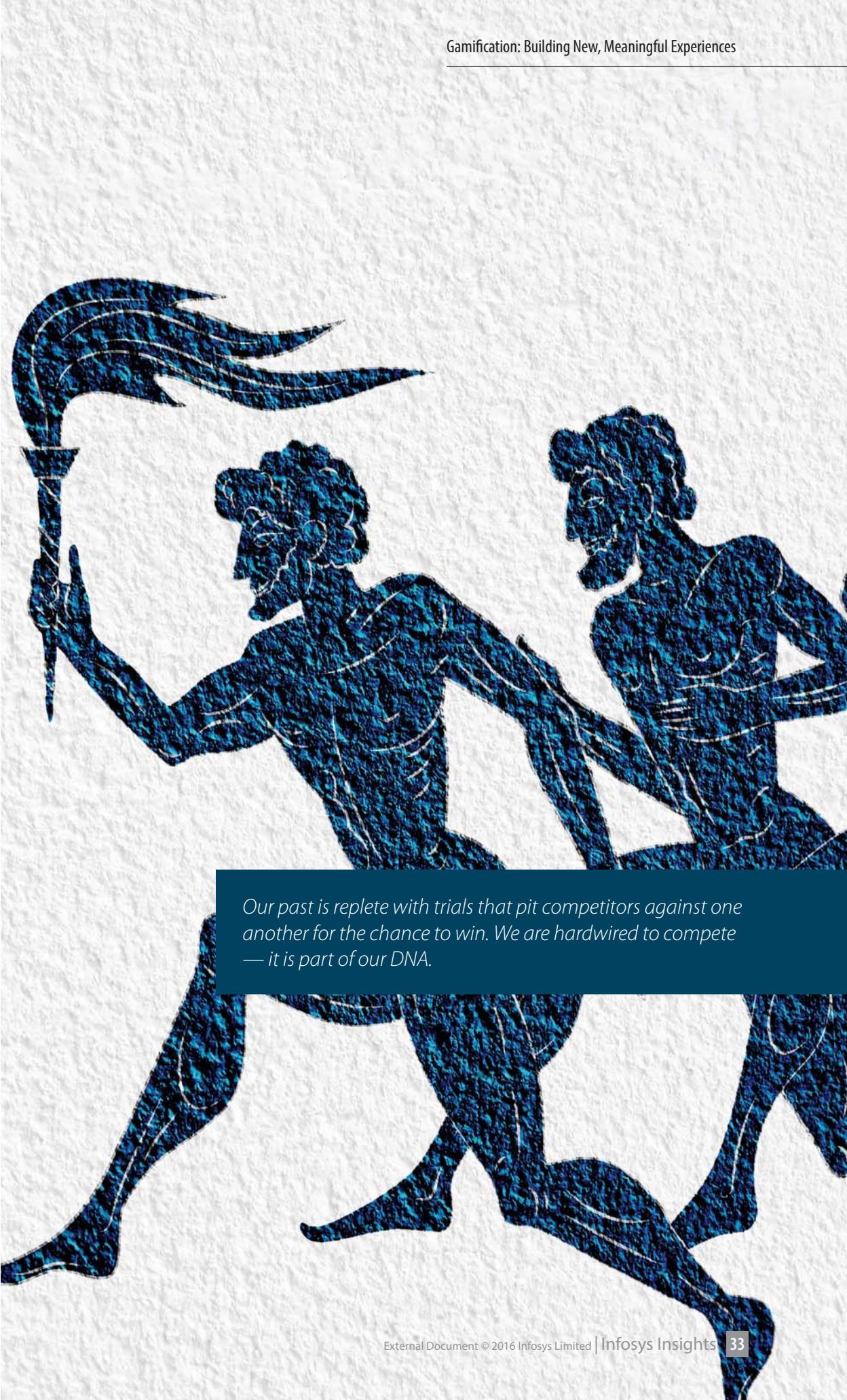
Gamification was around long before we had a name for it

Games have been around for over 7,000 years — Senet, Mancala, the Royal Game of Ur, and more dot our history. Our past is replete with trials that pit competitors against one another for the chance to win. We are hardwired to compete — it is part of our DNA.

The concept of ‘gamification’ too has been a part of our lives, even before there was a word to describe it. The British Parliament ‘gamified’ the development of a navigation device as far back as 1714 with the Longitude Prize. In fact, most people don’t know that Charles

Lindbergh braved the transatlantic flight because a hotel magnate named Raymond Orteig put up a prize incentive of US\$20,000 in an attempt to catalyze the aviation industry. Brands have gamified the shopping industry since as far back as 1896, by selling S&H Green Stamps to retailers in order to reward loyal customers.

Since then, we have gamified just about everything we can; from ‘choose your adventure’ books and movie serials to TV shows and video games through massively multiplayer online games (MMOGs) and branded entertainment.



Our past is replete with trials that pit competitors against one another for the chance to win. We are hardwired to compete — it is part of our DNA.

Gamified brands push the boundaries

Brands have tried desperately to play in this arena, with mixed results. While they endeavor to employ game mechanics to drive brand engagement, many sacrifice a satisfying game experience by obsessing about the brand and their traditional return on investment. For every 'McDonald's plus Monopoly' or 'Starbucks Rewards' program, the marketing landscape is littered with failed attempts at creating emotional connections and tapping into the consumer's innate desire to compete and win.

'Nike+ Fuelband' broke new ground when it first arrived on the scene, gaining nearly 30 million users in just two years.

What it offered was a way to not only gamify workouts by pitting users against each other to achieve their personal best, but it also connected them to a larger community that they could challenge and compete with to drive their fitness commitment to whole new levels. This social integration elevated a historically solitary, chore-like activity (working out) and turned it into a social experience

that tapped into the human spirit of sharing, competition, and achievement. Once the wearable tracker market became cluttered, Nike pivoted away from hardware to focus on community and experience, with the more recent Apple Watch Nike+.

At its best, gamification creates memorable experiences; and at the end of the day, it is the experience that consumers remember.

It's about the experience, not the money

In the good old days, a brand could just launch a TV campaign, throw in some print and radio, and watch their business boom. Why go through the expense of creating 'experiences' when all you had to do was invest in a megaphone? Well, the times have changed.

Creating a memorable experience that surprises and delights customers pays exponential dividends in terms of brand

loyalty – eventually leading to profits that are sticky. Think of it this way: You can give a customer a good deal today and they will tell their friends about it tomorrow. However, savings fade over time and give way to newer bargains and newer savings. It's fleeting, much like getting a raise at work. It's exciting when it first happens, but soon after you expand your lifestyle to fit your new salary, you're back where you started — in need of a new fix. A memorable experience, on the other hand, lasts a lifetime.

Pokémon Go is showing brands how it's done

Niantic built it. And they came. What we wound up with is a fun experience, and the money followed. An estimated US\$1.7 million per day of in-app purchases is generated on Apple devices alone in the US, not including thousands of business location sponsorships. The magic of Pokémon Go is that, for the first time, brands have a variety of ways to leverage gamification that are endemic to the game. Hence, the headlines:

'Pokémon Go is driving insane amounts of sales at small local businesses'

'How to invest in the Pokémon Go and augmented-reality revolution'

'McDonald's Sponsors 'Pokémon Go' in Japan'

'Pokémon Go is driving insane amounts of sales at small local businesses'

'How to invest in the Pokémon Go and augmented-reality revolution'

'McDonald's sponsors 'Pokémon Go' in Japan'

By leveraging augmented reality (AR) technology to create real world gamification, Niantic has tapped into a player's desire for sharing and competition, while driving an 'electronic empathy' that connects them to the broader community. And now, they are taking it up a notch with the new 'Buddy System,' which will allow trainers to select specific Pokémon to 'bond' with. By making a Pokémon your 'buddy,' you can walk around with it and the game will reward you with candy. It's designed to deepen the experience by facilitating an emotional bond between the player and their virtual Pokémon.



'Nike+ Fuelband' broke new ground in employing game mechanics to drive brand engagement, by offering a way to gamify workouts by pitting users against each other to achieve their personal best.



A business that has been designated a PokéStop or gym will attract foot traffic without even trying because players flock to them for rewards and battles. 'Lures' increase the rate of Pokémon generation in the area around a PokéStop.



How brands are playing the game

As Pokémon Go players search for creatures, local stores, restaurants, movie theaters, and other businesses are leveraging the opportunity to drive huge amounts of foot traffic, with both simple in-app purchases and creative marketing campaigns.

Revenue opportunities are either seamlessly integrated or completely invisible to players, which allows the game to be pure entertainment, doing what it does best — tapping into the human spirit of community and competition. Here's how some businesses are playing:

- **Gyms and PokéStops:** A business that has been designated a PokéStop or gym will attract foot traffic without even trying because players flock to them for rewards and battles
- **Virtual fishing leads to real sales:** 'Lures' increase the rate of Pokémon generation in the area around a PokéStop. For a little more than a dollar an hour, businesses can drive practically guaranteed traffic with an impressive ROI
- **Capitalizing on a location near a Pokémon gym:** Gyms generate self-perpetuating traffic. Users meet at gyms regularly to fight each other for control. Businesses near gyms can capitalize on this by employing creative marketing techniques, ranging from giveaways to discounts
- **Promoting local Pokémon on social media:** Businesses that are PokeStops, or near gyms, can also promote rare Pokémon in their area to drive traffic and create referral programs

Many brands are striking while the iron's still hot, finding ways to reap the benefits of increased traffic and relevance by inserting themselves into the game. McDonald's became the first official Pokémon sponsor in Japan by turning its restaurants into PokéStops and PokéGyms. T-Mobile created a promotion to exempt the game from data charges for a year, provide US\$15 Lyft rides to key locations, and offer discounts on chargers and battery packs. Sprint's Boost Mobile stores are attracting Pokémon Go players with 'lures,' alongside providing on-site 'Pokémon Go experts' and free charging stations. Yelp has added a filter to their site that helps players find restaurants or stores that have nearby PokéStops. UK retailer, Marks and Spencer, has engaged in a lengthy Twitter exchange about a customer catching a 'Muk' in their Liverpool store. Australia's ME Bank, Oporto, and Australian Bananas have posted Pokémon sightings on social media and Chobani yoghurt used their actual product as a lure.

Why is it working?

While everyone is trying to understand the success of Pokémon Go, the data shows how the game has tapped into consumer behavior and how this 'experience-first' brand is expanding beyond its 20-year heritage. Here are a few key highlights of the brand:

- **Large fan base:** We can't ignore the fact that this is a 20-year old brand with a large fan base that is emotionally connected to these characters. Much like a Disney or a Warner Bros., a whole generation grew up with Pokémon



- **Mobile-only experience:** While limiting the ‘anywhere, any screen’ nature of what makes many digital experiences compelling, Pokémon Go is driving communities of gamers into the streets, making them travel from location to location and business to business, and encouraging them to engage with each other digitally as well as physically
- **Catalyst of good health and wellness:** While not a primary driver of the game, Pokémon Go is, unintentionally, driving health benefits that Nintendo Wii originally touted. On average, players are spending two to over four more hours outside than they previously did. Further, 43 percent of them have said that they lost weight while playing
- **Promotes social networking:** Gamers are comparing collections, competing with each other, meeting on the street, and congregating at gyms. It’s bringing disparate people together because players are easy to spot and the outdoor and social aspects of the game are also being attributed to its appeal amongst women
- **News-making:** Record-breaking sales, unauthorized downloads, rumors of people falling off cliffs while playing, and the president of Israel posting a screenshot of a ‘Meowth’ in his office. Besides, having Justin Bieber, Demi Lovato, and Jimmy Fallon playing the game doesn’t hurt either

Implications for the future

As 3D sensors and more sophisticated augmented reality and digital technologies evolve, their applications are limited only by our imagination. Advanced AR could allow brands to gamify activities to enhance otherwise ordinary marketing programs.

Digital marketers could hide their products in unlikely places, contextually place a car insurance offer at a car dealership, or even position their product next to a competitor’s. When you think about it, the possibilities are endless because the game enhances everyday life experiences.

One thing is for certain — Pokémon Go is sure to teach us volumes about the potential of new technologies that drive gamified experiences to engage and delight consumers. Its current success provides further incentive to develop the technology to create what has yet to be imagined. Brands will be well-advised to prioritize the customer experience, journey, and engagement to connect with their customers on a more visceral and emotional level. Ultimately, the companies that will win are those that pay attention to these seismic shifts in order to capitalize on them when the time is right.

About the Author



Scott Sorokin

Global Head – Digital, Infosys

Scott leverages his experience to help companies navigate the complex technology landscape of mobile, social, search, and data, driving the evolution and strategic vision of brands in an increasingly digital world. Prior to joining Infosys, he was the Chief Strategy Officer at Publicis.Sapient / Razorfish. Scott has been a strategist and digital partner for senior-level executives at Fortune 100 companies for over 25 years. Providing actionable strategic guidance across the entire digital ecosystem, Scott brings a rare combination of CXO-level business strategy, technology, and marketing experience in a fast-changing global market.

TECH TALK

THE UNABATING GROWTH OF DIGITAL TECHNOLOGY BRINGS US NEW INNOVATIONS EVERY DAY AND THE PROMISE OF A MORE ADVANCED WORLD. BUT HOW EXACTLY DO THESE DOTS CONNECT? WHERE DO WE GO NEXT?

FIND THE ANSWERS YOU NEED AS INDUSTRY EXPERTS DISCUSS THE POTENTIAL OF TECHNOLOGIES LIKE THE INTERNET OF THINGS, AUGMENTED REALITY, VIRTUAL REALITY, AND BLOCKCHAIN; THEIR IMPLEMENTATIONS TODAY; AND WHAT THEY HAVE PLANNED FOR TOMORROW.



THE FUTURE FOR INDUSTRIAL SERVICES: THE DIGITAL TWIN

The next big thing in industrial services will be about accurately forecasting the future of physical assets through their digital twins. Experts from GE take you behind the scene on how GE created an intelligent, IoT-based industrial monitoring and diagnostics platform that's setting new standards.



Digitization of the industrial marketplace

The significant impact of digitization in consumer marketplaces continues to be felt through myriad business, leadership, and technology transformations across industries such as retail, travel, entertainment, and advertising. Digitization technologies and their rapid adoption rates are at the core of globalization, which has impacted the social and political landscapes of many countries. Now, digitization is poised to exert

its tremendous influence in the industrial marketplace, and at an even faster rate than it did in the consumer marketplace. There has been an immense amount of research, alongside multiple opinion-based articles, on the digitization of the industrial marketplace. Although the actual economic value, number of connected assets, and winning ecosystems in this transformation may vary, the large financial and societal impacts that it can have remain and exceed that of the consumer impact.



The **Digital Twin** is essentially a living model of the physical asset or system, which will continually adapt to changes in the environment or operations and deliver the best business outcome. It can also be rapidly and easily scaled for quick deployment for other, similar applications.

In crafting their digital industrial transformation journey, GE analyzed the best approaches used by consumer marketplace leaders and leveraged the most useful ones to build upon and accelerate the journey. After analyzing key consumer marketplace leaders (such as Amazon, Google, and Apple), it was clear that they used a similar approach to sustain their leadership in their respective marketplaces. The approach was focused on a very effective pattern, which includes three essential parts:

- Continually collecting a significant amount of data about each individual customer to create a model of that individual's consumption behavior (that is, a 'model of one')
- Implementing analytics that use the individual models to derive a business outcome and to learn from the consumption actions that are taken (that is, a 'P&L / profit and loss of one')
- Combining modeling and analytics techniques into a platform that simplifies and accelerates their use, allowing these capabilities to be easily adapted for new services or other industry applications

This approach was used by Amazon, when it moved from selling just books to conducting general retail through Amazon Online, video and music in Amazon Prime, and then to IaaS and PaaS services in Amazon Web Services.

The Digital Twin

GE has started on its digital transformation journey, at the core of which is an approach centered on the Digital Twin. The Digital Twin collects data from its manufacturing, maintenance, operations, and operating environments and uses this data to create a unique model of each specific asset, system, or process, while focusing on a key behavior (such as life, efficiency, or flexibility). This is the 'model of one.'

Analytics are then applied to these models to detect anomalies in the system. The twin then determines an optimal set of actions that maximize some key performance metrics, and provides forecasts for long-term planning. These modeling and analytics techniques are embedded in GE's Predix platform and allow the enterprise to rapidly create, tune, or modify business services for customers. This is the 'P&L of one.'

The Digital Twin is then used in a specified analytics workflow to enable the delivery of a specific business outcome, using environmental and operational data that is consistently acquired. This consistent data flow permits the Digital Twin model to continually adapt to changes in the environment or operations and deliver the best business outcome. Thus, the Digital Twin essentially becomes a living model of the physical asset or system. These twins can also be rapidly and easily scaled for quick deployment for other, similar applications.



GE has built Digital Twins of critical jet engine components that predict the business outcomes associated with the remaining life of those components.

GE has built Digital Twins of critical jet engine components that predict the business outcomes associated with the remaining life of those components; for example, of gas turbines to deliver the desired electrical power output at the lowest possible fuel consumption, and of wind turbines that collectively optimize the production of electricity from wind farms. These Digital Twins provide up-to-date and customized information that enables GE's businesses and customers to make timely decisions and intercessions for continued profitability and maximized performance.

While the digitization efforts of the industrial marketplace are uncovering a broad span of productivity-related savings and new revenue opportunities, many of the pre-eminent early productivity benefits are being felt through the unlocking of additional value in working assets, systems, and processes. These benefits can be grouped into three broad categories: Early warning / anomaly detection, prediction, and optimization.

Early warning, prediction, and optimization

GE is using Digital Twins in the monitoring and diagnostics (M&D) space to flag irregular behaviors that could be early signs of an emerging issue. Anomaly detection systems have been in use for many decades as a means to detect possible impactful events and have been deployed at many M&D centers. Today, several Digital Twin anomaly detection models have been created that provide early warnings, which enable a potential unscheduled outage to be just a scheduled maintenance event. To begin with, these models underscore the normal or optimal behavior of the assets, systems, or processes using a consistent data flow and associated domain understanding. The domain understanding may be used to create virtual sensors from which additional data is acquired to increase the fidelity of the model.

The Digital Twin Framework incorporates artificial intelligence agents that automatically suggest connections and insights among the model and application developers.

In addition, machine learning workflows are leveraged to detect anomalies as early as possible, in order to understand if they are a precursor to a potential impactful event. GE has created Digital Twin anomaly detection models to identify anomalies in the bearings of rotating machines up to 60 days in advance, as opposed to the usual 20–30 days.

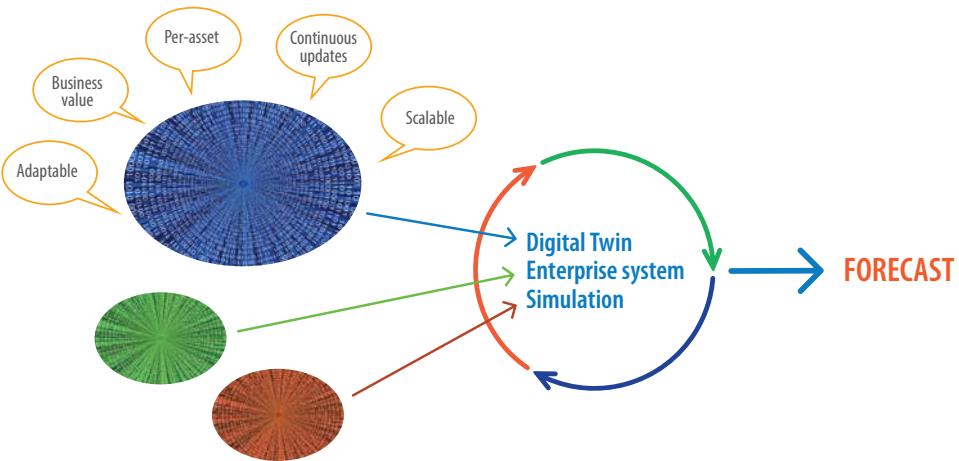
Prediction is at the core of the Digital Twin capability and leverages a combination of physics-based models and data-driven analytics to optimize key business indicators such as uptime and throughput. As an example, the Digital Twin can be used to

predict the remaining life of a turbine blade on a specific aircraft engine with great accuracy. This allows the application of condition-based maintenance (CBM) to manage a specific engine, rather than wasting time with the usual periodic approach. It also determines the remaining life of the turbine blade after each flight or a set of flights, by evaluating operational and environmental data

and customer needs. With this condition-based approach, the customer can determine exactly when to schedule maintenance and also take action to increase the uptime before maintenance — for example, changing filters or giving the engine a water wash to reduce contamination of key parts, thus increasing the uptime of the asset.

Industrial services are being transformed by knowing the likely outcomes of individual assets. GE has also created enterprise-scale Digital Twins that simulate full-scale, complex systems interactions, which simulate several 'what-if' scenarios of the future and determine optimum key performance indicators for situations with highest probability. By leveraging large data sources for weather, performance, and operations, these simulations play out possible scenarios that could impact an enterprise.

For example, power generation customers are using Digital Twins to plan fuel-versus-efficiency trade-offs so that the committed electrical power output can be delivered

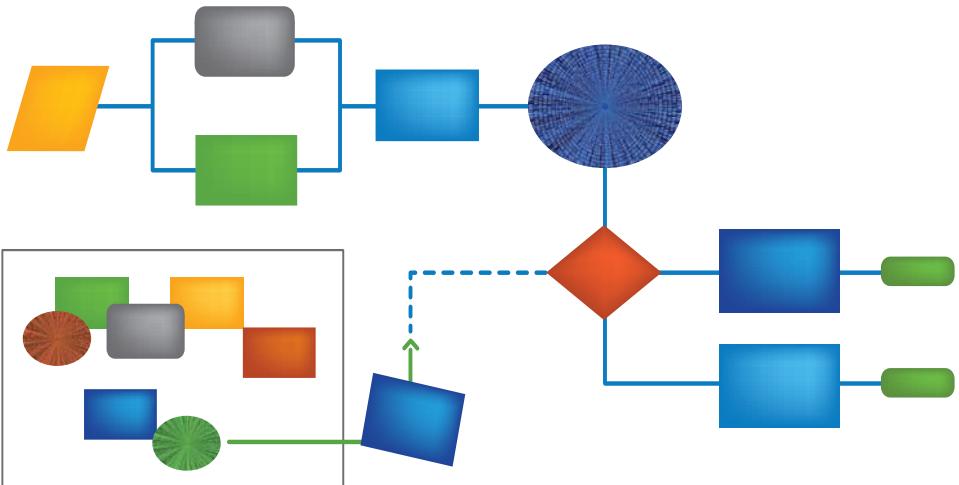


through minimal fuel consumption levels, or so that it can be maximized at the highest possible price. Further, railway customers are using Digital Twins to optimize a locomotive's fuel cost and emissions on a specific trip, by processing the total weight of the train, the car configuration, the topography of the route, and the environmental conditions along the route.

Digital Twin technologies and ecosystems

Automating model-building and scaling the Digital Twin community

Enterprise-scale simulation and optimization requires Digital Twin models of every asset, across the business portfolio. GE created the Digital Twin Framework and a company-



wide community of thousands of modelers to create asset-level models that become Digital Twins. The Framework hosts a variety of physics-based and analytical machine-learning methods to generate models, as well as supporting infrastructure to ingest and curate data sets and to validate and publish the final models. Industrial models and analytics have precision, throughput, and other performance requirements that are substantially different from the consumer Internet, and the Digital Twin Framework for

GE's Predix is the industrial strength capability for building Digital Twins.

The Digital Twin Framework also provides sophisticated capabilities for building and deploying digital services applications that create economic value by optimizing over possible future scenarios. Digital Twins are published into a runtime environment built to handle the daily volume and model updates that run across multiple applications. In this environment, developers can combine

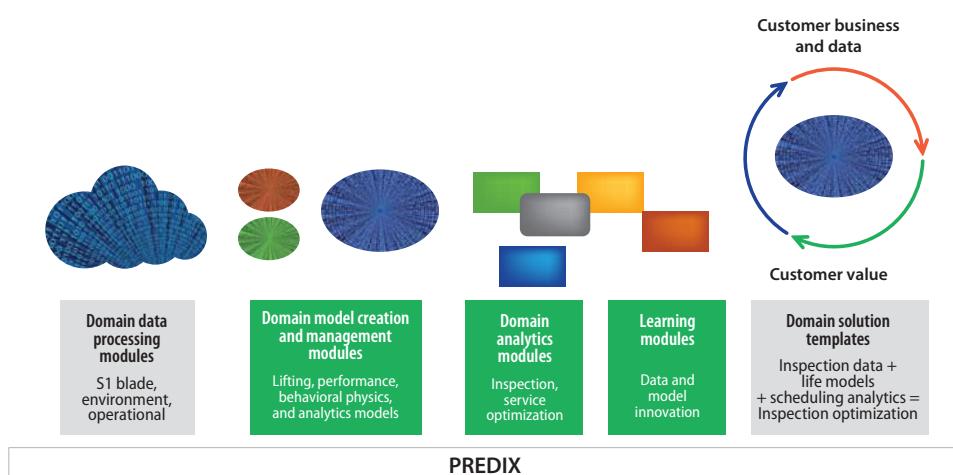
the Digital Twin models with data sets and UX and UI widgets, and enable analytics to create industrial-grade applications. These applications are polymorphic, allowing users to 'hot-swap' analytical modules and Digital Twin models for redeployment to new applications and industries.

The Digital Twin Framework incorporates artificial intelligence agents that automatically suggest connections and insights among the model and application developers. This

capability continually grows by learning from user interactions. Some of the models built in the Framework today are products of a fully automated process, learned and established from the learnings of the community and network.

Digital Twin ecosystem

The developer community is at the core of the Digital Twin. Within GE, domain experts, model developers, data scientists,



and business innovators form teams that continually build new Digital Twin capabilities and outcomes. The Digital Twin Framework hosts these teams within the larger community, fostering new connections and insights as well as accidental innovation. As the framework resides on Predix, it is a resource that is available to all customers and partners. Non-GE developers and users are now growing the Digital Twin ecosystem.

Infosys is a great example of an early adopter of the Digital Twin approach. In 2015, Infosys partnered with GE to develop the world's first Digital Twin for an airplane's landing gear, enabling early warnings and failure predictions for several key components. This Digital Twin, combined with those of the engine, airframe, and other systems, scale to form a Digital Twin of the entire aircraft. Fuel economy is impacted by operational tradeoffs among these components — and the enterprise simulation balances these interactions to optimize fuel consumption,

while also maximizing safety and timeliness. This is the power of the expanding Digital Twin ecosystem, which is transforming industrial services through its ability to forecast the future.

The evolving Digital Twin era

We are at the beginning of the Digital Industrial Era and the Digital Twin is in its infancy. However, we are already seeing glimpses of the tremendous changes that lie ahead. As these Digital Twins become the 'living' models of physical entities that they represent, they embody asset 'memories' and even 'group consciousness.' Let us consider the example of The Wind Turbine Farm — a group of wind turbines placed together that generate electricity. In this case, a wind turbines farm is deployed in a field and has been producing electricity for the past four years. A new turbine that has been in production for two months needs to be added to the farm, when suddenly its control

system notices some unusual sensor input that is unrecognizable. Subsequently, the sensor in the turbine will communicate with older turbines that have been functioning in the farm and assess if they have experienced this irregular input pattern before and what events are associated with it. It might then receive inputs from these turbines that indicate that they have experienced this pattern and a potential failure event is associated with it. The new turbine then uses its Digital Twin (as it has different parts and configuration) to determine the impact on

its own components. Thus, the twins are in communication and constantly learning from each other.

This notion of machines talking, reasoning, and making decisions with each other will be transformative for how industrial systems are operated and managed in the future. During the 2020-2030 decade, there may be over 50 billion machines connected together, with over seven billion internet consumers. With the network effect in play, the world will see another, even more sweeping internet transformation.

About the Authors



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Vice President of Software Research, GE Global Research Center

As a senior member of GE Global Research Center, he is responsible for the software, systems, and analytics research for GE's industrial and capital businesses. He works with GE's subsidiaries, partners, and clients, to leverage their deep domain expertise and significant data assets. Colin is also an Officer of the GE Corporation.

Colin previously worked with IBM from 1994 to 2014. In his previous role as the Vice President of Systems Research in the IBM TJ Watson Research Division, he was responsible for creating market making systems and system software that provided leadership for IBM's next-generation mainframe, distributed, and storage systems. He has also been a member of the IBM Integration and Values Team (top 300 executives worldwide) for the past 11 years.

Colin received a PhD degree in electrical engineering from the University of California, Berkeley; a master's degree in the science of management (MSM) from Stanford University (as a Sloan Fellow); a master's degree in electrical engineering and computer science at the University of California, Berkeley (MSEECS); and a bachelor's degree in electrical engineering at Howard University (BSEE). What's more, in addition to six patents, he has also received various technical and community honors.



Dr. J. Brandon Laflen

Head — Digital Services, GE Global Research Center

Dr. Brandon wears many hats — he leads digital services at GE's Global Research Center, manages a portfolio of advanced technology research programs that combine digital strategy with GE's services technology pillars (that deliver hundreds of millions of annual benefits to GE's businesses and customers), and builds the next-generation product portfolio for GE Digital. Prior to this, Brandon led software transformation and worked closely with the Vice President for Software Research and the leadership team to develop the digital strategy and digital twin. Brandon joined GE in 2008 and has led software and digital research programs at the intersection of statistical signal processing, computer vision, physics-based modeling, and materials science, before managing the System and Signal Analytics Laboratory in 2013. Brandon received his PhD degree in electrical engineering from Purdue University.



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MOVING TO DISTRIBUTED SYSTEMS: BLOCKCHAIN AND THE STANDARDS OPPORTUNITY

With the growing popularity of blockchain technology, days of the static, offline ledger are numbered. In this article, we examine the enthusiasm towards its adoption and the importance of standards in ensuring its hassle-free, global implementation.



Standards sit at the core of every aspect of a business, a technology, and a heavy industry. Without standardization, we would not be able to run trains across borders, as rail spacing and thickness would not be uniform. We would have much wider disparities in power voltages and mains plugs, severely impacting manufacturers of electronic goods. Without standardization, it would be impossible to reliably source components like nuts, bolts, and screws to assemble everything from a laptop to a suspension bridge. Standards bring order to chaos and nurture industry-wide development of

systems and platforms, discouraging myriad individual directions, creating incompatible variations on the same theme.

IT systems are no different. Standards have helped define everything from the web and email to programming languages as well as ensuring interoperability of systems and networks. It is hard to believe, today, that we would build applications and operating systems that differ from the current accepted practice. However, before clear industry standards emerged, it was a very different, incompatible world.

Interoperability in record-keeping and ledgering is a classic example of where standards serve to bring method to madness, especially where there is a need for a standards-driven approach to delivering the next-generation of electronic, interoperable record-keeping platforms.

Interoperability in record-keeping and ledging is a classic example of where standards serve to bring method to madness, especially where there is a need for a standards-driven approach to delivering the next generation of electronic, interoperable record-keeping platforms.

The case for the distributed ledger technology

At the center of digitized ledging efforts is the distributed ledger technology (DLT) — the notion of a trusted, electronic ledger platform that can be shared by organizations as well as an entire sector.

Right now, we are witnessing an explosion of innovation in this space, led by efforts based on the blockchain. The technology could prove to have the capacity to deliver a whole new level of trust to a wide range of services, based on open standards. Open data has fundamentally changed public and enterprise relationships, with each other and with the government. The same approach can reform our financial markets, supply chains, consumer and business-to-business services, and publicly-held registers.

Delivering a trusted, hardened, and interoperable platform is essential — it does not work if groups go their own unique ways. Sectors need to settle on a single, standards-based approach. This is why blockchain is increasingly being seen as the solution. It overcomes key inefficiencies in the market, allowing organizations and bodies to scale a platform without requiring an equally significant increase in staff numbers.

Why blockchain?

A blockchain distributed ledger is essentially an asset database that can be shared across a network of multiple sites, geographies, or institutions. Any changes can be replicated to all copies of a ledger quickly, ensuring that no participant is left working on outdated information. The security and accuracy of data within the ledger is maintained cryptographically through the use of 'keys'

and 'signatures'. These not only control who can edit the ledger, but also curtail retrospective tampering.

Additionally, it removes the need for a centralized body to reconcile and adjudicate over transactions while building security. Each record is interlinked with the one before and after it, making retrospective tampering and hacking impossible to achieve without detection.

Haruhiko Kuroda, governor of the Bank of Japan, made the point about the potential of a distributed ledger technology like blockchain when he recently said, "The development of financial services has been supported by ledgers as the basic infrastructure for information. The dramatic changes in how ledgers are kept may have the potential of significantly changing the structure of financial services."

In short, shared protocols enable the collaborative creation of digital distributed ledgers with properties and capabilities that go far beyond traditional paper-based ledgers, removing the need for clearing, reconciliation, and other translating middleware. When combined with

standardised, computer-readable semantics for contracts, distributed ledgers also open up the possibility of automating the processing and execution of contracts – resulting in so-called 'smart contracts'.

Standards take time to agree

Any standards-driven approach to platform development takes time. Agreements about data interoperability, policy interoperability, and the effective implementation of international standards is time-consuming, requires negotiation, and involves many stakeholders. After all, we did not settle on standardized railroads or shipping containers overnight - it took many decades for such standards to emerge, and it was a process driven largely by the demand of international business.

Interoperability in recordkeeping and ledging is a classic example of where standards serve to bring method to madness.

Similarly, with blockchain, businesses have a pivotal role to play in tackling issues of security, privacy, and the development of standards — all areas where industrial advantage will be gained by cooperation rather than competition. Furthermore, governments need to work with academia and the industry to ensure that standards are correctly enshrined in the legislation, and that these are deemed as an industry best practice, and elaborated upon through education.

For example, UBS, Deutsche Bank, Santander, and the Bank of New York Mellon are teaming up to develop a new form of digital cash to clear and settle financial trades using blockchain technology. This is just one of the several initiatives that could ultimately breed the next industry-wide platform. Without standards, fragmentation and technology forking inhibit adoption, adding complexity and cost.

Furthermore, many bodies and influential standards groups are already conforming, in support of blockchain-based technologies. For example, the Linux Foundation is backing Hyperledger, while the W3C, R3 group, and other bodies are actively collaborating with enterprise stakeholders to ensure that distributed ledgers built with different technologies will be able to interoperate on a basic level.

Love open data, love standards

For Infosys and other champions that are working with blockchain, the opportunities and flexibility offered by the technology are varied and motivating. As an underlying platform, blockchain lends itself to everything from land registries and tax payments, to bank account transactions and social security payments. For anything that needs accurate, legally robust recordkeeping that can withstand attempts to tamper with the flow of information, blockchain is a viable standards-based option. Moreover, the standardization required to maximize value from DLT would have a ripple effect of improving and standardizing some of the contracts and instruments around this workflow, such as supply chain documents, financial instruments, and other components of the process.

However, while most industry players agree that standardization will add value, we are some time away from knowing which of the various proposals will emerge as the true standard. The success of standards should not emerge from another 'VHS vs. Betamax' battle, where market forces settle the argument after years of confusion. The best standards are those that emerge from stakeholders sitting down together and agreeing on an approach that meets their collective needs. When laying down the pipework of the next generation of financial infrastructure, the stakes are too high to do it any other way.

About the Author



Peter Loop

*Associate Vice President and Senior Principal Technology Architect,
EdgeVerve Systems (an Infosys subsidiary)*

Peter Loop brings to the table his vast expertise in the banking industry and over 30 years of engineering experience at Intel and Microsoft. He is an innovative senior leader with a long career of transforming the enterprise system ecosystem. He has developed solutions to accelerate innovation and reduce disruption, cloud migration of banking solutions, API management and integrations, user experience strategy, mobility, and BI strategies. Peter is leading efforts in the field of cryptocurrency / distributed ledger technologies (Blockchain) for global financial services markets and their potential applications to banking, and also in driving evangelism and adoption of new technologies.

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BIT BY BIT: HOW AR AND VR ARE ENTERING THE REAL WORLD

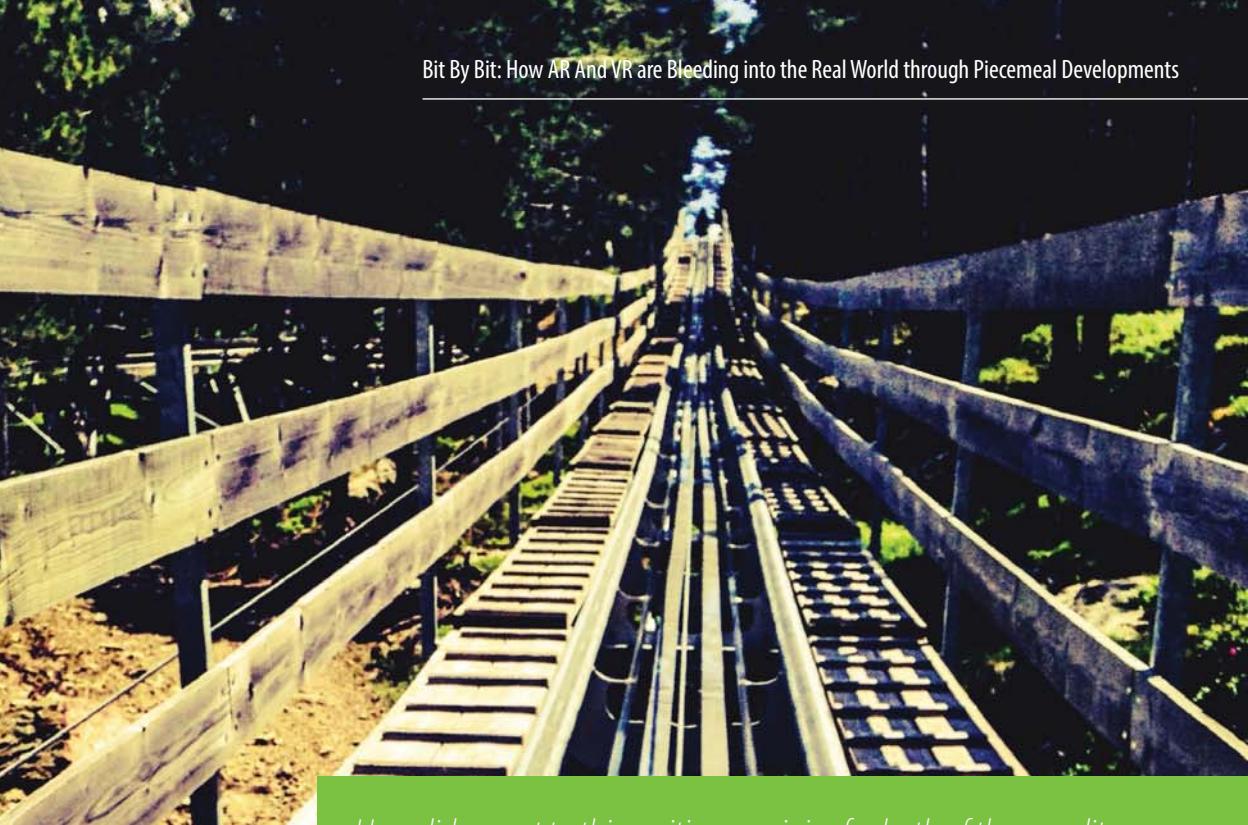
Most of us understand augmented reality and virtual reality in the context of entertainment; not many of us can fathom the sheer impact these can have in our daily lives — until now.



Consumer and business interests in the possibilities presented by augmented reality (AR) and virtual reality (VR) have boomed over the past few months. The reason is simple: technology has advanced enough to take exotic, expensive, and niche products, and turn them into everyday experiences. People are delighted by what might unfold from such advances. However, this change isn't happening all at once. Rather, it's a piecemeal process driven by a few notable, disparate developments that, put together, create practical interactions within the AR and the VR environments.

Historically, AR and VR have been held back by poor hardware and software, and the high cost of both. Hardware was often either too large or too expensive for mass adoption; software wasn't able to process and interpret data reliably; and the supply chain and applications necessary to produce components for AR and VR cost-effectively for a mass market were just not available.

Yet, there hasn't been a better time for both of these reality-bending industries. VR has captured the imagination of video game enthusiasts, thanks to the HTC Vive and



How did we get to this exciting precipice for both of these reality-bending industries? The same way we did with technologies before — combining the slow, steady building up of capabilities in increasingly smaller hardware, with the rising robustness of software.



Oculus Rift. Filmmakers too have shown interest in the field with some success; for instance, the virtual reality short film, 'Henry,' recently won an Emmy award. Further, interest in AR gaming and applications has exploded after Nintendo and Niantic's surprise hit, Pokémon Go, and after Microsoft introduced its AR headset, the Microsoft HoloLens, to much fanfare.

So how did we get to this exciting precipice? The same way we did with technologies before — combining the slow, steady building up of capabilities in increasingly smaller hardware, with the rising robustness of software. Another contributing factor for the imminent success of AR and VR is the concurrence of another technological innovation, the smartphone.

The confluence of opportunities

As soon-to-be industries, AR and VR both owe a lot to the smartphone. The rapid miniaturization of processors and sensors, along with the establishment of standards already account for most of what AR and VR require to succeed. They have the supply chains, the user base, the software expertise, and proven use cases for the technology at home as well as at work. All that remains is to put the pieces together in the hands of both consumers and enterprises.

This movement is already taking shape because of the latest development in smartphone technology: dual cameras. The dual camera setup is almost a necessity for AR because it enables depth measurement, which is crucial for an optimum AR experience. So, the fact that Apple's flagship phone, the iPhone 7 Plus, features dual cameras is remarkable (in fact, this is also how Apple achieves the prized 'bokeh' effect it is marketing in its new phones). Additionally, Apple's smart use of artificial intelligence also helps to address known shortcomings.

We don't know yet if Apple intends to use the iPhone 7 Plus' dual cameras for AR. But,

regardless of the Cupertino giant's intentions, one thing remains true — dual cameras are here to stay for the foreseeable future because Apple has long set the standard for what's expected of a modern smartphone (even though they weren't the first to experiment with dual cameras on a smartphone). As for AR and VR, the more standardized this feature becomes across smartphones, the more capable the AR and VR software ecosystem will become.

Software for AR and VR is tricky today because the standards for both technologies aren't fully developed. There are, however, efforts to correct these shortcomings. One project, the Open Source Virtual Reality (OSVR) project, is seeking to standardize VR experiences through open source software and hardware. Additionally, the Immersive Technology Alliance is also seeking to cement open source (software) and open standards (for both hardware and software) for AR, VR, and other immersive technology fields.

Because of the confluence of these factors (rapid

miniaturization and rapid standardization), the cost of producing and buying AR- and VR-ready headsets should fall from their current heights (US\$3,000 for Microsoft's HoloLens developer kit) to a reasonable price point that will appeal to both enterprises and consumers. In fact, as mentioned before, we may not even see a direct flashpoint of AR and VR devices on the market, but a gradual buildup to AR and VR capabilities through smartphones and similar mobile devices.

The endless possibilities

The wide adoption of AR and VR, and of their respective software ecosystems, has massive implications for not just the tech sector, but nearly every other industry. Manufacturing, travel, education, and medical industries are some obvious examples. In fact, these industries are already pursuing and experimenting with AR and VR technologies.

Software for AR and VR is tricky today because the standards for both technologies aren't fully developed. There are, however, efforts to correct these shortcomings, such as the Open Source Virtual Reality (OSVR) project

What's even more fascinating are the varied, potential applications of AR and VR outside of common workplace environments. Do-it-yourself (DIY) homeowners and hobbyists could leverage AR to make home repairs or build products at home. Farmers could use the data collected from drones to get a birds-eye view of their crop's health in VR and pinpoint areas of concern. The fact that consumers and the general public may no longer have to rely on specialists for repairs could spur a boom in AR and VR guides,

software development, and entertainment. The possibilities are truly endless.

AR and VR are capturing people's attention today because they have the potential to transform how we work and play tomorrow. Thankfully for us, the gradual progress of technology is turning this dream into a reality. We've still some way to go to make AR and VR an everyday reality, but each morning brings us a bit closer.

About the Author



Vishwa Ranjan

Head – Augmented Reality / Virtual Reality, Infosys

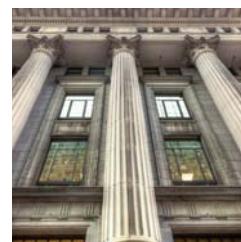
Vishwa Ranjan sees things others don't, thanks to his 20-odd years working in the computer graphics field. At Infosys, Vishwa helps to paint a better picture of augmented and virtual reality capabilities by showing how the technologies will impact consumers and professionals, how they'll buttress new and old industries, and what paths are necessary to get there. When he's not showcasing VR demos at the World Economic Forum in Davos, Switzerland, Vishwa can be found in the classroom using his doctorate in computer graphics to teach.

Prior to joining Infosys, Vishwa pushed the limits of animation and visual effects for Industrial Light & Magic, Electronic Arts, and DreamWorks Animation, including work on films and video games in the Star Wars and Lord of the Rings franchises.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

ARTIFICIAL INTELLIGENCE: CAN IT BRING PRODUCTIVITY AND ECONOMIC HEALTH BACK TO FINANCIAL SERVICES?

With financial services advancing into the digital age and Fintechs disrupting the landscape, banks are struggling to adapt. We explore the threats banks face from these new entrants and why artificial intelligence (AI) and automation are key to reinventing themselves.



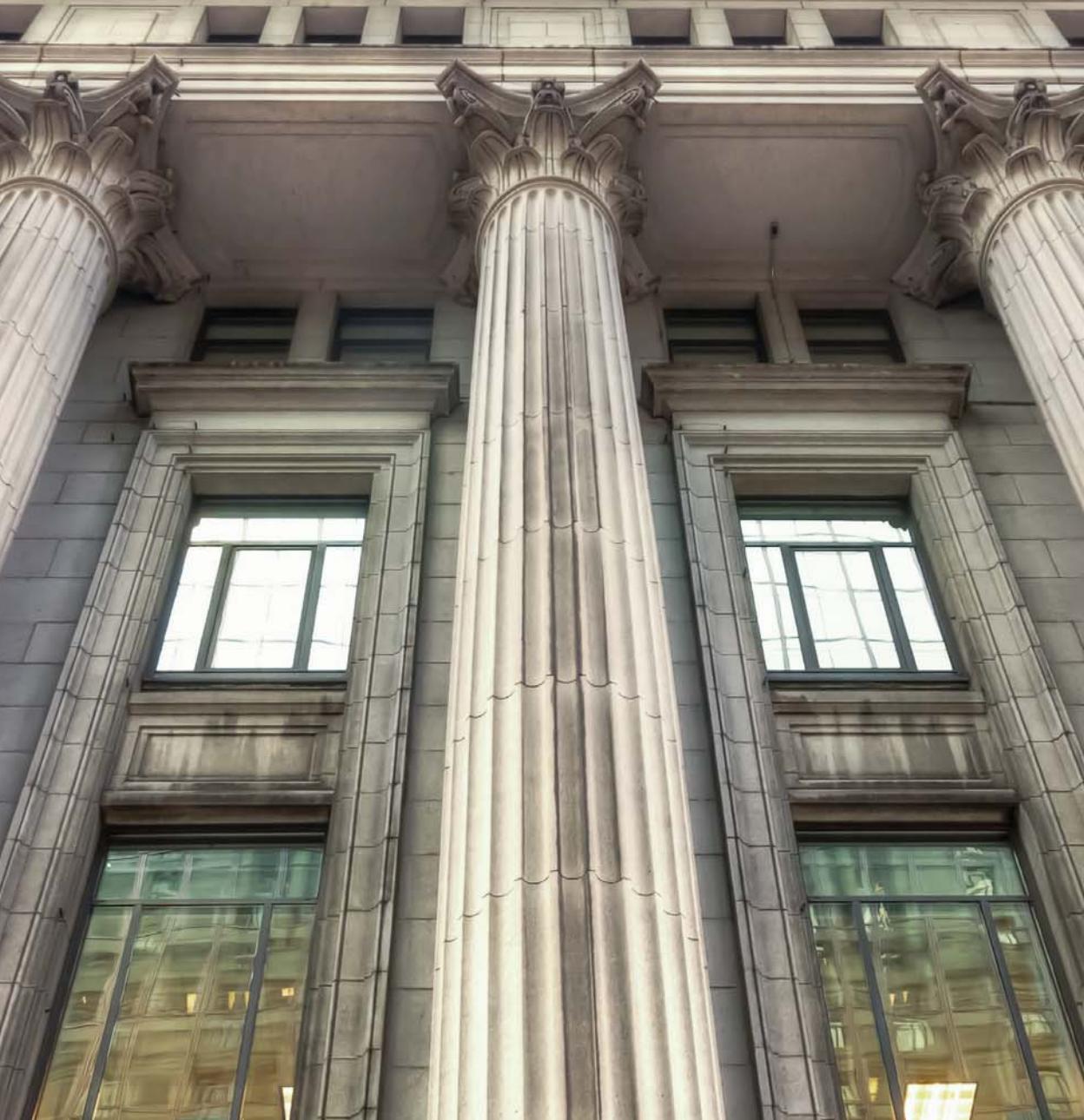
Few industries are more mired in traditional operations, legacy systems, and maintaining their status quo than financial services. More often than not, this rigidity is the by-product of regulations and monitoring. Even so, unprecedented new competition and legislation along with a new, digital savvy customer base, have given the industry a genuine challenge: Evolve or die.

Thankfully, recent times have seen the evolution and refinement of artificial intelligence (AI) solutions within financial services. As use cases have evolved from

being fantastical to practical, industry leaders are compelled to renew legacy technologies, invest in next-generation innovations, and enhance the adoption of AI through a better understanding of its capabilities. In fact, these developments in finance will shape AI's adoption across other industries for the years to come.

In a world of legacy

Banking is an age-old industry that is weighed down by monolithic systems, rigid regulations, and cultural traditions. Some



Few industries are more mired in maintaining their tradition, legacy, and status quo than financial services. More often than not, this rigidity is the byproduct of regulation and monitoring.

countries like the UK use conventions and traditions dating back to the age of ink, quills, and dusty ledgers! For example, the internal compliance procedures at many traditional banks still require physical signatures to open bank accounts. Further, back office processes and routine decision-making also require paper-based forms and manual intervention, which delay services and add considerable costs.

But changes are taking place. Thanks to advancements in automation and data-led intelligence, financial AI technologies with minimal, day-to-day impact on workflows are becoming feasible while still maintaining compliance with existing or emerging regulations. This is because knowledge repositories that capture boundaries and basic interaction rules — regulatory protocols that need to be digitized if new AI systems are to remain within the boundaries of the law — already exist. AI, in essence, stands on the shoulders of the data and process automation technology trends that preceded it.

These trends, combined with new machine-learning technologies, will allow financial services providers to concentrate on high-value activities and creative solutions. Automated systems will handle volume-based and repetitive activities at lower costs, enabling higher throughput and reducing the need for oversight — all the while ensuring that banks can deliver compliant sales and service outcomes.

Two applications: High-frequency trading and investments

The notion that computers will dominate the financial services landscape is not new. Today, many specialized algorithms not only run the processes, but also make buy and sell decisions without stockbrokers. We can see an instance of this in high-frequency trading (HFT). HFT is a subset of algorithmic trading, focused on volume, speed, and autonomous decision-making. By using the data that is funneled into the system, these pieces of intelligent code can make informed market decisions and can also react to split-second

opportunities in the market in ways that human stockbrokers can't, given that human brokers simply cannot move quickly enough to make such trades.

However, automation in trading isn't always about speed. Some algorithms are beginning to learn how to trade on their own through a variety of machine-learning methods. Whether it's through Bayesian networks, evolutionary computation, or deep learning, corporates and startups are leveraging the access they have to massive amounts of data, in order to train machines to automatically recognize and predict changes in the market. This is distinct from HFT as these AI traders are looking for long-term investments, not immediate ones; and are looking for them on their own.

High-frequency and AI-fueled trading isn't a replacement for human traders – who hold critical roles in larger deals, book-building, and other portfolio management processes.

That being said, high-frequency and AI-based trading isn't a replacement for human traders, who hold critical roles in larger deals, book building, and other portfolio management processes. However, for scenarios that are characterized by high volumes, small margins, and speed, machines have proven to be more

productive, cheaper to operate, and have the ability to produce higher returns. In fact, HFT's success is so widespread that it's now a key component of traditional investment banking strategies and, for some entities, is now overtaking traditional trading as the primary revenue and profit generator.

Keeping the machines in check

Although the benefits of AI in financial services are clear, this isn't to say that autonomous or AI-driven trading isn't without its risks. For example, in 2012, US market maker, Knight Capital, lost over US\$400 million in a half-hour after an algorithm malfunctioned. Even the New York Stock Exchange (NYSE) saw a pause in trading while technicians corrected software issues within an automated system. Still, it's arguable that the benefits of this technology more than outweigh the impact of occasional glitches.

Given that autonomous systems are susceptible to 'judgement' lapses just like



Even the New York Stock Exchange has undergone a pause in trading while technicians corrected software issues within an automated system.

their human counterparts, it's unlikely that we will see completely autonomous models for banking, share dealing, and insurance risk analysis any time soon within the capital markets. The same goes for AI in retail banking, which has to tackle with the added complexities of human languages, dialects, and customer-centric interactions.

These are not, however, AI-killing problems. In fact, this is exactly where those pre-existing knowledge systems that govern compliance come into play. AI's biggest opportunity lies in automating the frontline, where usage is most intensive and the return on investment is often lowest. Cutting costs, increasing throughput, and extending operating hours all result in more trade, lower transaction charges, and greater economies of scale.

Retail banking has a different risk-benefit profile. The benefits of engaging with customers in a more automated and intelligent way offers significant cost savings, with the risk being spread over millions of customer interactions. The main issue is that the complexity of the more 'human'

interactions is greater than the relatively simple, albeit impressive, number crunching that needs to take place in capital markets.

The future: Client and retail-facing applications

What's crucial to both existing and new market entrants is how they use automation to interact directly with customers. Automation offers retail financial services organizations the opportunity to reduce their physical footprint, lower their operational and transaction costs, and accelerate their time to market.

For competitive, branchless banks, like those operating as mobile app-based businesses, AI is a critical component of their strategy. Such businesses have the opportunity to automate customer-facing functionalities like frontline customer service, basic transaction fulfillment (transfers and payment reconciliation), and risk assessment for credit and transaction matching. These actions can help reduce their



operating costs. For example, these branchless organizations can use algorithms to circumvent the traditional mechanism for processing foreign currencies, in order to maximize the profit in a grouped trade. Doing so can reduce the overall transaction cost of fulfilling what would otherwise be a large number of low-value, high-unit, cost trades. This approach is best illustrated by the success of TransferWise in the retail foreign exchange (FX) markets.

The same approach can be employed to dispatch cross-border transfers via the most effective and cost-efficient partners and routes. For PayPal-like organizations that offer an alternate route to traditional financial transfers, intelligent and AI-driven money-routing could represent huge cost savings. Further, it could also provide the foundation to scale transaction volumes significantly faster than would be possible if human intervention was required to do the same work.

For other parts of the sector, such as insurance, AI presents an opportunity to take on frontline assessment of risk, fraud, and claims management. Using well-defined parameters, AI can be used to adjudicate and escalate claims, set premiums based on data-driven perceived risk, and even evaluate information to spot questionable activity. These are functions traditionally handled by armies of people and they represent one of the largest cost bases in insurance that AI can unpick. These advancements could also enable insurance companies to provide dynamic pricing to their customers, allowing them to enroll in products that are priced

based on the personal choices and actions of customers.

The financial services sector is in need of significant and immediate change. Be it to address inefficiency, improve profitability, support higher liquidity regulation requirements, or make banks more efficient in the face of growing competition. AI-based applications must be developed to deliver the desired benefits while staying within clear boundaries. With clear limits and good data, AI systems have the potential to deliver substantial benefits that customers and institutions can trust.

About the Author



Richard Hamerton-Stove

Infosys Consulting

Richard believes in the Googly mantra of ‘know the user, know the magic, connect the two.’ For the past 20 years, he has shaped how companies make the Internet work for their customers across fintech, cloud, artificial intelligence (AI), and big data. He now uses his experience to be a trusted advisor to executives who know that something needs to be done, but would like to be a little more certain about what to do and how to do it. He guides large financial organizations on their journey from atoms to bits and has been pivotal in driving blockchain research, examining AI’s impact on financial services, and modernizing digital experiences for clients.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

RENEW-NEW

IN ORDER TO SUCCEED IN A WORLD THAT IS BEING IRREVOCABLY DIGITIZED, ORGANIZATIONS MUST RENEW THEIR CORE AND SIMULTANEOUSLY INNOVATE INTO NEW FRONTIERS. WHETHER IT IS IN THE RENEWAL OF EXISTING SYSTEMS AND BRINGING IN MORE EFFICIENCY, OR ADDRESSING COMPLETELY NEW KINDS OF OPPORTUNITIES THAT ARE OPENING UP – ENTERPRISES NEED NEW IDEAS AND NEW INNOVATIONS. RENEW-NEW IS THEREFORE A TOP PRIORITY FOR EVERY LEADER.

THIS SECTION EXPLORES HOW THIS MANTRA IS DEFINING PRIORITIES ACROSS SOME SECTORS.





REIMAGINING THE FUTURE WITH 3D PRINTING

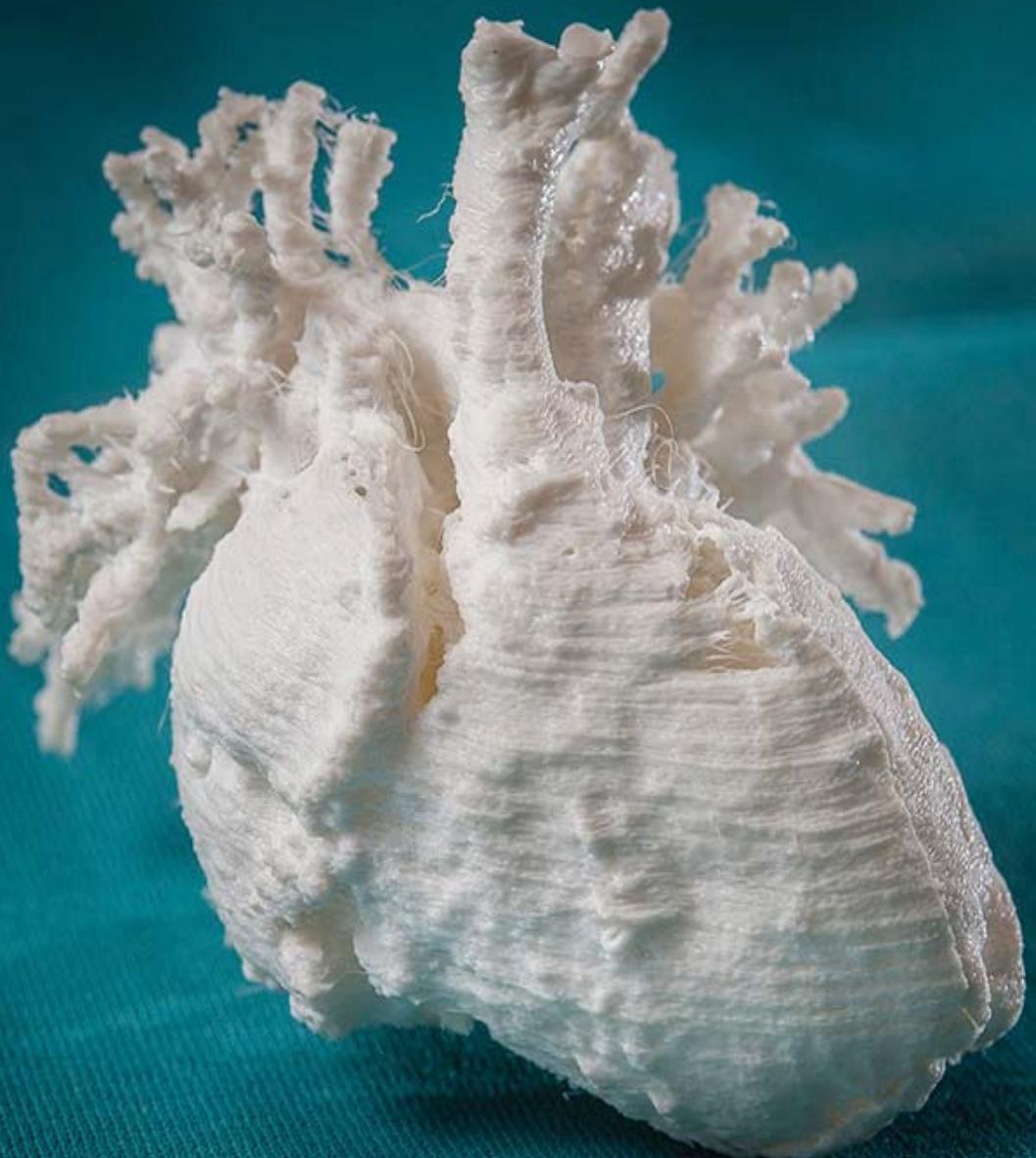
I3D printing opens up a universe of possibilities in manufacturing — from low-cost manufacturing to a lean approach to design and development. This think piece explores the journey of this technology and what it could mean for our future.



Around the turn of the 20th century, manufacturing was perceived as the ‘old economy.’ The new economy seemed like a whole new world, inhabited by enterprises with a digital DNA. However, the onset of the Industrial Internet of Things (IIoT) changed this perception, with binary bits and physical atoms merging to alter the manufacturing landscape, paving the way for a ‘maker movement.’ And at the epicenter of this movement is three-dimensional printing or 3D printing; transforming manufacturing, engineering, industrial design, and hardware. It has the potential to upend industries and

change lives — imagine consumers printing superfoods with a specific calorific value or doctors printing prosthetic limbs to correct deformities!

3D printing is making a dent in niche areas, but not across traditional manufacturing. The trajectory of most technologies follows an uncharted, but predictable journey: The technology becomes mainstream after multiple catalysts encourage its adoption by a critical mass of users. Take for instance, personal computing, whose acceptance was low when it presented itself as an alternative



The scope of 3D printing encompasses objects like aircraft components, musical keyboards, interactive posters, human organs, and much more, such as this 3D printed model of a child's heart.

to mainframe computers. Similarly, at the outset of the electric vehicles movement, electric cars appealed only to a small number of consumers, with the majority of vehicles running on gasoline.

"For me, the 'tipping point' isn't about how many manufacturers have changed, it is about how many minds have. Thanks to more accessible technology, we are now reaching a critical mass of people who, when they think about how things are made, think in a different way. You could say that they are thinking in 3D," says T. J. McCue in the Harvard Business Review. McCue leads the GoExplore3D project, tracking the growth of 3D printing technology in the US.

Also known as additive manufacturing, 3D printing is making rapid strides with the confluence of the Internet of Things, artificial intelligence, big data analytics, advanced simulation and modeling, industrial biology, and quantum computing. The scope of 3D printing encompasses objects like

aircraft components, musical keyboards, interactive posters, human organs, and much more. In fact, 3D printing is even salvaging our heritage: 3,000-year-old Assyrian artworks and Hatra sculptures that were vandalized in the Mosul Museum, Iraq, are being recreated using 3D printing.

The impact of 3D printing has surprised Charles (Chuck) Hull, who invented stereolithography printing and cofounded 3D Systems to commercialize the technology. "Although I expected 3D printing to be embraced by manufacturers, I could never have anticipated how widespread 3D printing is today, or the types of things that people are doing with it. For the past 30 years, we have had the distinct pleasure of watching our innovation spur more innovation," said Chuck, on being honored by the American Society of Mechanical Engineers (ASME).

A digital crossover

3D printers create moving components and can manage a wide range of substances — from recycled materials and rare earth

metals to biological matter. The technology transforms manufacturing by enhancing versatility across various industry segments, including aerospace, automotive, consumer goods, chemical, defense, healthcare, infrastructure, and utilities.

Thanks in large measure to an ecosystem — a network of networks — with near real-time interfaces across products, manufacturing systems, assets, and stakeholders, 3D printing is now a part of the mainstream. Today, it redefines the way consumer and industrial products are designed, developed, and delivered. This technology improves product performance dramatically by supporting new materials, novel designs, and innovative

functionality. It positions organizations at Zero Distance to customers, by facilitating production at the point of purchase / consumption and diluting the advantage of economies of scale.

Distributed manufacturing allows extreme customization and low-volume

production of products. 'Normal,' a New York City-based startup, uses 3D printing to make premium earphones. Customers place an order via an app after sharing images of their ears and specifying their preferred color. The earphones are printed, assembled, and shipped from the Normal office-cum-factory-cum-store in less than 48 hours.

Global manufacturers are adopting 3D printing to simplify production and enhance the quality of their products. GE established the Center for Additive Technology Advancement (CATA) in Pennsylvania to innovate across business lines, including aviation, healthcare, oil and gas, power, renewable energy, and transportation. Today, it has an 'industrialization lab' to optimize 3D designs and simulate production.

Software designs hardware

Data, simulation techniques, and algorithms lie at the heart of additive manufacturing. A 3D printer processes intricate designs from 3D-scanned images and/or Computer-Aided Design (CAD) files and renders it in different

Distributed manufacturing allows extreme customization and low-volume production of products.

materials. The software can be tweaked to personalize the design for a customer or adapt the product to a specific market / requirement. What is more, the agility of 3D printers rationalizes the cost of production, as a single printer can be used to print different objects as well as parts for diverse applications. Boeing uses 3D printing to make components for different aircraft models.

Additive manufacturing accelerates product development by eliminating the dependence on design / product specialists for prototyping. It minimizes the cost for mass customization as well as bespoke offerings. Thus, by leveling the playing field, it minimizes capital investment and mitigates the risks associated with new product launches. More importantly, it encourages product companies to serve niche market segments.

In addition, 3D printing minimizes the complexity in product design and

development. A 3D-printed car has roughly 40 parts, as against 20,000 parts in an assembled car. NASA is exploring 3D printing to generate food for manned space missions in partnership with 'Made in Space,' a Silicon Valley startup. It follows the successful launch of Made in Space's zero-gravity 3D printer at the International Space Station to print spare parts and components.

The concept of 'open design' — akin to 'open source' in software — will be adopted to collaborate for the manufacture of physical products and components. Designs will be co-created and enhanced, ensuring superior and cost-effective products. In several areas, 'open design' will render independently designed products obsolete, a prime example being how Wikipedia is preferred to the Encyclopedia Britannica by users. Shapeways, a 3D printing factory, depends on 'open design,' wherein customers create their own products, seek inputs from experts for unique designs, or select from a curated list of

The concept of 'open design' — akin to 'open source' in software — will be adopted to collaborate for the manufacture of physical products and components.



designs uploaded by users. Shapeways offers over 50 materials, including sandstone and precious metals, to print ordered objects.

A shift in the manufacturing ecosystem

3D printing will create new paradigms in manufacturing. It will disrupt traditional methods and provide business opportunities to early adopters. Further, the technology will change the character of the manufacturing landscape and its extended supply chain in the following ways:

- Distribution centers may become obsolete, as it makes more economic sense to facilitate production powered by 3D printing as close as possible to the place of consumption
- 3D printing lowers the entry-level barrier in manufacturing by avoiding huge capital investments. It could spur the emergence of a new breed of manufacturing enterprises, similar to the Internet, creating a new genre of companies like Amazon
- The process of manufacturing will become more agile. One 3D printer can manufacture a diverse range of products, ranging from an aircraft part to an automotive component
- Manufacturers can achieve a high level of customization for each product. The concept of 'engineer to order' will become mainstream in manufacturing
- Crowdsourced design or 'open design' will pave the way for better quality products. GE is collaborating with Snecma S.A., a French aircraft and rocket engine manufacturer, to develop fuel nozzles for jet engines through additive manufacturing. The printed fuel nozzle is lighter and more durable than the manufactured version
- A new breed of collaborative enterprises will emerge with the mass adoption of 3D printing. For example, 3D Hubs, an online 3D printing services platform, connects 3D

printer owners with customers. The network offers services in more than 20,000 locations around the world. Engineers and designers choose service providers based on their proximity and specific materials. The forum enables owners of 3D printers to maximize their capacity utilization, while providing access to 3D production

Green by design

3D printing inherently has a modest carbon footprint as it consumes less energy. At the same time, it ensures above-par product quality and productivity. Manufacturers can ensure sustainability across the product life cycle (from extraction of raw materials to disposal of the used product) and safeguard the environment as well as community health.

3D is taking another big leap towards 4D printing, a term coined by Skylar Tibbits, director of the Self-Assembly Laboratory at the Massachusetts Institute of Technology.

In conventional subtractive manufacturing, approximately 80 percent of the material is machined out. Additive manufacturing offers a leaner alternative, by depositing the exact amount of material required, thereby ensuring zero wastage.

Additionally, green and low-cost materials can be used as feedstock for printing. WinSun Decoration Design Engineering Co., a Chinese construction company, used a mixture of recycled construction waste, cement, and fiber glass to 3D print multi-storeyed buildings.

Logistics and after-sales services are set to be transformed by on-demand manufacturing. Product companies may not require regional warehouses, distribution centers, and stockists. In-house 3D printers and printing service providers may replace subcontractors and suppliers of parts and accessories. Transportation and inventory costs may become insignificant in the on-site manufacturing supply chain.

The next orbit of 3D

3D is taking another big leap towards 4D printing, a term coined by Skylar Tibbits, director of the Self-Assembly Laboratory at the Massachusetts Institute of Technology.

It involves printing objects that respond to stimuli such as impact, temperature, and moisture. Research in self-transforming printed products may culminate in the wings of an aircraft adjusting to aerodynamic conditions, or shoes shrinking and soles responding to the wearer's gait.

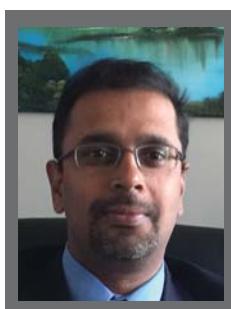
While advances in digital and computing technology have shone a light on 3D printing, the shop floor requires reinvention in order to successfully and efficiently assemble 3D-printed parts. "It takes a long time to get all of the functionality into the system, at a level of robustness and availability that people expect in traditional subtractive equipment; but again, that is just the normal growth and learning phase of any new technology," says Roger England, director of materials science and technology, technical quality, and intellectual property at Cummins Inc., in an interview with the American Society of Mechanical Engineers (ASME).

In a landscape of seismic changes, manufacturers need to address some

fundamental questions such as:

- What are the implications of product safety when you deliver digital designs and not the end product? Which party / stakeholder is responsible for the warranty of the product?
- Would a manufacturer perceive itself as an assembler rather than a manufacturer in the future? Will the factory of the future be an assembly line for 3D printed parts?
- What are the business implications of delivering digital designs rather than products? Should manufacturers adopt the publishing industry model of a major print run of 3D parts or print on receiving orders?
- How do manufacturers create an ecosystem for design collaboration within and beyond the enterprise?
- What should be the focus areas of investment – building the ecosystem, or reinforcing manufacturing capabilities?

About the Author



N. Vijay

Head — Manufacturing Practice, Infosys (Americas)

Vijay is the regional head for the Manufacturing Practice in the Americas. He has been with Infosys for 19 years and is responsible for enhancing the capabilities of the manufacturing sector. For over ten years, he has been involved with the Manufacturing Practice and has been a keen observer of the trends in that sector.

In addition, he has also led the discrete manufacturing and specialty automotive portfolio at Infosys.

LEARNING TO BE MORE HUMAN: A SKILLS MANDATE FOR 2020

There is a tectonic shift in the hiring landscape, with employers set to favor ‘human’ skills like creativity over process-oriented skills like quality control. We explore its potential effects and how organizations can respond to this new paradigm.



The services industry is undergoing a radical, under-the-radar transformation of its skills and capabilities. Amid the market changes triggered by the Fourth Industrial Revolution, we are witnessing a notable shift in skill-priorities as the line between the roles of people and technology in organizations continues to blur.

This is more than just an observation. In its ‘Future of Jobs’ report, published in February, 2016, the World Economic Forum (WEF) detected a change in the skills requirements of the digitally-enabled service economy as follows:

Top 10 skills	
In 2020	In 2015
Complex problem solving	Complex problem solving
Critical thinking	Coordinating with others
Creativity	People management
People management	Critical thinking
Coordinating with others	Negotiation
Emotional intelligence	Quality control
Judgement and decision-making	Service orientation
Service orientation	Judgement and decision-making
Negotiation	Active listening
Cognitive flexibility	Creativity



The shift in required skills is a reflection of the growing autonomous role that technology will have in the next few years.



While the two lists look similar, the few differences between them are critical to changing the job market over the next few years. Amid constants such as 'complex problem solving' and 'people management,' we see skills like 'quality control' (number six in the 2015 list) and 'active listening' (number nine in the 2015 list) — which are currently in demand — becoming far less important by the end of the decade. On the other hand, by 2020, skills such as 'emotional intelligence' (number six in the 2020 list) and 'cognitive flexibility' (number ten in the 2020 list) are expected to be far more critical to business needs. This shift in required skills is not about developing new capabilities in order to use technology, but rather a reflection of the growing autonomous role that technology will have in the next few years.

Rather than devaluing the importance of quality control, the WEF data reflects the increased role

of machines and technology in dealing with quality control functions autonomously, with artificial intelligence enabling self-diagnosis and self-healing. Companies are veering away from paying humans to perform 'checking' and 'fixing' functions now that they can be reliably and efficiently handled by machines.

Similar scenarios apply to skills like 'active listening.' Companies now realize that listening must be paired with the appreciative and empathetic responses that characterize emotional intelligence, rather than being a skill in isolation. Future service delivery will require a combination of physical behavior (listening), intellectual activity (analysis and problem solving), and on-target emotional response to be truly effective and to help companies stand out from the crowd.

Superior service demands agility, which is why we are seeing 'cognitive flexibility' emerge as a top 10 skill for 2020. Who hasn't been infuriated by a call center agent who seems capable only of reading a script, rather than answering your specific question? The user experience all of us now expect is an on-demand, personalized, and conversational one. Service providers must be able to think on their feet and seamlessly shift gears

Superior service demands agility, which is why we are seeing 'cognitive flexibility' emerge as a top 10 skill for 2020.

between intellectual activities and possible solution sets.

While some industries are rising to the challenge, it is not enough. These are not skills that can be easily taught in a classroom, let alone online. They require on-the-job training in order to establish context and real-world cognitive responses. Shrinking training budgets are mostly targeted at issues of scalability, speed, reusability, and automation in learning programs. These are good attributes, although not conducive to developing deep, compound, multi-faceted, experiential skills such as emotional intelligence and cognitive flexibility. Millennials have extremely short attention spans for in-depth training, and most new technologies are so intuitive that they eliminate the need for it. Consequently, companies are getting rusty in developing and delivering complex, in-depth training curricula.

Collectively, we are now finding innovative solutions to our tactical training needs. Today, we use 'Massive Open Online Courses' (MOOCs) to enrich our employees' knowledge, gamification to drive near-term tactical changes, and even artificial intelligence to power interactive online content with many of the same attributes as personalized instructor interaction. However, things like emotional intelligence or cognitive flexibility are closer to a 'practice' than a skill and so require a degree of instinctive reaction or 'muscle memory.' They are built through successive cycles of insight, application, feedback, and internalization.

A current Infosys learning program for a similarly complex area — Design Thinking — offers some ideas on how to achieve this in organizations. Like emotional intelligence or cognitive flexibility, Design Thinking requires a shift in personal mindset alongside retraining conditioned responses. It insists that before rushing into problem-solving, we pause to reflect on and explore the real needs and emotions of users. This is so that we can approach the designing of solutions from a human-centric angle, rather than a process, technology, or financial one. It also requires

us to abandon our fear of failure and criticism, and open ourselves up to successive cycles of prototyping, testing, and feedback. This, in turn, allows us to optimally tune a solution to the real-world needs of the target user.

It is a complex, compound skill that combines listening, empathy, creativity, facilitation, prototyping abilities, and more. It is also something that Infosys has trained over 100,000 employees in, over the past 18 months. We have not only taught them how to complete a design exercise, but also sought to reframe their entire approach to problem-solving and client interaction. Doing this called for a combination of face-to-face instruction, continuous on-the-job practice and application, and creation of a supportive and reinforcing environment.

Design Thinking has enabled our organization to remove internal roadblocks, improve client service, identify new technological innovations, and help clients improve their own agility and innovation. We believe this four-part approach — involving instruction, practice, ongoing application, and creation of critical mass in a supportive environment — is essential to building this complex skill. A similar approach is necessary when organizations tackle the development of emotional intelligence or cognitive flexibility skills.

On a final note, we see one other fascinating influence on the development of deep, compound skills —mindfulness. It inherently helps develop intellect, emotion, self-reflection, curiosity, openness, and other attributes, all of which fuel emotional intelligence and cognitive flexibility. A decade ago, the topic of mindfulness was reserved for a spiritual or meditative practice. Today, there are entire conferences dedicated to mindfulness in business, and mainstream companies are investing in introducing mindfulness training in their organizations. Google, LinkedIn, Facebook, Aetna, Ford, Eileen Fisher, Twitter, Slack, and Kaiser Permanente, for starters, have all spoken publicly on this topic and on the positive impact it has had on their organizations. These companies alone showcase the mainstream nature of mindfulness in modern business.

The top 10 skills the workforce and employers require as we approach 2020 are not in the realm of technology. Instead, they reflect the need for better interaction between people. It's a great time for all of us in the world of business to rethink how we will develop the complex, compound skills required to meet customers' rising expectations on service and user experience, and to support our employees in building them.



By 2020, among the key 10 skills will be 'emotional intelligence' (number six in the list) and 'negotiation,'(number nine in the list) both of which are expected to be far more critical to business needs.

Saadia Zahidi

Member of the Executive Committee and Head of Education, Gender and Work Initiatives, World Economic Forum, Geneva

“ Regardless of the job you are in, expect to face pressure to constantly modify your skills. Across nearly all industries, the impact of technological and other changes is shortening the shelf-life of employees' existing skill sets. What's more, in this new environment, a change in business model often translates to a disruption in skill set almost simultaneously and with a minimal time lag. Even jobs that will shrink in number are simultaneously undergoing change in the skill sets required to do them. On average, by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job today. In addition, technical skills will need to be supplemented with strong social and collaboration skills. The pace at which this evolution is progressing will require everyone to adopt a new training mindset, requiring to upskill or reskill through lifelong (continuous) learning. **”**

About the Author**Holly Benson**

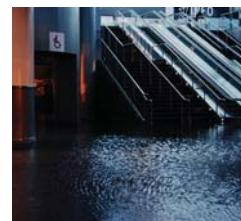
Vice President and Managing Partner, Infosys Consulting

Holly brings the scientist's curiosity and observational skills to the world around her. She uses her interactions with some of the world's leading corporations — and their work forces — to form fresh and intriguing insights on education and skills. After 25 years of work in the consulting domain, she remains a hands-on practitioner who helps clients deal with people and organizational implications of agile enterprises and changing business models. Her forte is to deliver learning programs for Infosys and its clients. Holly is now bringing this perspective to the World Economic Forum, as a steering committee member of their Global Future Council System Initiative on education, gender, and work.

If you wish to share your thoughts on this article or seek more information, write to us at Insights@infosys.com

NAVIGATING THE DIGITAL JOURNEY IN INSURANCE

As various industries reap the benefits of digital transformations, the insurance sector needs to adopt technology as a hedge against ever-increasing risks. In this article, we explore why insurers need to turn to data and analytics to not only stay afloat, but also meet the rising expectations of consumers.



The insurance industry safeguards diverse assets and covers multiple risks, including oil and gas facilities in the deep sea, subsurface structures in megacities, employees and cyber systems of digital enterprises, commodities and perishables in transit across continents, and the reputation of risk managers.

The risk quotient, however, increases exponentially with the meteoric rise in population and economic activity, and the corresponding impact on the environment and society. In addition, stringent solvency regulations, low-yield assets, penalties for negative spread, and fierce competition only increase the odds for the insurance

industry. In such a scenario, global insurance companies can reduce their liabilities by adopting a holistic approach to investment structures. While insurance enterprises can redeploy capital based on risk-adjusted metrics, cross-border hedging and treasury management strategies still carry risks.

In such situations, digital technology allows insurers to transform core systems by offering innovative solutions for unforeseen risks. It helps enterprises keep pace with the social, technological, environmental, economical, and political landscape by anticipating requirements and identifying opportunities in real time. Seamless connectivity, automation,

Simulation models facilitate risk evaluation, which helps insurers offer adequate coverage and to better serve high-risk segments. Advanced modeling helps forecast diverse risk scenarios, from damage due to faulty plumbing in a high-rise building to production shortfall in a wind farm.

and data analytics alter the entire insurance value chain, which comprises products, underwriting, distribution, and claims management, across both personal and commercial lines.

Insurance as a commodity

Price cannot be the only differentiator in insurance. Unlike comparison shopping for books, shoes, and phones, a policy is not a standardized product that can be easily compared before making a purchase decision. Risk protection requirements vary from one individual / business to another. Moreover, due to differences in liability categories, deductibles, exclusions, restrictions, riders, and claim settlement practices among insurance carriers, insurance cannot be commoditized. Yet, customers accustomed to the convenience of online comparison shopping expect insurance quotes to be offered à la carte.

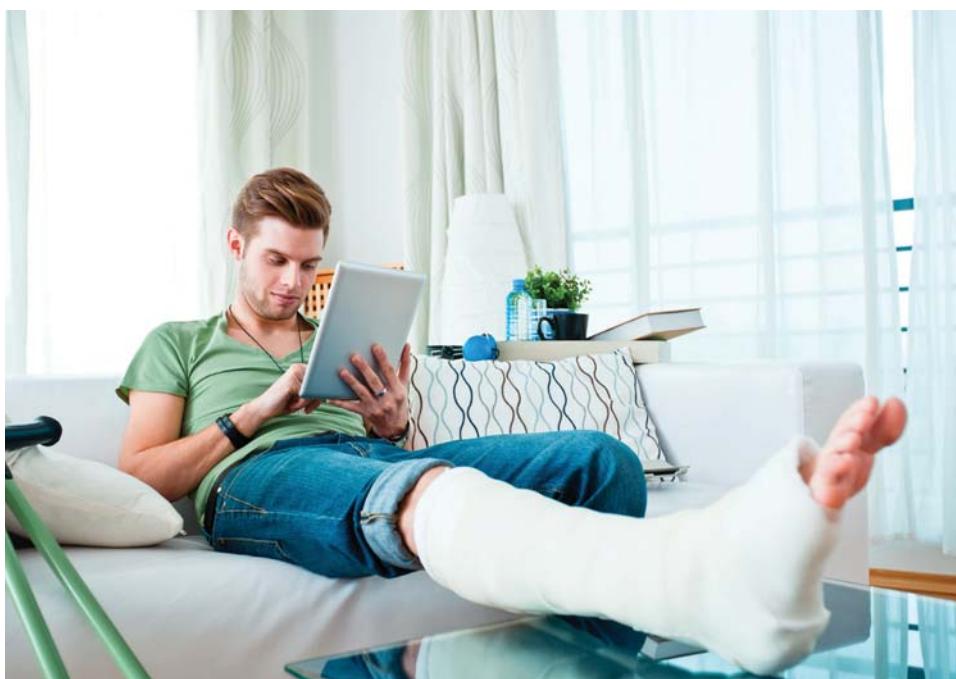
Digital channels help insurers offer a premium vis-à-vis cost of risk-mitigation comparison to help customers make informed decisions. It is not a good practice to strip down insurance products to accelerate the quotation process or gain a price advantage. A denial of claim due to insufficient coverage will incur a prohibitive cost for the insurer as well as the insured. Further, millennials share their

experiences on social channels without the back story, only adding to insurers' woes. Digital channels should thus save them effort, time, and money while providing customers with visibility into service levels. Every policy must fulfill its objective: Ensure adequate protection and facilitate smooth settlement. Consequently, purchase of an online health or auto insurance plan can mimic grocery purchases from Walmart.

Smart agents as underwriters

Claims transformation programs powered by automation tools and intelligent bots can raise the bar in customer experience. Bots will eventually eliminate middlemen — such as insurance brokers and independent agents — who are quickly being made redundant by the do-it-yourself millennial generation. Significantly, digital intermediaries rationalize costs, reduce turnaround time, and boost efficiency across the underwriting, premium collection, and claims settlement processes.

Smart agents can be integrated with big data analytics and social media in order to enhance marketing and sales. Chatbots blend contextual content with artificial intelligence to enhance customer service through meaningful voice conversations, instant text messaging, and proactive content distribution.



Automated processes and seamless collaborations ensure 'Zero Distance' to the customer. However, such disintermediation shifts the responsibility of brand building and marketing to the insurance carriers. The online product suite should address the broad spectrum of insurance needs, engage customers who 'search' for products, share comprehensive information to replace advice from agents, and enable equitable comparison to close a new policy. For customers who prefer interactions with agents, enterprises should enhance the independent agency model with a digital sales ecosystem for real-time collaboration.

Insurance as a service

The combined use of telematics, sensors, global positioning systems (GPS), and digital devices enhances the value of insurance products. Connected homes with smart security solutions benefit from lower rates on policies as well as prompt service in the event of a security alert. Progressive Corporation, National General Insurance, and several other leading auto insurers offer behavior / usage-based insurance products that reward safe driving and low usage. Real-time monitoring of vehicles minimizes the risk of theft and ensures swift response to accidents. Further, the social benefits of pay-as-you-drive auto insurance include fewer accidents, less traffic congestion, and reduced carbon emissions.

Digitization is unleashing new business models and products that redefine service. Swiss Re collaborates with local insurers and the Syngenta Foundation for Sustainable Agriculture (SFSA) to provide index-based weather insurance coverage to farmers in Kenya and Rwanda. The project, funded by the International Finance Corporation, offers insurance as a business service to marginal and large farms by using weather stations for automatic claims disbursement. The agriculture micro-insurance model covers inputs as well as harvests of crops. Weather

data from monitoring stations is used to determine insurance payouts during a crop failure caused by excessive rainfall or drought. Payment is made via a mobile transfer service without farm visits.

Data as an asset

Risk managers and insurance professionals need visibility into risk characteristics, claims statistics, and emerging threats, in order to target customer micro-segments, accurately underwrite policies, and effectively manage claims. To this end, the Internet of Things, social platforms, and mobile apps accumulate and disseminate contextual information. Additionally, real-time data feeds from a digital ecosystem provide visibility into potential risks, which pave the way for a superior customer experience across the insurance life cycle — initial research, moment of purchase, and settlement.

Data-oriented enterprises collect demographic, behavioral, asset, location, and other types of information in comprehensible formats, and provide interfaces to consume / monetize this data. Digital insurers become more responsive by listening to customers. For instance, a mobile application from Progressive Insurance uses a digital format of a driver's license to generate an auto insurance quote for policy seekers. Several insurers leverage apps to

improve auto claims management; wherein policyholders initiate the claim from the accident site by uploading photos on the spot. In addition, drones are now being used to accelerate the assessment of damages when site visits by an appraiser are unsafe or time-consuming.

The Internet of Things, social platforms, and mobile apps accumulate and disseminate contextual information, while real-time data feeds from a digital ecosystem provide visibility into potential risks.

Analytics as a catalyst

Analytical tools capitalize on the customer's digital trail — such as telematics apps, connected home devices, health-monitoring wearables, spending patterns, and social interactions — to generate real-time risk profiles. Credit risk scores help insurance

companies determine liability limits and deductibles, and pre-approve plans. Moreover, accurate risk assessments help insurers offer discounts and bundle requirements / products to minimize the cost of coverage.

Predictive analytics platforms connect the dots between diverse data sources to anticipate risks, including fraudulent claims. For example, data from a telematics device plugged into a car monitors driving data, while also transmitting its location data. Analytical solutions integrate this data with information from other sources, such as healthcare records and traffic monitoring systems, to identify and prevent processing of false claims.

Simulation models facilitate risk evaluation while minimizing dependence on old claims records. This helps insurers offer adequate coverage and to better serve high-risk segments. Advanced modeling helps forecast diverse risk scenarios, from damage due to faulty plumbing in a high-rise building to production shortfall in a wind farm. Most importantly, it prevents overselling, especially

in health insurance. Brokers often pitch wrong plans or oversell coverage. Insight-driven pricing models make use of an applicant's data and consolidated statistics to rationalize the cost of personalized healthcare plans.

Big data analytics helps configure products with benefits that transcend policyholders and financial criteria. Insurance solutions that align premium rates with a customer's driving history, lifestyle, well-being, and energy efficiency help achieve socio-economic goals through investments in wellness products, hybrid vehicles, green buildings, energy-efficient industrial equipment, and renewable energy.

The insurance industry lags in digital adoption. Digital tools are not used uniformly across business functions and lines of business. A digital transformation will help insurance carriers bundle products with an added layer of experiences, configure new forms of coverage for emerging risks (including self-driving fleets and cybercrimes), stave off competition from non-insurers and peer-to-peer insurance companies, and stabilize industry growth.



Digitization is redefining services, such as Swiss Re collaborating with local insurers and the Syngenta Foundation for Sustainable Agriculture (SFSA) to provide index-based weather insurance coverage to farmers in Kenya and Rwanda.

About the Author



Pankaj Kulkarni

VP and Global Head, Insurance, Infosys

Pankaj heads the Infosys business for insurance, focusing predominantly on clients based out of the Americas and Europe, and is a part of the Executive Council for the Insurance, Cards, and Payments Group within Infosys. Pankaj anchors the senior stakeholder relationships for these clients and leads multiple account teams to deliver on the client transformation agenda.

He has been involved in setting up transformation programs and partnering with senior executives to deliver on tangible business outcomes. He has in the past also led the Capital Markets practice in Europe and has been involved in developing innovative solutions for the business.

And he has worked extensively in the financial services and insurance industry, on various initiatives like client onboarding, organization structure and governance, business / IT alignment, process redesign, and business transformation.

Previously, Pankaj has personally delivered critical business transformation initiatives in large organizations and has been consulted by a number of senior executives on transformation-related challenges. He has been contributing to thought leadership and innovation through numerous white papers and various speaking engagements around the world.

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REINVENTING CAPITAL INVESTMENTS

As startups and corporates seek out partnerships that transcend monetary funding, we take an interesting, by-the-numbers look at how the investment landscape has evolved over the years to become largely symbiotic.



In a recent report, titled 'Finding and Developing Partners of the Future,' Forrester Research had some compelling advice for corporate venture funds. It stated, "Considering the rate at which new tech accelerators keep cropping up — and the fact that small and medium-sized businesses (SMBs) have long been the engines driving economic growth — tech vendors would be remiss not to proactively recruit these new entrants into their partner ecosystems."

Still, several tech companies that make this investment, choose to buy an equity stake in a startup with the intent of selling it off, or use the smaller company's technology to

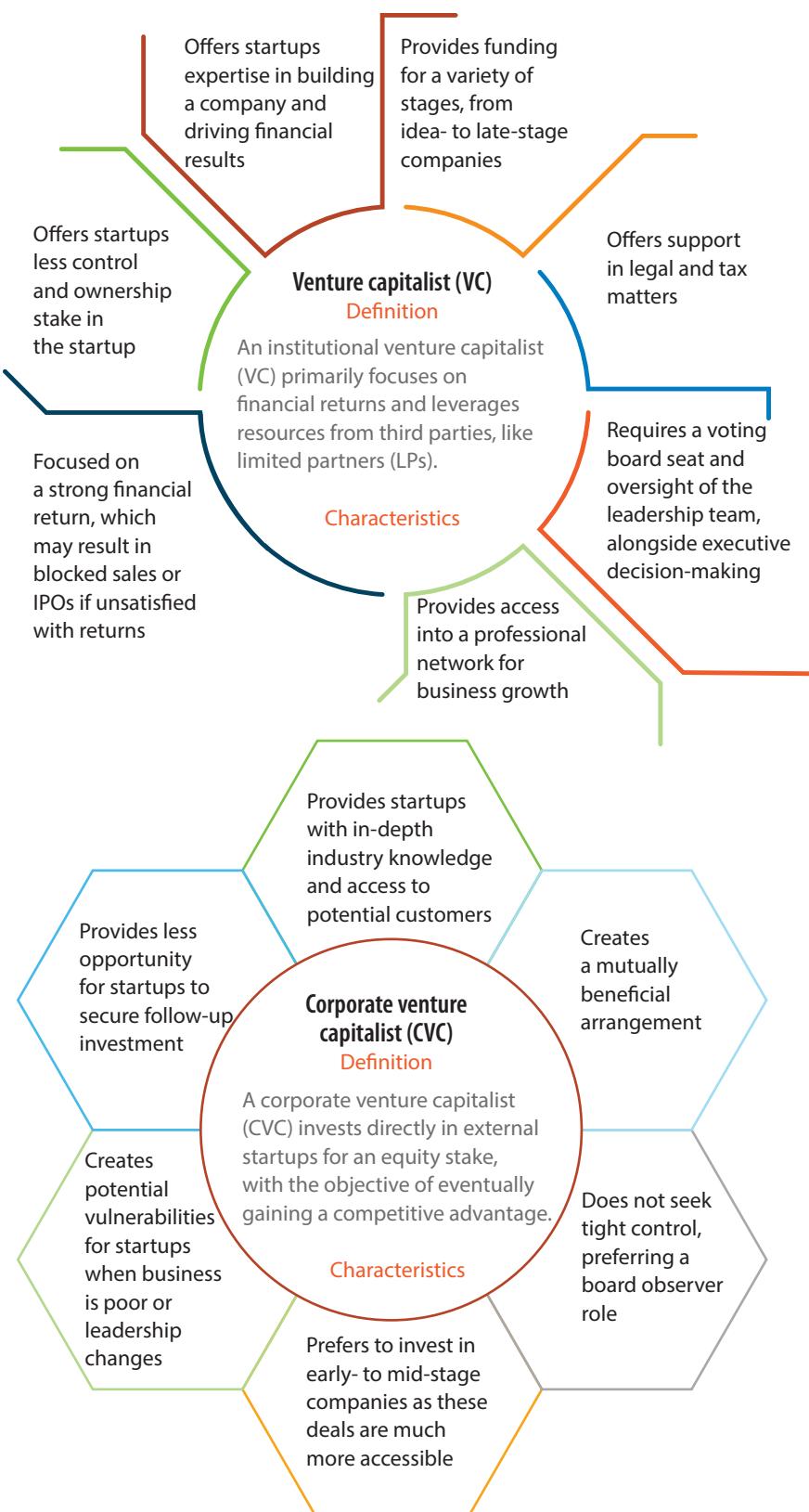
gain a competitive advantage in the future. However, another model called 'Partner Venture Capital,' in which the parent company invests in a startup with the intention of using the startup's technology immediately to build out their own stable of offerings and within their existing work, is emerging as a partnership that has long-term benefits. With VC-backed funds slowing, compared to last year, startups in search of greater exposure and momentum with new, established customers are seeking out experienced technology partners that can go beyond funding and offer engagements with clients that can benefit from their solutions.

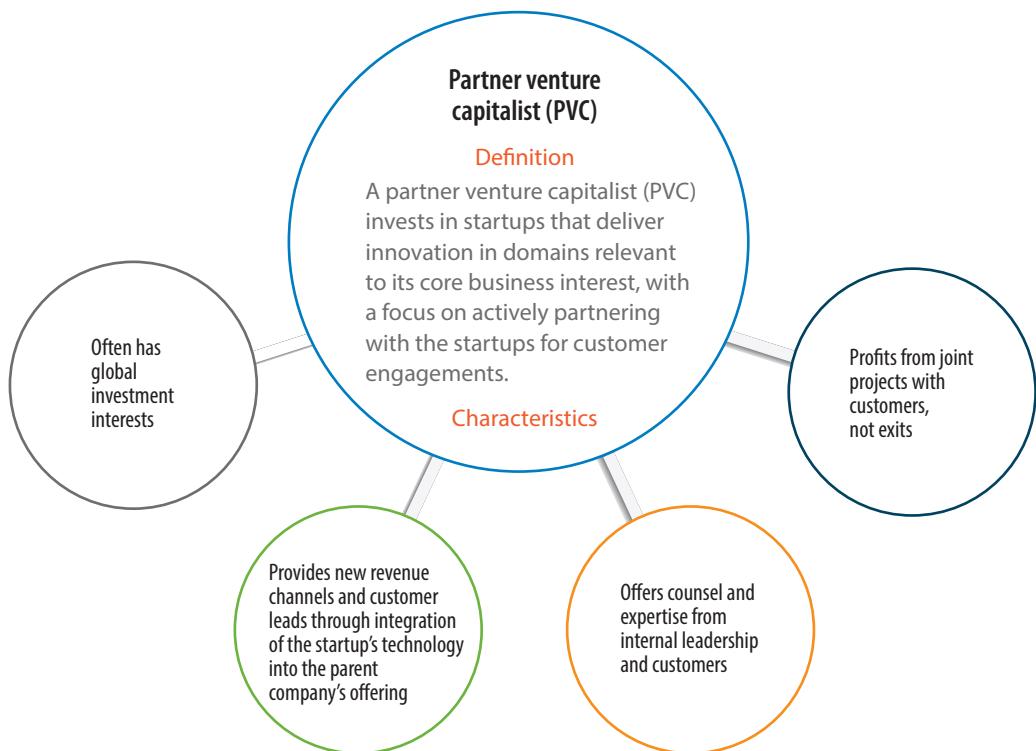


In the 'Partner Venture Capital' model, the parent company invests in a startup with the intention of using the startup's technology immediately to build out their own stable of offerings.



Defining the investment models

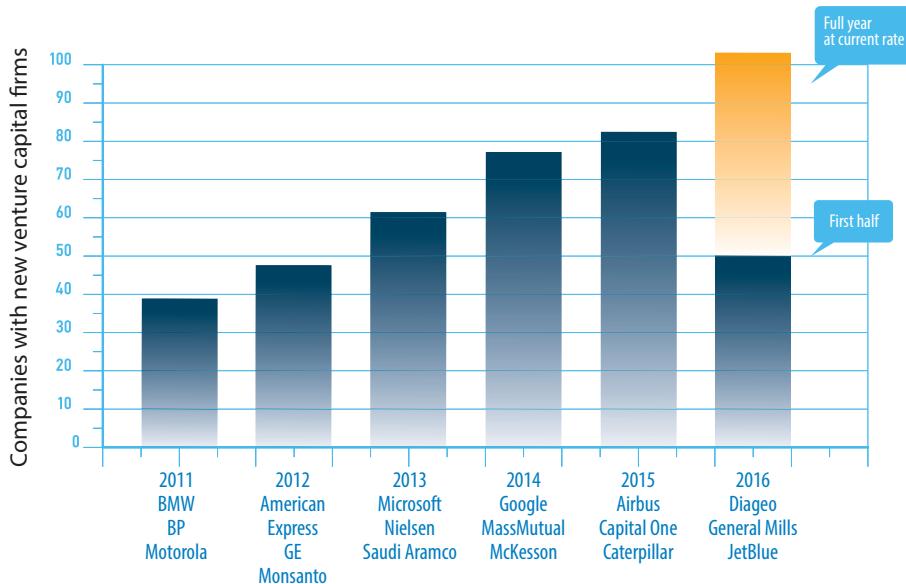




Data to tell the story

The new VCs

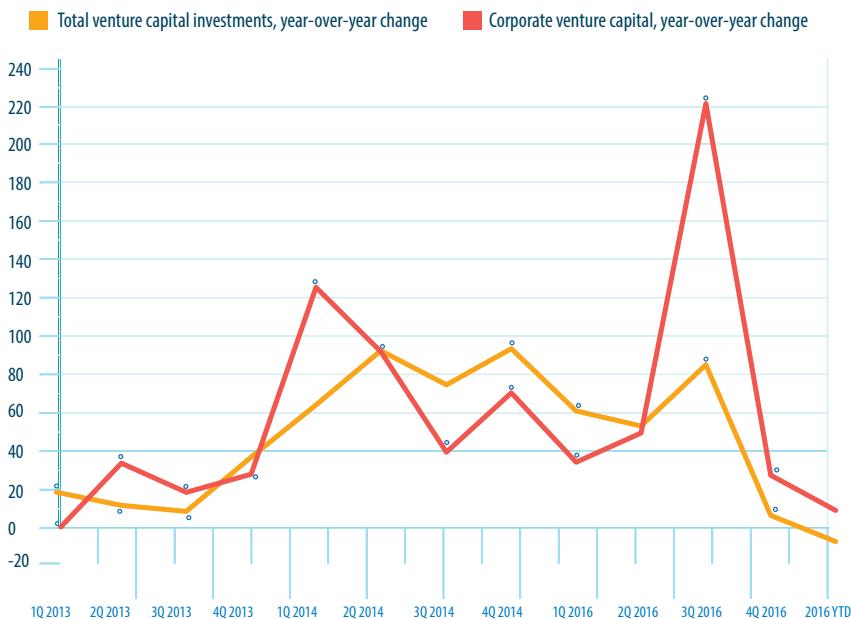
The number of new corporate venture capital units has steadily increased over the past five years



Source: CB Insights

Split opinion

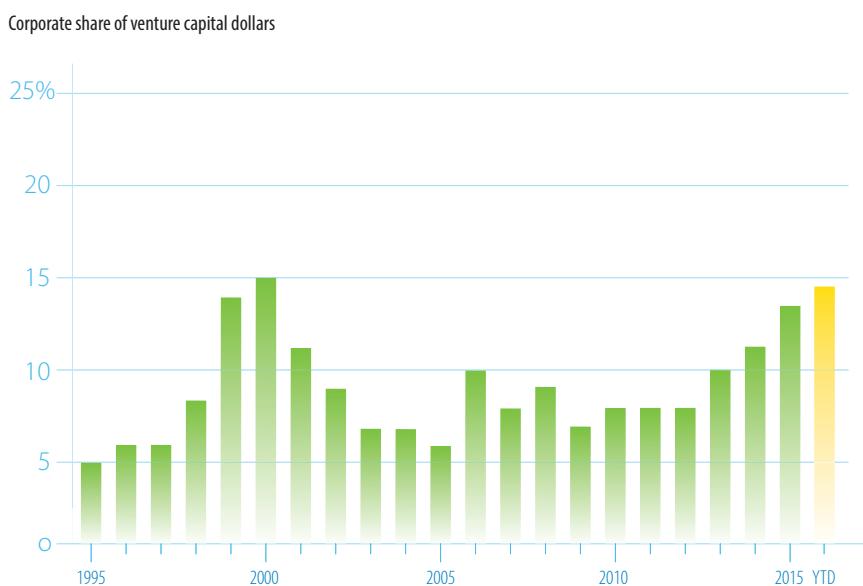
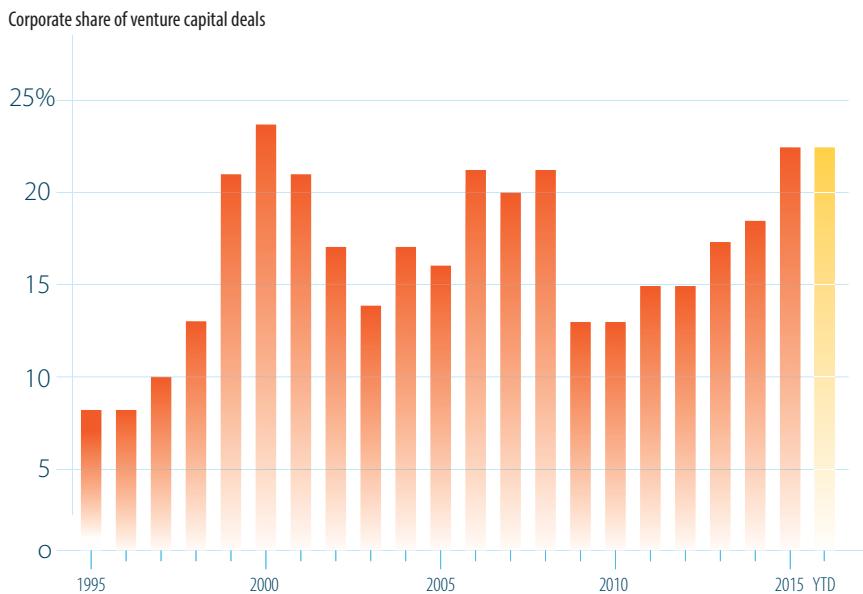
Investments in startups have slowed from 2015. But corporate money continues to flow into startups.



Source: CB Insights and KPMG International

Corporate checkbooks

Not since the dotcom era have companies and their investment funds been such big participants in funding startups.



Note: YTD includes deals from the first half of 2016.

Source: National Venture Capital Association

Source: www.bloomberg.com

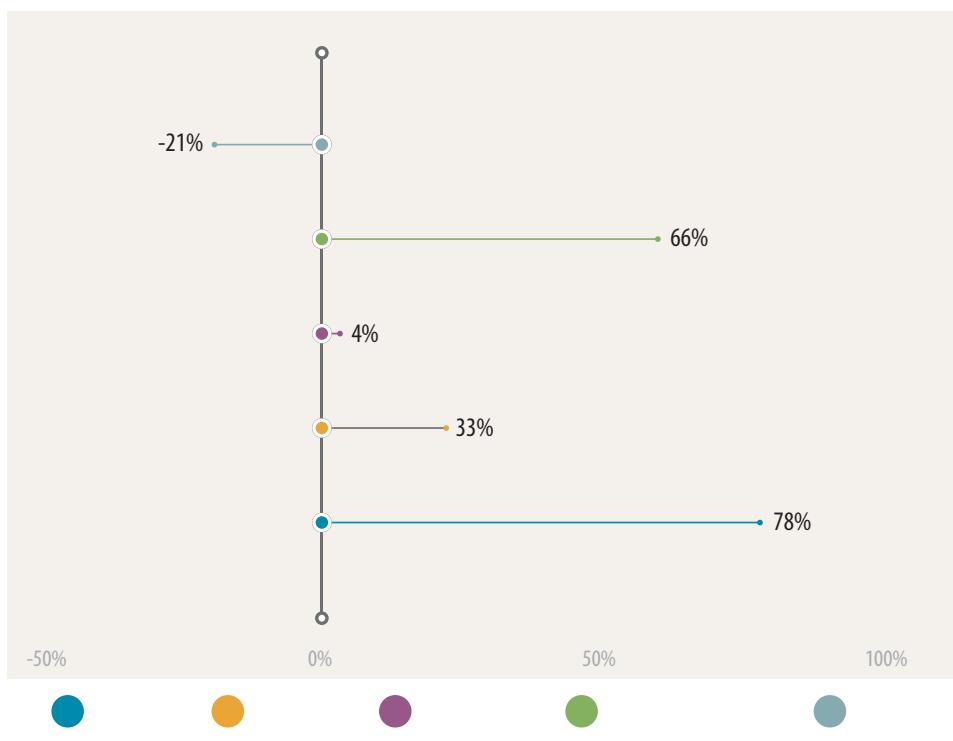
"As evidence of this shifting IPO climate, the total number of new stock debuts this year remains the lowest since 2009, according to data from the Wall Street Journal and Dealogic. Just 63 companies had gone public as of late August, raising a cumulative US\$12.9 billion. That's a 50% drop from the year-to-date volume in 2015 and a 73% drop over the first eight months of 2014. In fact, there have only been two slower years for IPOs since 1995 – in 2003 following the dot-com crash, and in 2009 right after the Great Recession."

Source: www.venturebeat.com

"While many startups used to rely exclusively on venture capital firms to provide funding, the amount of VC firms in existence has dropped substantially in recent years. In fact, according to the study, private venture capital firms have fallen over the last decade, representing the only type of investor that has seen a decrease in that time."

Most investor types have seen growth in numbers

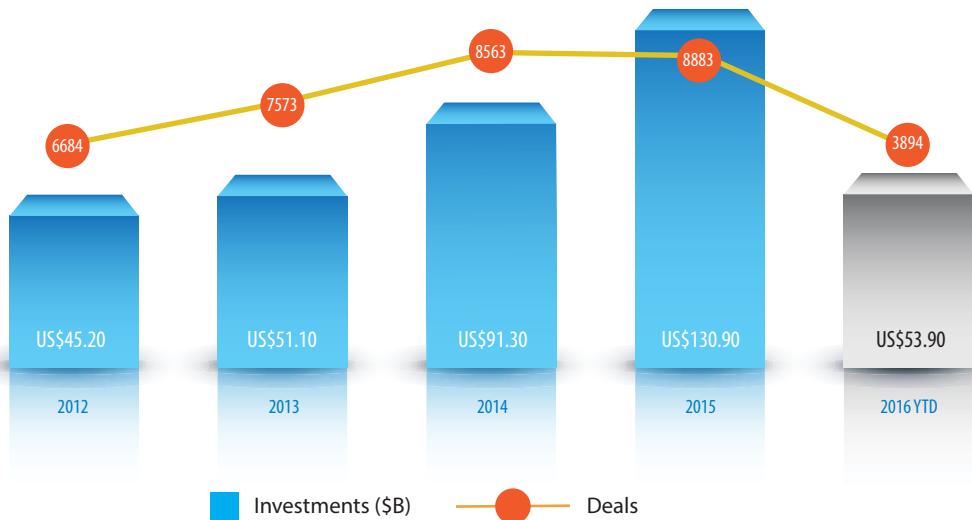
Change in the number of investor startup companies from 2004–2013¹, %



Source: www.tech.co

Annual global financing trends to VC-backed companies

2012–2016 YTD (Q2 '16)

**Source:** CB Insights

By an Infosys contributor

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INFOSYS AND WATERLINE DATA DEMYSTIFY BIG DATA FOR COMPANIES

What's in a data lake? Lots of data, to be sure, and lots of potential to make better decisions, increase sales, improve efficiency, and reduce risk.

Big data is only getting richer, which means enterprise data lakes are getting deeper and becoming more complex. Yet, if you ask a Chief Data Officer how easy it is to find a data set in a data lake, you may not get a satisfactory answer. That's because, while big data assets are growing and are tremendously valuable, most organizations haven't spent enough time or resources figuring out how to effectively catalog that data in order to make it easier to discover and analyze.

There's a hard truth facing organizations: As data lakes grow, it gets harder to find, share,

and trust the data they own.

Companies don't know their own data. We recognized that this would be a growing pain point within enterprises when we formed our company, Waterline Data, based on a technology that helps companies to automate the cataloging and governance of their data. Our Smart Data Catalog automatically scans and categorizes millions of fields of data in the data lake, making it accessible so that any user can find the right data set to use for their analytics.

This problem of finding a data set has existed in enterprises for years. It often takes new analysts months, or even years, to understand whom to ask about what data, much less to know and understand all the data themselves.

There's a hard truth facing organizations: As data lakes grow, it gets harder to find, share, and trust the data they own.



There is simply no way to remember what millions of fields of data mean or to manually classify and document them. At Waterline Data, we believe applying automation and machine learning to the problem is the only viable solution.

Instead of leveraging ‘tribal knowledge’ and finding people to ask, Waterline Data’s Smart Data Catalog provides people a way to ‘shop’ for data, mirroring an online shopping experience.

Despite recognizing that automating and categorizing big data assets and bringing self-service to data lakes is a critical need, many enterprises are simply not prepared to take on this challenge all by themselves. They look for trusted partners like Infosys for guidance, methodology, and implementation help. There is simply no way for Waterline Data to scale up quickly enough to provide this support to customers.

This represents a void between need and innovation.

I believe Infosys is ahead of the curve, in that it has identified this gap and is partnering

with us to introduce our innovative data science solution to its clients. The mature relationships and domain knowledge of Infosys mean that the company has the ability and the trust to recognize when Waterline Data could help.

Our partnership means that Infosys clients themselves aren’t forced to search the vast data technology landscape for something that might fit their company’s requirements. Rather, they can rely on Infosys to integrate Waterline into their existing work and begin solving real problems immediately.

Working together, we help companies understand what’s possible in empowering their use of metadata and ushering in self-service to big data. While Infosys brings the value of experience in deploying the methodology, Waterline provides the unique, cutting-edge technology.

The end result of the relationship is a client that is much more capable of accessing and browsing big data for insights, alongside the elimination of the time and resource gap between a need and the solution.

About the Author



Alex Gorelik

Founder and CEO, Waterline

Alex has worked with data for more than 30 years, helping companies around the world figure out where their data is and what it can tell them. His goal is to help companies understand that they don’t truly know their data, and then help solve that problem. At Waterline Data, he’s bringing automation of cataloging and governance to big data, which means companies can locate the data they need faster and spend time on bigger problems. Alex has spent his career building and bringing to market innovative data-related technologies and starting successful companies.

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RESEARCH UNRAVELED

INNOVATION FUELLED BY RESEARCH AND DEVELOPMENT IS INTEGRAL TO THE MAKING OF A SUCCESSFUL ENTERPRISE. THIS EXPLAINS WHY ESTABLISHED MARKET LEADERS AND ENTHUSIASTIC STARTUPS ALIKE ARE INVESTING IN THE CURRENT TRENDING TECHNOLOGY – ARTIFICIAL INTELLIGENCE (AI).

EMBRACING AI IMPLIES MOVING BEYOND ALGORITHMS AND DATA SCIENTISTS. THIS SECTION DISCUSSES SEVEN ESSENTIALS THAT ARE REQUIRED TO CATALYZE A NEW WAVE OF AI-DRIVEN SMART SERVICES.





SEVEN ESSENTIALS THAT WILL PROPEL AI FROM FANTASY TO REALITY

Artificial intelligence (AI) has not only captured the imagination of the masses, but also the unflinching attention of enterprises the world over. This article explains why AI is now the go-to technology for businesses and the seven factors crucial for any AI initiative to succeed.



Perpetually wary of market disruptions, and in their quest to maintain a competitive advantage, board rooms and CXOs of Market Leader and Fast Follower brands across the world have rushed to artificial intelligence as the next big bet. By virtue of being early adopters of / adapters to disruptive business models and technologies, Market Leader and Fast Follower brands not only command the largest share of the market, but that of profits as well. They are the big boys or leaders of their segments, categories. — think Apple, Google, or even Tesla.

Market leaders tend to adopt a 'go-it-alone' strategy, while Fast Followers are open to co-innovation and co-creation. Fast Followers are

also reactive and wait for the market leaders to take a position, before jumping in.

According to Constellation Research, though these leader brands are yet to achieve the full potential of mass personalization (market segmentation of one), their next rush is focused on investments in artificial intelligence use cases and pilots, and in establishing 'co-create' or 'co-innovate' partnerships with vendors. Their initiatives in AI's subsets of machine learning, deep learning, natural language processing, and cognitive computing have been steadily moving from science projects to new digital business models powered by smart services. A good example of this shift comes from



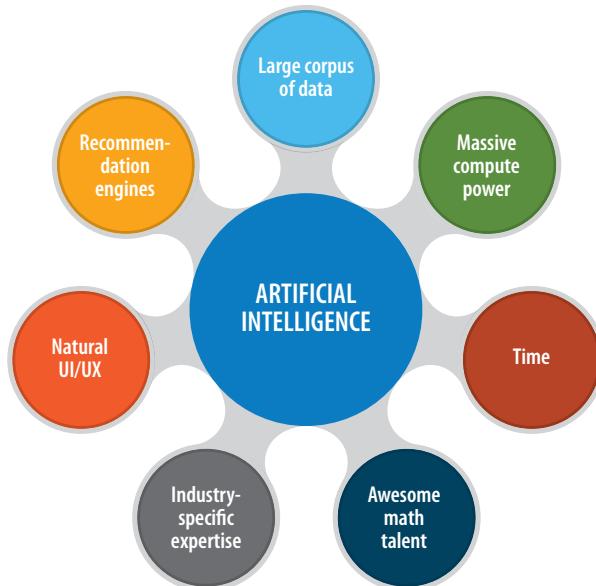
People enable artificial intelligence, and algorithms are only as good as the math talent that build them. Success will require the hiring of 'Digital Artisans' — people who can balance their right brain and left brain expertise.

machine-learning services that analyze sentiments or address fraud management patterns in commerce.

For an organization betting on AI for digital initiatives, the goal has to be precision decisions. Successful AI projects within enterprises require more than just great algorithms or access to data scientists. What the Market Leaders and Fast Followers have discovered so far are the following seven traits that require nurturing:

- **A large corpus of data:** The battle for large data sets has nothing to do with having more data. The ultimate goal is to build the largest graph that maps the connections within the data. A greater quantity of data will improve the precision of insights and allow for more patterns to emerge.
- **Massive computing power:** Winning brands will either own or have access to affordable computing power. The ultimate metric for AI rests not just in 'pricing by computing power,' but potentially, also in 'cost per kilowatt-hour.' Thus, the cheapest rate of computing power may determine the cost structure for AI smart services.
- **Time:** There is no substitute for time when it comes to AI. Algorithms need time to improve and gathering data sets requires time for better precision. More interactions in the network depend on time. Hence, early adopters gain the advantage of time.
- **Exceptional math talent:** The discovery of patterns, creation of new algorithms, and the ability to apply human intuition to computing requires great math talent. People enable artificial intelligence, and algorithms are only as good as the math talent that build them. Success will require the hiring of 'Digital Artisans'— people who can balance their right brain and left brain expertise.
- **Industry-specific expertise:** Vertical industry experience will emerge as the key differentiator in AI smart services. The more advanced and specialized the AI system, the more its relevance to the end users.
- **Natural user interfaces and experiences:** Expect AI systems to mimic human interaction going forward. Interfaces for sensory and visualization capabilities, voice, gestures, and more will improve providing natural, human-like capabilities.
- **Intelligent recommendation engines:** The output of AI comes to precision decisions. AI systems augment humanity. The recommendation engines that emerge will enable choices, accelerate decision-making, and ultimately provide filters that deliver situational awareness.

Figure: Seven elements of successful artificial intelligence (AI)



We feel that the value in AI will come from the smart services that emerge through digital transformation projects. More than just automation, these AI-driven smart services will power future business models that rely on the

insights derived from digital technologies, data, and algorithms. The question that will soon make its way into your board room might be: How do we nurture these traits to ensure that our AI investments succeed?

About the Author



Ray Wang

Principal Analyst and Founder, Constellation Research

R 'Ray' Wang is the Principal Analyst and Founder of Constellation Research, Inc. He is also the author of the popular business strategy and technology blog 'A Software Insider's Point of View'. With tens of millions of page views a year, his blog provides insights into how disruptive technologies and new business models impact enterprises. He has held executive roles in product, marketing, strategy, and consulting at companies such as Forrester Research, Oracle, PeopleSoft, Deloitte, Ernst and Young, and Johns Hopkins Hospital.

Ray is a prolific keynote speaker and research analyst working with clients in diverse sectors like digital, innovation, business model design, engagement strategies, customer experience, matrix commerce, and big data. His Silicon Valley research firm advises Global 2000 companies on futuristic business strategy and disruptive technology adoption. He is a regular contributor to Harvard Business Review and is frequently quoted in The Wall Street Journal, Forbes, Bloomberg, CNBC TV, Reuters, IDG News Service, and other global media outlets.

His new book, Disrupting Digital Business, is published by the Harvard Business Review Press and available globally now. This book provides insights into why 52 percent of Fortune 500 companies have been merged, acquired, gone bankrupt, or fallen off the list since the year 2000. It highlights the fact that it is not technologies that drive this change — but a shift in how new business models are created by leveraging technologies.

He is available @rwang0 on Twitter

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