Capgemini

TECHNOVISION
2022

BEING LIKE WATER

TRENDS FOR CIOs AND TECH PRACTITIONERS

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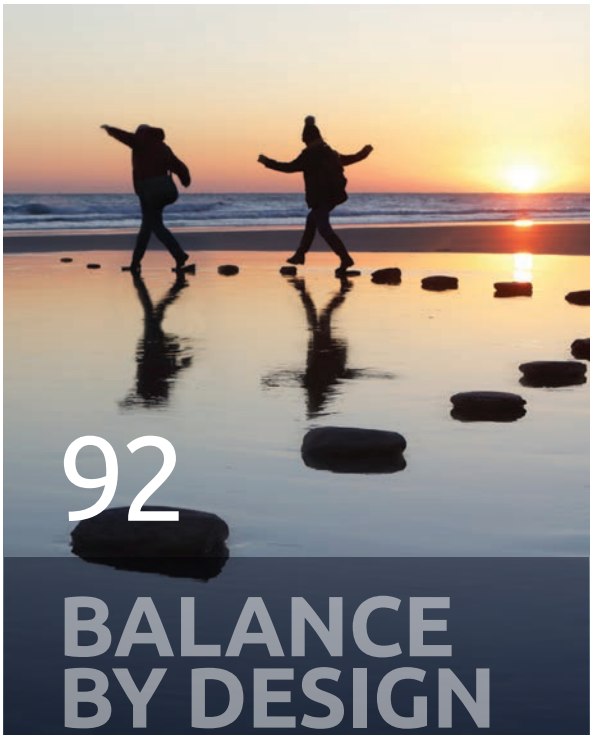


Introduction

In the years since TechnoVision's inception in 2007, our dependency on technology has increased exponentially. Technology brings us closer, allowing us to operate – facilitating collaboration, creativity, and community. So much so, that the very notion of a business not using technology seems incomprehensible. What may once have been perceived as a superfluous luxury, is now wholeheartedly part of the package. And it pertains in equal parts to what we, at least so far, call "business" and "technology."

The technological universe continues to expand, augment, and adapt at a phenomenal rate. Physical and virtual worlds merge, robots teach themselves, and the quantum realm looms ever nearer. Meanwhile, the time that organizations have to adjust to this accelerated technological development is compressed. More is demanded now, with a need to respond faster than ever before. All of this can be daunting: to know what to do, where to go, and how to adapt, all for the benefit of the organization. To respond successfully, it requires more dialog than ever, between everyone in the organization, regardless of business unit, role, or technological affinity.

This is where TechnoVision shines. Designed as an accessible, well-structured framework, it describes 37 technology trends – based on the contributions of Capgemini experts all around the world, from many different domains.

There's something in each trend for everybody, whether you are an IT expert looking for new angles, or a tech-curious businessperson wanting to understand the buzz.

This TechnoVision 2022 edition contains many inspiring use cases and stories that underpin each trend. And to refine our focus even more, we've extracted how to apply TechnoVision as a standalone publication, enabling access for those who need it and keeping the attention well and truly on the trends for this – now condensed – edition. But because technology is ever changing, and as a response to the rapids of technological innovation, we plan for a steady, continuous release of Sector Playbooks, showing the impact of technology trends and their sector and industry-specific challenges and opportunities throughout the year.

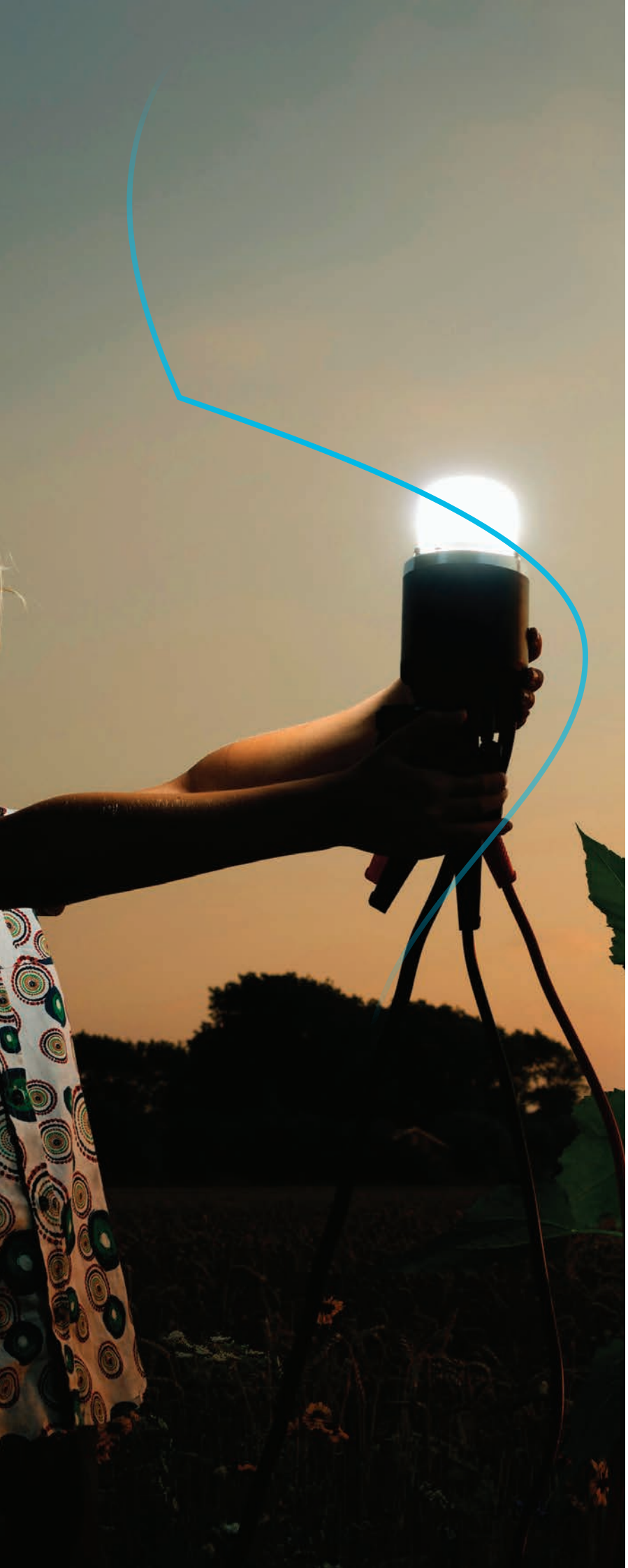
Of course, TechnoVision wouldn't be the same without its slightly left-field, playful approach to technology trends, using a rich, ever-expanding palette of different techniques and a distinct way with words. We hope this year's edition doesn't disappoint. If nothing else, it should bring you some fresh thinking to address the technology business issues of today, and helps you design, plan, and ultimately, get the future you want.

Come on in, the water's fine.

Ron Tolido

Gunnar Menzel

Pierre Hessler



Being Like Water

Sitting in his makeshift shed, the man wields his knife around a plastic bottle, forming the perfect water feeder for his allotment. “Waste not, want not,” he whispers to himself in the quiet acknowledgement of a lifelong mantra to repurpose, reuse, and recycle.

In India, they call it *“Jugaad”*: a flexible and pragmatic way of problem-solving, using limited resources in an innovative way. This frugal innovation approach – which may go by another name in different parts of the world – is now more relevant than ever, for many reasons.

We see the world straining its natural resources, no longer able to sustain our current levels of living and consumption. We must be more inventive with what we have, rather than spending too much of our scarce resources on energy-wasting, polluting, “build-from-scratch” activities.

Jugaad Masters skillfully control their tools and materials. Part of their way of life, their chosen “technology” is always with them, always available, always ready to innovate. These masters have become one with their tools and materials, *they are Jugaad*.

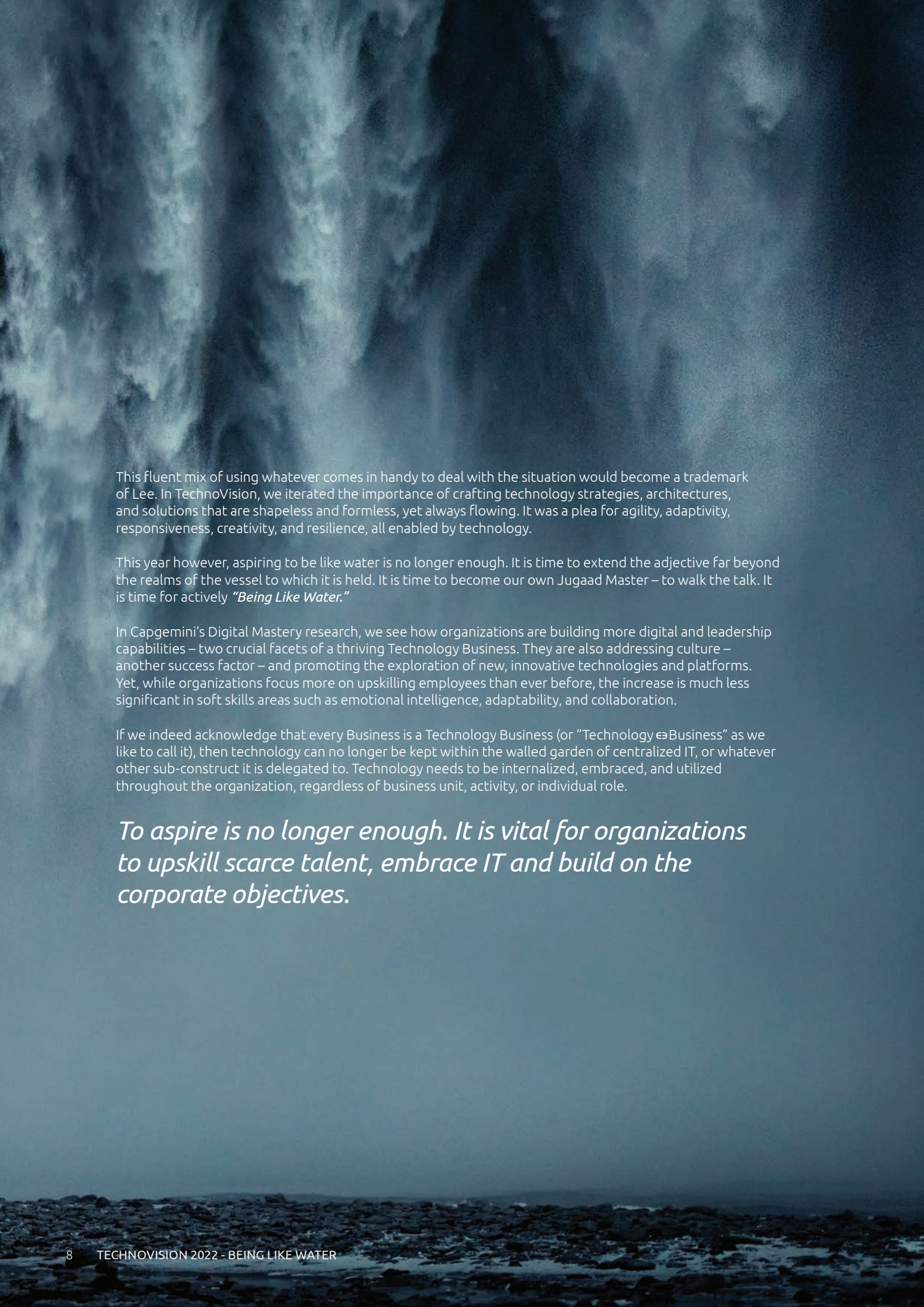
Sounds like something we need in today’s world of digital technology and business as well.


ASPIRATION
IS NOT
ENOUGH

For the turbulent year of 2021, we recognized the role technology played to deal with the flurry of unpredictable events, challenges, and opportunities. We created the leitmotiv, "***Be Like Water***" inspired by martial artist movie star, Bruce Lee and his most famous quote:

Be like water making its way through cracks. Do not be assertive, but adjust to the object, and you shall find a way around or through it. If nothing within you stays rigid, outward things will disclose themselves. Empty your mind, be formless. Shapeless, like water. If you put water into a cup, it becomes the cup. You put water into a bottle, it becomes the bottle. You put it in a teapot, it becomes the teapot. Now, water can flow, or it can crash. Be water, my friend.

- Bruce Lee



This fluent mix of using whatever comes in handy to deal with the situation would become a trademark of Lee. In TechnoVision, we iterated the importance of crafting technology strategies, architectures, and solutions that are shapeless and formless, yet always flowing. It was a plea for agility, adaptivity, responsiveness, creativity, and resilience, all enabled by technology.

This year however, aspiring to be like water is no longer enough. It is time to extend the adjective far beyond the realms of the vessel to which it is held. It is time to become our own Jugaad Master – to walk the talk. It is time for actively ***"Being Like Water."***

In Capgemini's Digital Mastery research, we see how organizations are building more digital and leadership capabilities – two crucial facets of a thriving Technology Business. They are also addressing culture – another success factor – and promoting the exploration of new, innovative technologies and platforms. Yet, while organizations focus more on upskilling employees than ever before, the increase is much less significant in soft skills areas such as emotional intelligence, adaptability, and collaboration.

If we indeed acknowledge that every Business is a Technology Business (or "Technology ∈ Business" as we like to call it), then technology can no longer be kept within the walled garden of centralized IT, or whatever other sub-construct it is delegated to. Technology needs to be internalized, embraced, and utilized throughout the organization, regardless of business unit, activity, or individual role.

To aspire is no longer enough. It is vital for organizations to upskill scarce talent, embrace IT and build on the corporate objectives.

Objectives are changing

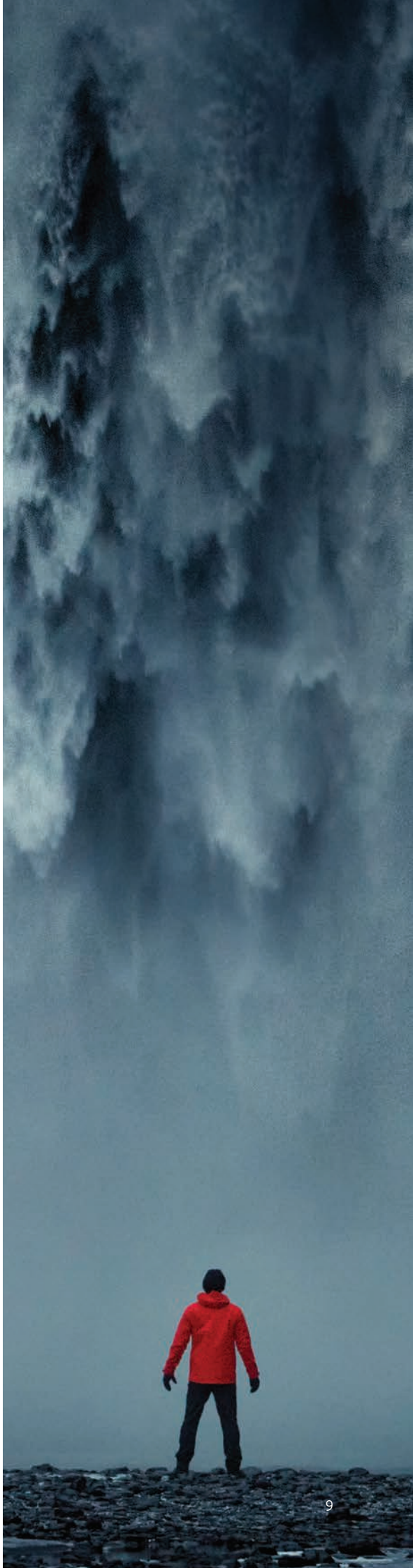
Sustainability returns to the top of the strategic priority list, after having taken an involuntary backseat during the pandemic. An organization's success may soon depend on its contribution to decreasing net-carbon emissions. How we operate, collaborate, travel, even function at the most basic of levels, will have an impact on the organizational carbon balance sheet. And all of that is scrutinized wholeheartedly by customers, employees, and shareholders alike.

Then, scarcity is rapidly turning out to be a new, determining factor for economic success – or failure. This not only relates to scarcity in terms of natural resources (although we must certainly apply caution here), but also human resources: it is increasingly harder to find qualified, skilled, and motivated talent in almost every branch of business, including technology. Furthermore, the next generation of workers is increasingly critical of what organization to work for, actively seeking compatibility with their own values, such as sustainability, diversity, and inclusion.

And finally, the next-level of digital playing field has swiftly emerged over the last two years, triggering a whole new wave of innovation initiatives – whether by cautious challengers sensing unexplored opportunities, or inquisitive incumbents wanting to catch up on a new reality. Capgemini's Digital Mastery research illustrates how innovation leaders still focus on a superior "customer-first" experience and highly effective operations. Yet, combine that with talent innovation and an "employee-centric" experience, and the reimagined business model could really excel.

StratOps: always be changing

While the world returns to some shade of normalcy, we have come to accept the era of Uncertainty^{squared}, where uncertainty for tomorrow has become part of our daily lives today. To thrive, businesses must fluently adjust their strategy to the challenges and opportunities they encounter, transforming both business and technology in a continuous, operational flow. Such a "StratOps" enterprise will embody this fluidity, living and breathing – being like water – and using technology to reboot the organization in this dramatically different world, successfully facing whatever challenge or opportunity it comes across, yet with a powerful and directional flow to fulfill its corporate purpose.



Technology is entwined

Whatever the business and societal challenges and opportunities are, they all have one commonality: they rely on technology to address them as an integral part of the change equation. Most apparent in ***Intelligent Industry***; we see software-driven cars, autonomous factories, and smart products as testament to the raw, transformative power of technology. But this is quickly rippling through other sectors and domains too, such as the smart concepts of "Society 5.0" in the Public Sector, taking its inspiration firmly from "Industry 4.0" (technology still craves version numbers it seems). Technology and business operations have become so entwined, it is increasingly blurry where one ends and the other begins.

And it shows when looking at technology trends in 2022. Whether it pertains to infrastructure, applications, data, process automation, user experience or collaboration, three big Technology Business concepts clearly stand out:

EDGE:

"Edge computing" emerged from Intelligent Industry and the realm of the Internet of Things (IoT). As we watch Information Technology (IT) and Operational Technology (OT) fuse, devices are increasingly enchanted with sensors, storage, networking, intelligence, and automation. Innovations appear magically ever closer to the distributed edge, further away from central IT. But this isn't just a one trick pony, as we see areas such as "headless" application services morph themselves into diverse, individualized user experiences (maybe one day in the looming "metaverse"), entirely dependent on the needs at the edge of the business. The edge is there for a reason, it pushes past our comfort zones, making us think about what's beyond. Exciting innovation happens at the edge – where the rubber meets the road – not at central IT or business units – bringing more applicable technologies to the places where it really counts.

MESH:

Originating in the world of loosely coupled, lightweight networks of autonomous nodes, "mesh" has expanded to the world of applications: a new way of weaving together small, independent application services ("service mesh") for all sorts of – ad-hoc – purposes. Now, it is rapidly conquering the world of data ("data mesh"), as a radically different, federative way of redistributing the ownership of data products to the business domains that are closest to them. And of course, in the multi-faceted user experience world of the Metaverse, mesh appears here as well, illustrating the variety of ways we can collaborate in online spaces. Not to mention the mesh-like characteristics popping up within distributed technologies such as blockchain. Mesh emphasizes the power of decentralization and federated ownership, rather than monolithic command and control.

AUGMENT:

AI and intelligent automation manifests powers across the full spectrum of technology. From smart products and services, intelligent applications, and killer algorithms, to "self-driving" business processes, the potential seems limitless. AI can even be applied for spectacular creative purposes, augmenting humans in ways that were previously considered their eternally exclusive forte. While the discussion on how AI will replace humans – versus augment them – may go on for some time, the increasing scarcity of talent in all major business areas, certainly shows AI and intelligent automation as powerful, sustainable fixes. Ultimately, technology enables us to produce better digital solutions with fewer people. And when provided directly to the business – for example through self-service tools – it serves the technology democratization ambitions any Technology Business should be aiming for.

A Need to Upcycle

Sustainability is finally a business priority. What once might have been just a line item for boardroom consideration is now right at the top of the corporate agenda. Every executive must help their organizations deliver on sustainability targets – and CIOs must play a fundamental role in a shift towards a "circular economy." By transforming the linear take-make-waste system to a more regenerative process, everyone can benefit, not least the corporate agenda. But we must address how much technology consumes and wastes finite resources. Millions of tons of electronic waste are generated worldwide every year, yet less than one-fifth of that e-waste is recycled.

Rather than rip and replace, we should recycle and reuse. Jugaad should become a way of life in IT, finding ways to tease more life out of the technology products used in our businesses. We need to think much more creatively about the hardware and software we discard. We must acknowledge that precious resources are finite. As an industry, and as businesses that consume these IT products, we have a responsibility to do better. We must find ways to extend the life, to reuse, or maybe even upcycle the technology we already have.

In India, Jugaad is often due to necessity: to innovate to find a solution for a problem. Elsewhere, organizations ignore making such choices: when something breaks, simply replace it. That attitude is now an anathema. The world demands change. But aspiring to change is only the starting point. Customers, and employees know that actions speak louder than words – and they will spot any attempts at uncommitted pretend and "greenwashing."

Jugaad should become a way of life in IT. Rather than rip and replace, we should recycle and reuse. We need to think more creatively about the hardware and software we discard and must find ways to extend the life, to reuse, or maybe even upcycle the technology we already have.

Epilogue

The man picks up his knife again. For him, Jugaad never ends. Everything has its place in this shed; each element unique, serving a bespoke purpose, doing its job perfectly. But there is always something new to achieve, some fresh creativity to apply. As a Technology Business, we can learn from that attitude: by no longer just talking about plans, but by walking the talk, living the mantra. By mastering our digital tools seamlessly within the organization, we can use technology to innovate, adapt, and achieve our corporate and societal goals. And by integrating technology with business so fluently that one no longer works without the other, they become essentially one and the same; being – and flowing – like water.

Questions to Ask

Mastering a Technology Business is not only about understanding trends and their overarching themes. It's about making it work, to move from articulating aspirations to actually "***Being Like Water***" in a Technology Business. Applying a Balance by Design mindset, we recommend asking seven questions at any signature digital juncture – when assessing a strategy, a portfolio, program, project, or architecture, or simply any time a promising innovative idea pops up:

Are business and technology the same?

Move from alignment to unity of business and IT, creating a seamless Technology Business strategy and operations.

Are systems and processes designed and built for change?

Move adaptability from afterthought to prime time.

Are systems and processes open by default?

Upgrade your technology platform to the ultimate Technology Business platform: a superior, open set of attractive services, acting as a magnet for active collaboration, internally and externally.

Do plans and actions contribute to societal good?

Boost the organization's societal purposes by saying "Yes" to technology that boosts sustainability and say "No" to what is energy-wasting or non-essential.

Is trust at the foundation of the organization?

Power up the entire trust ecosystem – from the organization's core to its edges – securing your existing business and pushing forward to its next permutation.

Is the data and AI applied human-centered?

Ensure a properly measured and monitored balance between three – sometimes conflicting – assets: the corporate Intelligence Quotient, Creativity Quotient, and Emotional Quotient.

Are all hands-free perspectives considered?

Assume full, hands-free automation as the default for all new Technology Business processes.

OVERVIEW OF TECHNOVISION

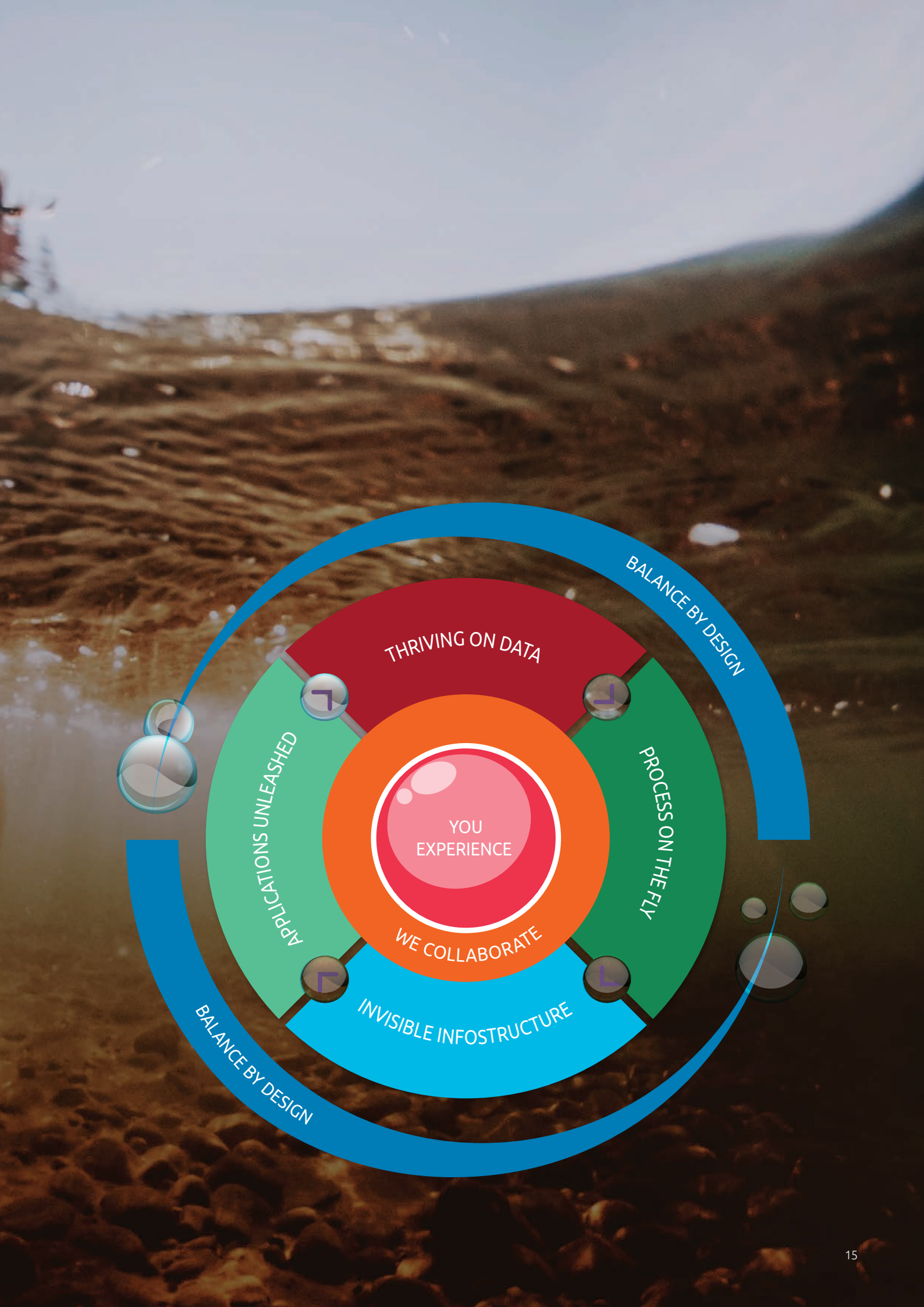
TechnoVision categorizes technology trends into six well-defined containers, offering a snapshot of innovation from different perspectives (the "what") – ranging from user experience and collaboration, via data and process automation, all the way to infrastructure and applications. A seventh container offers a series of overarching design principles to successfully apply to the trends and create transformational impact (the "how"). These principles help build a sharp mindset, ready for any portfolio, program, project, architecture, innovation initiative, or idea.

Those familiar with earlier versions of TechnoVision, will notice that we have discontinued the framework picture we have been using for years, which to some – unintendedly – suggested a sequential transformation from the more systems-orientated (infrastructure and applications) to the human-centered side (user experience and collaboration). Others thought they saw an architectural diagram.

To stay true to one of the key themes of this year's edition, we upcycled a somewhat older framework: a holistic, circular version, firmly placing You Experience and We Collaborate at the heart of the technology-driven exchange. This core foundation is surrounded by the more functional containers – Thriving on Data, Process on the Fly, Applications Unleashed and Invisible Infostructure. All wrapped up with Balance by Design, as the overarching container to be considered while working with the others.

Within each container, trends are presented as one-page summaries, designed to be crisp and to-the-point, yet appetizing enough to warrant further study. Balance by Design follows a similar format, offering a view of how to shape balance within an organization using easy to digest one-page principles.

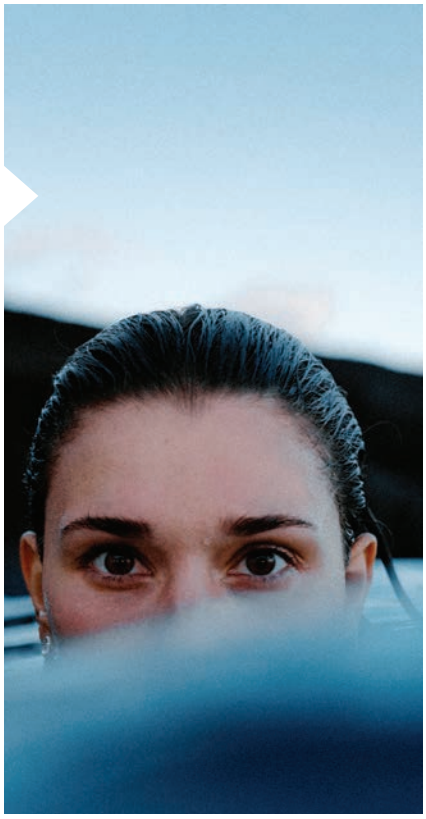
Read on for the summaries of the seven TechnoVision containers:


BALANCE BY DESIGN
THRIVING ON DATA
APPLICATIONS UNLEASHED
PROCESS ON THE FLY
YOU
EXPERIENCE
WE COLLABORATE
INVISIBLE INFOSTRUCTURE
BALANCE BY DESIGN

You Experience:
immersive, low-touch, emphatic

You Experience forms the very definition of a highly personalized, seamless user experience. As technology entwines itself in our daily lives, the user experience is no longer a separate discipline. Fully immersive, it is now an integral part of life: at home, at work, or even in leisure time. Organizations can no longer take the well-loved "customer-first" route, but must consider "employee-first," and even "partner-first" routes too, emphatically considering user experiences from a holistic, end-to-end perspective. Loyalty, advocacy, and satisfaction remain buzz words, joined by talent retention, engagement, emotional connection, sustainability, and inclusiveness to boot.

- Experience[2]
- Me, Myself & My Metaverse
- No Friction
- I Feel for You
- My Own Private Avatar



We Collaborate:
teamed, distributed, creative

Many realities have changed irrevocably since the pandemic – how businesses operate and collaborate being one of them. Many aspects of value delivery are now entirely independent of location and time. People work together in different ways, increasingly at the very edges of what used to be considered the "core organization." Consumers and employees expect creative, integrated experiences. It requires a new level of cross-organizational, cross-sector partnering to meet these expectations. Distribution is the leading design principle, together with mesh-style, loosely coupled collaboration. And as the physical and digital fuse, it's no longer clear where technology ends, and business begins.

- Fluid Workforce
- The Team is the Canvas
- Taken by Tokens
- Your Business is a Mesh
- It's All Connected

Six well-defined containers offer a snapshot of innovation from different perspectives, ranging from user experience and collaboration, via data and process automation, to infrastructure and applications.

Thriving on Data: algorithmic, federated, shared

It's no wonder organizations aspire to thrive on data, to be data-powered enterprises. With every business now being a de facto Technology Business, data is at its core. Dare we say, every Business is a Data Business? Data powers superior customer experiences, highly tuned operations, and smart, self-optimizing products and services. Data provides resilience, predictability, and effectiveness, but equally enables organizations to achieve their sustainability ambitions. It's tempting to declare data to be the new, corporate asset. But assets tend to be stacked, isolated, and safely put away. It's much better to see data as a first-class product; owned, managed, and activated by business domains, and shared in lively exchanges inside and outside the organization.

- Data Sharing is Caring
- Power to the People
- Data Apart Together
- Era of Algorithms
- Creative Machine

Process on the Fly: binding, portable, self-driving

Strategy tends to be eaten for breakfast, by culture – but also by a lack of operational execution. Organizational aspirations simply "blah blah blah" without any ability to turn insight into action, quickly respond to events, or go with whatever flow the corporate purpose supposes. And all that goodness must be delivered against a scarcity of skilled resources and a need to reduce travel and energy consumption. This is where Process on the Fly shines brighter. Having been less in the spotlight than its complementary container, Thriving on Data (ever heard of "Big Process"?), breakthroughs within intelligent automation and a taste of touchless execution, firmly places this container center stage.

- Process is Mine Mine Mine
- Rock, Robot Rock
- Silo Busters
- Can't Touch This
- Augmented Me

Applications Unleashed: meshed, headless, augmented

At the heart of any Technology Business is its applications portfolio. A thriving heartbeat of the organization – part of the business, responsive to every demand. These applications mirror the new business dynamics, built, and continuously changed at high speed, to a high quality, and in whatever incarnation necessary. Yet, many applications no longer look like the ones we used to know, as they morph into a connected mesh of microservices. With agility and minimum viable products no longer the "new normal," but the "well and truly established," the quality of application services needs to be at enterprise level, with a continuous, flawless deployment throughout all business operations.

- Kondo My Portfolio
- Honey, I Shrunk the Applications
- When Code Goes Low…
- Mesh Up Your Apps
- Apps ❤ AI

Invisible Infostructure: omnipresent, autonomous, invisible

The odyssey towards a truly invisible IT infrastructure remains ongoing, but progress is being made. For many organizations, the pandemic accelerated a move towards the cloud; a signpost of increasing "invisibility." To keep up with the pace of a Technology Business, IT infrastructure needs to be omnipresent, fluently adjusting to the whimsical ways of the time. A software and AI-driven, nearly autonomous supply chain is key – reliability built in. It also deals with the scarcity of skilled experts and excess energy consumption. But IT infrastructure also expands its reach, integrating Operational Technology and "things" at the edges of central IT, showing yet again that "Infostructure" is not a spelling mistake.

- Lord of the Clouds
- Crouching Tiger, Hidden Container
- Simply the Edge
- Ops, AI did it Again
- Silence of the Servers

Balance by Design: overarching, transformational, purposeful

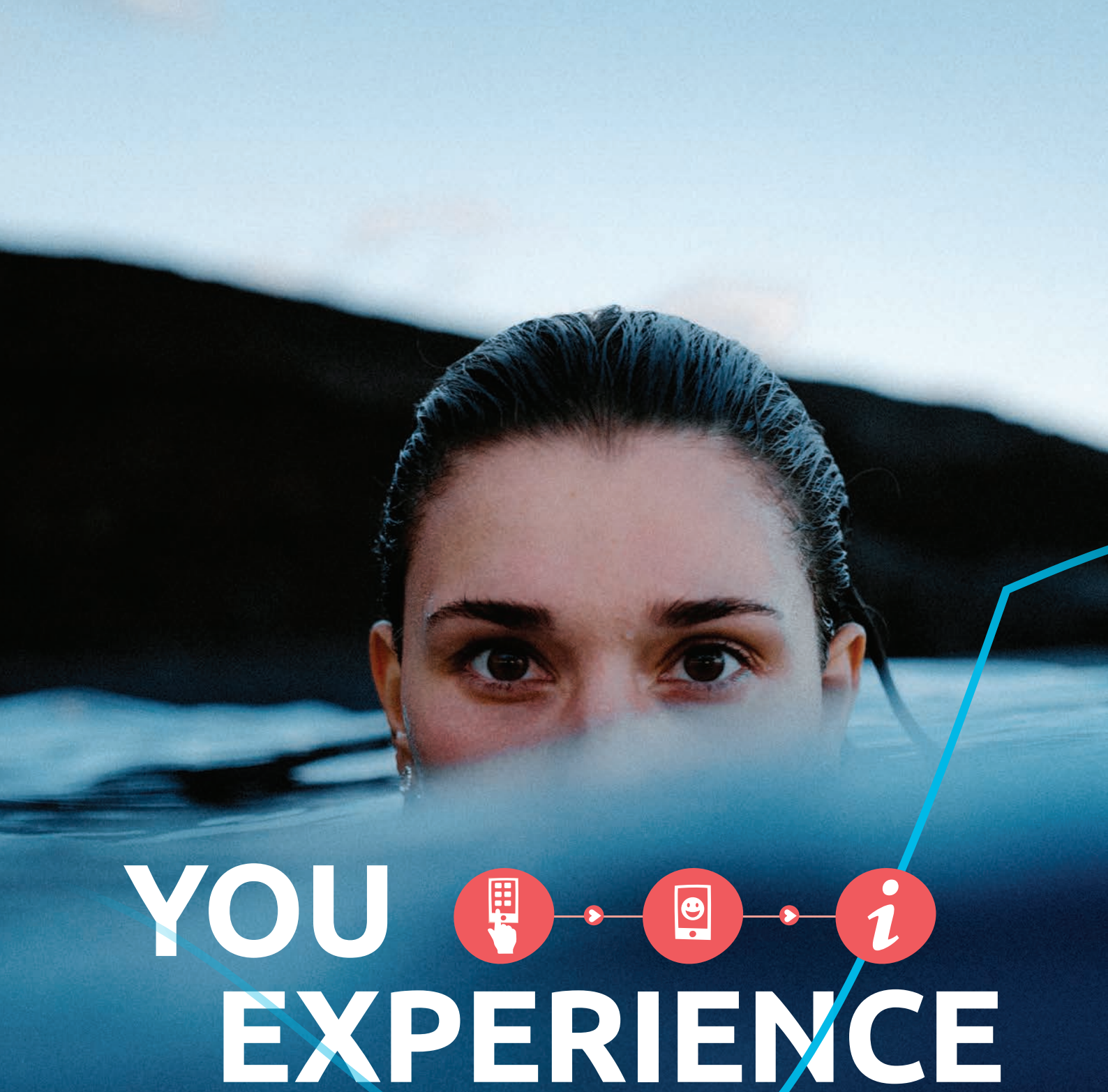
The essence of designing a Technology Business is to find and preserve several balances in parallel: balance between the interests of stakeholders, between short and long term, centralized and decentralized, friendly and authoritative, purposeful and spontaneous. Besides the WHAT of technology trends, TechnoVision offers a view of HOW to shape these balances within the organization – by purposeful design. The principles within this container aim to provide control questions for executives, a bouquet of perspectives for architects, and a systematic checklist for anybody involved in a Technology Business portfolio, program, project, or initiative.

- Technology∈∋Business
- With Open Arms
- Adapt First
- Do Well, Do Good
- Trust Thrust
- IQ EQ CQ Up
- No Hands on Deck

As always, the authors have had their way hiding copious references to rock, pop, movies, and other cultural and societal phenomena. The reader is invited to find as many of these "Easter Eggs" as possible. It should not be ruled out however, that Generation Z and their "OK, Boomer" colleagues – blessed as they are with quite different frames of reference – may find completely different hidden gems.

If you still possess an appetite for more, the TechnoVision Expert Connect community offers a variety of detailed posts and articles about your favorite 37 building blocks. And by all means, read our sister report "Applying TechnoVision" for various means of using, applying, and playing with TechnoVision in a unique and entertaining way. Finally, to dive even deeper into the TechnoVision universe, watch out for our sector and domain specific TechnoVision Playbooks to be released throughout the year.

A seventh container offers a series of overarching design principles for transformational impact. They help to build a sharp mindset, ready for any program, project, architecture, innovation initiative, or idea.



YOU EXPERIENCE

The definition of a highly personalized, seamless user experience – literally, a You Experience – has been included in our TechnoVision dictionary for some time. Yet, as technology entwines itself in our daily lives, the user experience is no longer a separate discipline. It is now an integral part of how we experience life: at home, at work, when shopping, traveling, or even when enjoying leisure time. Organizations can no longer take the well-loved "customer-first" route, but must consider "employee-first," and even "partner-first" routes too, considering user experiences from a holistic, end-to-end perspective. Loyalty, advocacy, and satisfaction remain buzz words, now in the company of talent retention, engagement, and emotional connection to boot. Here, we should take the principles from the School of Positive Computing to heart and apply well-being factors such as self-awareness, mindfulness, empathy, and compassion too. Call it *Us Experience*, if you like.

Having successfully busted corporate silos to infuse technology in all its business operations, a Technology Business recognizes that a user experience does not solely relate to the front-end of digital customer channels. It's a matter of living and breathing the user experience across all aspects of the corporate value chain, including the innovative technology that enables it. This Experience² mindset is no longer just applicable to the customer but pertains to the employee experience just as much. And it's not only bringing benefits in terms of better integrated service delivery to customers, it also helps to boost performance and productivity – even with a scarcity of human resources – and keeps employees motivated, inspired, and engaged with the organization's societal purposes.

Having said that, have we mentioned the innovative technologies that enable a whole new wave of digital interaction and immersion?

AI continues to advance, making conversational chatbots and voice assistants worthy, emphatic partners. Our research into the art of customer-centric AI shows that customers are increasingly using AI-based systems to interact with organizations. Already more than half (54%) of customers have daily AI-enabled interactions with organizations, including chatbots, digital assistants, facial recognition, and biometric scanners – three quarters of whom fall within the 18-35 age category. Unleash the power of machine learning on all the data points gathered through this emerging "Internet of Behavior," and the ingredients are at hand to create a truly frictionless, low-touch experience. One that seems to sense the intent – and the emotions – of the consumer or the employee even before she expresses them herself.

Next stop: the notion of virtual avatars and the Metaverse, heralded as the next incarnation of the mobile internet. It signals a further blurring of the boundaries of what we consider physical or digital, real, or fake. Originating from the world of gaming – where younger generations already make little distinction between their online digital and offline analogue identities and experiences – the phenomenon is now quickly spreading to more consumer and business contexts. It's fascinating to envision what ***You, Me, and Us*** will look like in this brand new, unexplored experience theater.

Alexandre Embry
Expert in Residence

EXPERIENCE²

Charlton Monsanto
Expert in Residence

Creating a user experience as an integrated whole, seamlessly covering the perspectives of customers, employees, and partners, enabled by all available variants of UX technology

What if we raise user experience to the power of 2? As we come to rely more on the various ways of online interaction, our expectations are rapidly evolving. Organizations need to enable virtual, mobile, and touchless interactions to engage, stimulate, and retain customer and employee attention. Consumers constantly seek that golden touch, where their personal believes are supported. Fail, and their loyalty may be at risk. Employees want to feel a sense of purpose, empowerment, and enablement. Fail, and they might easily change employer. These are rapidly changing psychographic trends. Addressed through a holistic, emotion-sensitive approach – across disciplines, channels, and business units – the net effect is differentiating and competitive. Do the math, combine it with the latest in "no friction" UX technology, and create an Experience Squared. You could have it all if it mattered so much.

WHAT

- Virtual, mobile, distributed user experiences have become the norm for interactions involving customers, employees, and partners. After the pandemic expectations regarding ease of use and effectiveness have only risen further.
- With customers, employees, and even partners becoming much more aware – and critical – of an organization's positioning on key societal themes, the user experience must echo these beliefs and purposes.
- This requires a unified experience strategy – connecting our user interaction across customers and employees – together with experience journey mapping; UX/UI technology built in.
- Designing an experience across the silos of journeys requires deep understanding, involving the feelings, emotions and associations that determine signature moments along on the way.
- An increasingly diverse mix of UX/UI options supports all sorts of alternative ways to create intent-driven, conversational, and low/no touch digital interactions. This adds to the different dimensions to consider when creating a unified experience.
- And more is on the way, especially in the world of connected "things" (such as delivery drones and robots, self-driving cars, and autonomous stores) and the Metaverse (extending VR and AR) that will shape the future "Experience Squared."

USE

- FILA partnered with Capgemini to launch a unified design system and streamline its digital commerce experience, creating a seamless, API-led architecture that engages customers and drives scalable growth.
- In the cosmetics industry, Belcorp integrated Perfect Corp's virtual try-on technology to provide a personalized online shopping experience for every customer to find their perfect makeup shade.
- In the United States, Ibotta enables shoppers to feel the rush of shopping simply by putting on a VR headset, selecting from one of Ibotta's 1,500 retail partners, and stepping into the virtual world of grocery shopping.
- IKEA launched a new AR design app called "IKEA Place," allowing its users to design and customize the whole room with items from IKEA. All products are 3D and true to scale.

IMPACT

- Increased loyalty with clients, who will return for personalized, compelling, and satisfactory user experiences matching their personal interests and search for purposeful brands, products, and services that underpin their beliefs and values.
- Dealing with the limited availability of retail personnel, by creating touchless and self-service shopping experiences.
- Increased employee productivity as they benefit from frictionless user experiences, allowing them to achieve higher quality results without being forced into overly repetitive, boring, or error-prone activities.
- Improved retainment of employees – even in a time of obvious scarcity– by providing satisfactory and inspiring daily user experiences and acknowledging their need for a working environment that supports their societal values.
- A highly optimized supply chain performance – all via a unified user experience for everyone (including partners) and virtually "touchless" processes.

TECH

- **Customer experience management:** Usermind, Highspot, Coveo, Qmatic
- **Real-time journey management tools:** Kitewheel, Alterian, Pointillist
- **Customer platform technologies:** Adobe Marketing Cloud, Salesforce Marketing Cloud and Service Cloud, SAP C/4 Hana, Pega, Usermind, Cemantica, Acoustic, Oracle Cloud CX Platform, Creatio, Hubspot, Salesforce Pardot, Threekit
- **Virtual and augmented reality:** PTC, Unity, Facebook Oculus, Microsoft Hololens
- **Customer data technologies:** Salesforce Customer 360, Microsoft Dynamics 365 Customer Insights, Adobe Experience Platform, SAP C/4Hana Customer Data Cloud, Oracle Unity Customer Data Platform, Netwise, SAS Customer Intelligence 360
- **Customer process management:** Microsoft Dynamics 365, Salesforce, Pega
- **Mobile marketing platforms:** Moengage, Adobe Experience Cloud, Vibes Mobile Engagement Platform, Salesforce Mobile Studio, Airship Mobile Engagement Platform

ME MYSELF AND MY METAVERSE

Gita Babaria
Expert in Residence

A new virtual world augments real life, creating a potentially profound impact on the way we live, work, and collaborate

Mirror, mirror, on the wall, what's the greatest buzzword of them all? The Metaverse is expected to be nothing less than the next generation of the internet, deeply impacting our daily lives. This shared virtual and hybrid space; accessible by anyone, anytime, anywhere, on any device, reflects a huge improvement in online interaction – augmenting real life. This includes realistic embodiment, a sense of presence, space and emotion; everything that was lacking in the legacy, flat, 2D experiences. More than ever, borders are blurring between virtual and physical worlds for business, shopping, entertainment, and social interactions. Not bad, for a buzzword. Yet, accelerated by recent technology advancements, mainstream use requires the Metaverse ecosystem to collectively assess critical challenges, including interoperability, being hack-proof, privacy, ethics, and societal concerns.

WHAT

- The concept of the Metaverse was first coined in Snow Crash, Neal Stephenson's 1992 sci-fi novel. It refers to a convergence of physical, augmented, and virtual reality in a shared online space.
- During the pandemic, people have been spending more time in shared, virtual environments to socialize, play, entertain, trade digital assets, and even "work" as avatars.
- The interoperable nature of the Metaverse – along with immersive and 5G technologies – enables businesses to communicate and cooperate with each other to provide personalized and enhanced user experiences to all: customers, consumers, and employees.
- Creation, avatars, and digital objects will become central to how we express ourselves, and lead to entirely new experiences and economic opportunities.
- Non-Fungible Tokens (NFTs, see our trend Taken by Tokens) are powering the Metaverse to create and purchase digital assets, which will allow users to fully interact in the space, as well as create and trade value.
- While the Metaverse is still evolving, crucial ethical and regulatory policies – for example regarding data privacy and use for positive purposes only – need to be considered, determined, and socialized.

USE

- SK Telecom launched "Ifland," a new Metaverse platform designed to maximize user experience via virtual spaces and avatars to offer "Social VR" and "Virtual Meet-up" services.
- L'Officiel, a French fashion magazine, launched "House of Dreams," a virtual museum experience exhibiting NFT-based archival artworks to celebrate its 100th anniversary.
- Ralph Lauren designed a virtual fashion collection within Zepeto, the South Korean virtual world and social networking app. Users can immerse themselves in a personalized, 3D avatar wearing the exclusive product and socialize with other users.
- Hyundai Motors plans to launch "Hyundai Mobility Adventure" – a metaverse space on Roblox featuring Hyundai Motor's advanced products, allowing participants to customize their avatars to their own preferences and interact with each other.
- Renowned club, Amnesia Ibiza developed "Virtual Club" in the Metaverse, powered by Decentral Games, which provides the flexibility to attend immersive 3D live music global events.

IMPACT

- A multipurpose, multi-modal Metaverse will decrease the need to gather lots of people around physical locations, reducing travel and energy consumption.
- The Metaverse can make scarce, highly specialized knowledge globally available without the need for experts to travel to (or from) any given location.
- Consumers have started to perceive high value in digital possessions, driving a new wave of virtual products in the virtual world.
- The Metaverse enables massive numbers of users to feel psychologically and emotionally immersed in their virtual environment, creating the potential to be a positive force for good, and an all-inclusive technology.
- Organizations will be able to better understand customer and employee preferences and choices in real-time, delivering seamless user experiences to yield better returns.

TECH

- **NFT-based Metaverse platforms:** Decentraland, The Sandbox, Sensorium, Somnium Space, Cryptovoxels, Ethverse
- **Virtual collaborative platforms:** Facebook Horizon, Microsoft Mesh, AltspaceVR, Mozilla Hubs, NVIDIA Omniverse, Second Life, VRChat, Glue
- **Avatars:** Soul Machines Digital DNA platform, Microsoft Rocketbox, Wolf3D, Avatarsdk
- **VR trade fairs and conferences:** Vibrela, HexaFair, vFairs, Hopin, MootUP
- **Virtual gaming platforms:** Roblox, Fortnite, Minecraft

NO FRICTION

Andreas Sjöström
Expert in Residence

The Experience Economy becomes real, enabling businesses to provide truly frictionless and never seen before “phygital” experiences

Still a fraction too much friction? Hold on tight. The next version of a Technology Business has zero latency, acts in real time and is algorithmically autonomous. It serves its customers and employees whatever they want or need, doing it faster and more beautifully than ever thought possible. All elements of friction removed. Its user experiences are hyper-personalized and truly predictive – almost “psychic” in their ability to read the intentions of the user. It seamlessly enables interactions across both physical and the increasingly diverse digital – call it “phygital” – boundaries, wherever the user may be. As a key part of a future “No Friction” enterprise, such experiences morph themselves autonomously, uncompromising, and relentlessly focused on the customer and employee, no questions asked.

WHAT

- According to Capgemini research into customer experience for Financial Services, 78% of consumers expect to use touchless interactions more, through voice assistants, facial recognition, or apps, compared to just 61% before the pandemic.
- The "Internet of Behavior," combined with AI technologies, captures data across multiple touch points, deriving deep behavioral patterns into insights, predictions, recommendations, and proactive, actionable steps.
- Using AI and intelligent process automation, actions can be executed in real time without latency or unnecessary friction points, requiring much less human intervention – becoming autonomous and "hands free" – to engage with the user.
- Multiple emerging technologies – including AI, 5G, Intelligent Automation, IoT, and immersive UI technology – create virtual environments that offer real-time, seamless customer and employee experiences across multiple sectors.
- Multi-modal, touchless interfaces increasingly allow humans to communicate with devices using natural means of communication, such as voice, movements, glances, or – eventually – even through thought.
- The Metaverse is coming, combining physical, augmented, and virtual realities. Intersecting trends and technologies, it leverages data from connected devices, omnipresent data, and contextually aware AI systems, creating a unique experience.

USE

- To quickly meet customer expectations, TAB Bank created an open banking platform to streamline lending processes using MuleSoft's Anypoint Platform, enabling loan processing for SMEs 60 times faster than before.
- Mortenson employed Unity for interactive VR to simulate operating room designs in interactive 3D spaces, allowing clients to visualize and interact with their crucial medical instruments and work areas to ensure optimal layout and ergonomics.
- Polish store chain, Żabka launched its autonomous NanoStore, which leverages AiFi's AI platform to bring customers a checkout-free, convenient shopping experience.
- Volvo Cars deployed Unity's VR car configurator as a marketing tool, building immersive 3D experiences to engage car buyers and aid them with their purchase decisions.
- Oakland International Airport installed identity technology and touchless security lanes from CLEAR to give travelers a frictionless travel experience across the US.

IMPACT

- Financial service firms have realized significant benefits, reducing their cost of operations by 13% and increasing revenue per customer by 10% after deploying AI in customer-facing functions.
- AI has also helped deliver improvements in customer satisfaction. Around one in five industry firms (25% for banks and 19% for insurers) have seen a 20 to 40% increase in customer engagement.
- Customers stay more loyal to businesses offering timely, personalized suggestions and updates, which will further drive customer acquisition, retention, and brand loyalty.
- Haptics and sensory technologies help implement touchless interfaces – a post-pandemic prerequisite – but also helps more people to interact with digital solutions, regardless of whether they had the means or capability before.

TECH

- **AI:** Microsoft AI Platform and Azure AI, Google AI Platform, AutoML, AWS AI, IBM Watson Studio, Salesforce Einstein, H2O AI Hybrid Cloud
- **API management and microservices:** Microsoft API Management, Mulesoft, Apigee API Management, AWS API Management, IBM API Connect, Dell Boomi API Management
- **IoT:** Microsoft Azure IoT Platform, Google Cloud IoT Core, AWS IoT, Intel Movidius Vision Processing Units (VPUs), SharpEnd
- **XR:** Unity, Unreal Engine, OpenXR, Microsoft Mixed Reality, Google ARCore, ARKit AWS Sumerian, Wikitude Augmented Reality, BLIPPAR Studio, Perfect Corp, UltraLeap

I FEEL FOR YOU

Claudia Crummenerl
Expert in Residence

Boosting both the individual and corporate EQ, by creating a more effective, meaningful, and satisfying symbiosis between people and their technology enablers

An essential characteristic of intelligent beings – such as humans – is their ability to share different types of ideas, expressions, and feelings. Emotion plays an integral part in our lives. So does technology. Significant progress has been made in the field of user experience and AI – we see continuous evolution and rapid advancements each day. While technology can interpret and even mimic human emotions to a certain degree, it cannot understand or replicate them – yet. But it has come a long way, if still only artificial and based on a cold, silicon heart. Emphatic technology and Emotion AI can benefit humans in so many ways, providing social comfort and inclusion, understanding and expression, as well as a plethora of industrial applications, of course. Now, it's more than a feeling. Technology, I think I love you.

WHAT

- Empathy and emotional intelligence work together, to produce long-lasting relationships. Together, they form the foundation of trust.
- As businesses redefine their ways of working in the aftermath of the pandemic – empathy is in short supply.
- Organizational empathy is moving beyond "customer centricity" and adding employees to the equation to drive business success. Focus is on the collective capacity of an organization to demonstrate empathy to all stakeholders, as well as a commitment by the organization to develop an understanding of customer needs.
- Emotion AI offers new insights to understand people and customers. Industries are identifying areas to integrate emotional intelligence, such as chatbots, virtual assistants, and facial recognition.
- However, Emotion AI requires transparency. For it to work, it is crucial to clearly communicate digital ethics and be transparent about what data is collected, for what purpose, with what access rights, and how long it is stored.
- AI is often not trained enough to understand cultural differences in expressing and reading emotions, making it harder to draw accurate judgement. Confusing these meanings can lead to potential bias.

USE

- Indian online tutoring platform, Vedantu leveraged an Emotion AI solution to optimize their educational content, relying on eye tracking and facial coding algorithms to analyze emotional triggers and generate metrics on engagement, attention, and fatigue for students and tutors.
- UCLA Children's Hospital implemented an AI robot to build peer-to-peer emotional interactions with children by analyzing facial expressions and context of conversations using reinforcement learning.
- Microsoft filed a patent for AI technology focussing on giving Xbox games the ability to collect audio streams from voice chat and analyze a player's emotions to help identify potential issues with heightened emotion.
- Seoul Researchers created an AI-based, 5G-integrated virtual emotion recognition system that can be used to recognize any disruptive emotional cues, warning others of potential danger.
- Startup Find Solution, based in Hong Kong, launched 4 Little Trees software, which uses Emotion AI in schools to identify emotions of students, targeting knowledge gaps and offering game-style tests designed to make learning fun.
- Hyundai Motor unveiled a mini EV equipped with Emotion Adaptive Vehicle Control technology that optimizes the vehicle environment based on the driver's mood.

IMPACT

- Voice-enabled AI technologies actively monitor a user's voice to check emotional wellbeing through unique vocal biomarkers and predict core symptoms of mood and anxiety disorders: depressed mood, diminished interest, avoidance, and fatigue.
- Companies are leveraging Emotion AI when training call center employees. AI analyzes the quality, tone, and pace of the individual, and trains them to speak with more empathy, confidence, and efficiency where needed.
- AI-based approaches can easily detect human expression, such as joy, surprise, fear, or anger, but will soon recognize traits such as age, race, and gender to understand social dynamics, bringing more personalized experiences to consumers – without bias.
- In China, emotion recognition technology is being widely used to bring benefits in many areas including health, anti-terrorism, urban security, and road safety.

TECH

- **Emotion AI in learning:** Entropik, Smile, Proctortrack
- **Employees management:** EI Experience, TeamEQ, Amber, Lead_ Honestly, InsideBoard
- **AI to build resilience:** Driven, Resilient AI, Resiliency
- **Emotional analysis:** ENABLEX FACEAI, TypingDNA, Emokit, NVISO, Element Human, Receptiviti, ComapanionMX
- **Facial analysis:** smileML, Affectiva, Amazon Rekognition, Microsoft Face API
- **Driving AI:** drivebuddyAI, Affectiva Automotive AI
- **Retail solutions:** LilyAI, Entropik, Madstreetden
- **Language analyzer:** Watson Tone Analyzer, Vocalis Health, Emoshape, Cognito, Amazon Connect, Modulate-ToxM od

MY OWN PRIVATE AVATAR

Menno Van Doorn
Expert in Residence

Hyper-realistic representations of humans bring unprecedented and unexplored ways to communicate within the context of virtual channels and the Metaverse

Technology never looked more human. Generative AI, body sensors, scanners to name a few, bring entirely new ways of anthropomorphic communication. We are provided with a means to create hyper-realistic, “real fake” representations of ourselves, and use them for a variety of personal and business purposes within the virtual realm. So advanced are these avatars, that many technology providers can now claim to have successfully passed the doom of the “uncanny valley,” where synthetic representations of humans were just not convincing enough and as such, triggered discomfort. Now, the road is open for VTubers, virtual humans, holograms, virtual social media influencers, and many, many more connotations of anthropomorphism. They will fool around with our perceptions of reality, and trigger a crucial debate about ethics, authenticity and what defines us as humans.

WHAT

- Generative AI (see our Thriving on Data trend, Creative Machine), combined with body scanners and sensors that track face and body movements, enables realistic synthetic representations of humans for digital purposes.
- These avatars can be represented in different ways, for example through audio, video, or holograms, and can be used across various (social) media channels, also notably within the evolving context of the Metaverse (see our trend Me, Myself and My Metaverse).
- Originally mainly applied within the gaming and entertainment context, virtual avatars are now increasingly being used within marketing, customer service, and remote work environments, escaping the limitations of two-dimensional visualization.
- Virtual avatars are engineered to achieve an instant connection with customers, forming a brand-customer bond. They convert ads to brand stories and enable people to resonate with the brand, establishing a more personalized connection.
- As with many breakthroughs in technology, misuse is a threat: "deepfake" tools that generate doctored audio and videos are becoming far more affordable and accessible, triggering ethical discussions and potentially legal measures.
- Technology such as AI and anthropomorphic communication should always be assessed and applied from a human-centered perspective. It does make us rethink our unique position as human beings, and the various ways "reality" is perceived.

USE

- Snapchat and Adidas partnered to enable Snapchatters to dress their "bitmojis" in various Adidas designs to express themselves with a brand that resonates with them, offering a personal, creative, and fun way to interact digitally with friends.
- Verizon and Dreamscape created avatar-driven synthetic training and simulation experiences for students, government, and professional learning – by using 5G and immersive technology – aiming to make VR training more accessible for students.
- Warner Bros used personalized deepfakes to promote its new movie "Reminiscence" by working with synthetic media startup D-ID, allowing consumers to insert their face in a Warner Bros trailer.
- The Agricultural Bank of China deployed an AI-based digital human receptionist, designed to mimic its human counterpart for personalized services, lifting its overall service quality and operational efficiency.
- As part of its Metaverse strategy, Meta's Facebook launched VR-based Horizon Workrooms; a collaboration experience that lets people work together in virtual work spaces, represented by their own virtual avatar.

IMPACT

- Virtual avatars decrease the need to travel to and from any physical location, helping with the scarcity of specialized resource, decreasing travel requirements, saving energy and the environment.
- Avatars form part of an inclusive technology platform, allowing more people to express themselves in creative and productive ways – even if they did not previously have the capability to do so before.
- Companies are increasingly employing avatars for personalized customer service and marketing. When configured and trained properly, avatars can be highly productive, eradicating the round-the-clock need for available, scarce human resources.
- Avatars provide entirely new, unique ways for organizations to profile themselves in the virtual world, serving the brand's purpose objectives and the evolving expectations of its customers and employees.

TECH

- **Motion capture body suits:** Xsens, Notch, DeepMotion, Rokoko, Qualisys -iClone
- **VR:** Avaatar Medical, Cubic Motion, Seimens Teamcenter VR, Pinscreen, Microsoft Mesh, Horizon Workrooms
- **Avatar-based conversational platforms:** DeepBrainAI, Hour One, Bigthinx, Sensly, DaveAi
- **Deepfake technology:** DataGrid, Resemble AI, Veritone, Sentinel
- **Holograms:** Spatial, INDE-Live Avataar, Ericsson One, Human Studio, Microsoft Mesh

WE COLLABORATE

Back to life, back to reality. The world may return to some semblance of what it looked like before the pandemic, but many realities have changed irrevocably – how businesses operate being one of them. Many aspects of value delivery are now entirely independent from location and time. People work together in different ways, in different setups, increasingly at the very edges of what used to be considered the "core organization." Consumers and employees expect integrated experiences, with their latest online endeavors fresh in mind. It requires a new level of cross-organization, cross-sector partnering to meet these expectations. Distribution is the leading design principle, together with mesh-style, loosely coupled collaboration. And with physical and digital worlds fusing, it's no longer clear where the technology network ends, and the business network begins. Oh, it's back to life. But not as we know it.

As employees transitioned from office spaces to their homes, organizations have seen unprecedented changes in value creation and delivery, critically without compromising on productivity. The transformation is only not limited to the change in physical location but is also evident in how the workforce is compiled. Permanent employee teams are increasingly augmented by the "gig economy," as enterprises look for more adaptive, more resilient sourcing models.

Virtual workplaces have necessitated the advent of new productivity tools and techniques, bolstering the team as the default entry into the workday. An always connected – yet asynchronous – collaborative style of working is breaking barriers of geography and time zones, redefining what we call "just another day at the office" now and in the future.

Customer demand for seamless experiences across services has given rise to meshed, cross-industry business models. It introduces an era of co-opetition, as organizations reach beyond the boundaries of their own industry to develop new value propositions with ecosystem partners, startups – and yes, even competitors. It's also by far the best way to achieve joint targets for sustainability and areas of social good.

The convergence of the physical and virtual worlds leads to a new, distributed online economy, powered by trust. Digitization of assets is spreading, from Financial Services to other sectors as well. Distributed ledger technology now finds use in areas as diverse as art, retail, real estate, and the upcoming Metaverse. This new economy certainly looks decentralized, with autonomy enabled via peer-to-peer transactions.

At the very foundation of it all are the ever-evolving technologies, such as IoT and AI, enabled by ubiquitous (5G) connectivity. The sheer volume and speed of connections and data demand more intelligence and actionability at the very edges of business and IT. That way, technology becomes business, business becomes technology.

Sound familiar?

Sudhir Pai
Expert in Residence

FLUID WORKFORCE

Isabelle Schastok
Expert in Residence

An agile, adaptive workforce model that boosts organizational resilience and productivity, saves costs, and addresses the shortages of skilled resources

Under pressure, everything becomes fluid. Still, a hybrid workforce is not just the unavoidable response to the challenges of a post pandemic-driven world: it is a key element of the future of all work. Seducing the business with advantages such as increased productivity and cost savings, not to mention the impact on the carbon balance sheet, it also enables organizations to thrive in the war of talent scarcity – expanding previous sourcing boundaries well beyond the edge of the organization. Shifting towards this hybrid workforce model, however, requires a reinvented, trusted work culture, a robust working technology platform, and an employee experience designed to flow with the new, fluid workforce model. Caring about ourselves. Under pressure.

WHAT

- Even before the pandemic, four out of five organizations had tried a hybrid workforce, mainly to close specific gaps in expertise within their own, local talent pool.
- According to Capgemini's Future of Work research, more than 25% of organizations expect that over 70% of their workforce will work remotely in the future. Organizations need to establish the best hybrid work model for them.
- Hybrid models also include freelance, independent, gig, or crowdsourced workers. Addressing critical skills demand, our Fluid Workforce research demonstrates how 89% of organizations plan to expand hybrid models over a wider range of functions.
- The workforce increasingly prefers to work with fewer constraints, offering flexibility, variety, and a better work/life balance. Only a decreasing minority considers fixed office locations as the best place to work.
- Critical to success is a trusted culture, accompanying social contracts and employee experiences. They connect digital communities, activate purpose, and create a sense of joint belonging – independent of working location or type of contract.
- For hybrid models, leaders must be authentic and empathic, focusing on employee empowerment, encouraging autonomy and transparency. Data-driven collaboration platforms enable workers to achieve results in new, agile ways.

USE

- A global OEM built a joint digital employee experience for all workers – "blue and white collar" alike – using an application including functionalities to aid collaboration, internal communication, personal development, and career planning.
- A public sector client developed an innovative recruiting solution to address candidates' needs, customizing the candidate journey according to age group and generation.
- A large HR service provider used geo-based analytics to create a new recruitment strategy by proactively anticipating upcoming opportunities, and matching job seekers with relevant openings.
- An electricity company designed an entirely new, platform for knowledge management, breaking down siloed structures and establishing a broadly adopted culture of sharing and collaboration.
- A large biotech company built a collaborative digital workplace to eliminate information silos, enabling self-organizing teams, collaboration, and faster decision making.
- Capgemini redesigned its employee experience to increase motivation, engagement, and productivity within their new, hybrid model. It upskilled managers to drive this experience on a platform encouraging two-directional employee feedback and "digital happiness" assurance.

IMPACT

- Our Fluid Workforce research shows benefits including improved time to market and agility, better alignment of talent with the business imperatives, enhanced customer satisfaction, and improved brand perception and sales.
- The same research demonstrates that almost 70% of organizations aim for reduced business costs, and providing out-of-hours support, while around half want to attract higher quality talent, and increase the speed of working.
- The flexibility in work location creates an opportunity for organizations to attract more external talent while reducing office space, saving costs and the need to travel.
- However, rising stress levels is a factor to be considered within hybrid working and needs to be managed proactively. More than half of employees stated higher stress levels and are concerned about their network shrinking due to remote working. The ability to choose a work location can certainly act as a smart countermeasure.

TECH

- **Workforce planning/HR solutions:** Capgemini People Analytics, IBM Talent Management, Workday HCM, SAP SuccessFactors, Upwork Inc, Honeypot, Braincities, Faethm, Service Now (ITSM and CSM), 365 Talents
- **Digital workplace solutions:** Microsoft Office 365, G Suite
- **Self-management and work effectiveness solutions:** Sapience, holaSpirit, glassfrog, Team EQ, Trello, Monday, Amplifai
- **Employee adoption and well-being management solutions:** InsideBoard, Peakon, Lattice, 15Five, Quantum

THE TEAM IS THE CANVAS

Judith Kennes
Expert in Residence

Collaborating in teams-oriented workspaces becomes the new natural place for creating next-level business results

We have long been doing our work using the metaphor of a desktop: a workspace that arranges applications and data from an individual perspective. And yet, in post COVID-times – where working online is the accepted standard – the canvas on which we work is shaped by the teams we are part of. It navigates the social graph of people in and around these teams, the way in which they collaborate to achieve goals, and the data that is needed. The new canvas is virtual, distributed, and asynchronous at times. And it contains all the tools needed for the team to create its next works of technology business art – whether impressionist, expressionist, or just a quick charcoal drawing.

WHAT

- Open and secure collaborative platforms provide shared team workspaces, combining many of previously stand-alone collaboration and communication solutions.
- To extend the functionality of the platform, tools pop up as "plugins" to perform specific tasks such as brainstorming, working on a 3D prototype, developing software, or managing a team's progress.
- Entirely programmable, these platforms provide low-code tools and process automation to create mini-applications with automated flows, increasing the productivity of the team.
- Supported by AI, mini surveys and online, on-demand learning environments, improving a team's skillset becomes a continuous, often just-in-time process as the team progresses towards achieving its objectives and key results.
- Virtual meeting rooms and huddle spaces are easy to book and ready to connect seamlessly with other rooms, anywhere else in the world. The upcoming Metaverse (see Me, Myself and My Metaverse) will bring entirely new ways of meeting.

USE

- The University of Strathclyde uses the Medallia platform to listen and respond to their staff, and to tap into ideas from their faculty and students to manage a range of health and wellbeing challenges with and for citizens and institutions.
- The Mediterranean Shipping Company uses the 8x8 platform together with Microsoft Teams to collaborate internally while offering an omnichannel experience for customers. Having one, global system saves considerable time and resources.
- Siemens Energy uses Librestream, a provider of augmented reality and remote collaboration tools to build their "Connected Worker" solution to remotely inspect, diagnose, and maintain industrial, often remote equipment.

IMPACT

- Being physically apart in a much more virtual, online world challenges our social connections and well-being. But collaboration platforms and augmented reality – and maybe even the Metaverse in the near future – bring people closer again.
- When provided with an open and secure platform, teams become more productive – saving hours per week – tackling challenging tasks through improved collaboration, information sharing, and asynchronous task optimization.
- By putting together a specific collaboration toolset, teams can create their own signature platform to work together, leading to more innovation, motivation, and better retention of scarce human resources.
- With less dependence on being together in a physical setting – and still be able to produce excellent results – there is less need for fixed office space and travel, ultimately contributing to corporate sustainability goals.

TECH

- **Collaboration platforms:** Humanity Platform, Microsoft Teams, Avaya OneCloud, Slack, Google WorkSpace
- **Virtual meetings and events:** Zoom, Google Meet, Cisco Webex, Adobe Connect, GoToMeeting
- **Virtual/Augmented Reality and Metaverse:** Horizon Workrooms, Microsoft Mesh, Librestream Onsight
- **Whiteboard and ideation:** Mural, Miro, Bluescape, Klaxoon
- **Surveys and quizzes:** Medallia Crowdicity

TAKEN BY TOKENS

Muhammed Ahmed
Expert in Residence

Emergence of a “Token Economy” through the convergence of “real” and digital assets within real and digital business models – converging on themselves

Whether in currency or real estate, digital music, the Metaverse, or even world wide web source code, tokens bring a very particular set of skills. Skills that have been acquired during a long evolution of blockchain technology. Skills that have the potential to create a decentralized token economy, disrupting business models, fundamentally changing the way we transact and trade. Tokenization can transform industries, making transactions more efficient, secure, reliable, and accessible. It creates a new meaning of what we perceive as value, as it makes digital assets just as tangible – and valuable – as real-world assets. Tokens: I will look for you, I will find you, and I will leverage you.

WHAT

- Tokenization is the representation of an asset and its ownership on a digital using through distributed ledger technology. A token is a digital asset, stored securely on the blockchain.
- Tokens are mostly known as crypto currencies, such as Bitcoin or Ether tokens. However, they can relate to anything, from votes, licenses, access rights, even to ownership of a song, or digital assets in a Metaverse.
- There are broadly three categories of tokens: payment tokens serve the function of money (cryptocurrency), security tokens represent ownership of an underlying asset (financial instruments, real estate, art, digital assets in a 3D world), and utility tokens provide access to a particular set of goods or services (ICOs, collectibles, identity tokens).
- A "token economy" will enable peer-to-peer transactions without relying on a trusted authority, thereby vastly increasing the volume of trade, potentially unlocking trillions of dollars in illiquid assets.
- Tokenization accelerates the convergence of the "real" world with its tangible assets, and the "virtual" world with its digital assets, giving rise to a decentralized economy, powered by trust and unbreakable, distributed technology.

USE

- Over 80% of the central banks are exploring Central Bank Digital Currencies (CBDCs). Token-based CBDCs will decentralize the currency system, allowing users to operate through wallets and transact in a peer-to-peer fashion.
- Financial assets can be tokenized and digitally traded through Security Token Offerings (STOs) in cryptocurrency exchanges or security token exchanges.
- Customers can purchase and trade digital assets for products and services – such as Nomura's subscription service for a high-end Italian food delivery service – or tokenize their credentials to streamline transactions – such as Mastercard's online shopping experience for Amazon customers.
- Non-Fungible Tokens (NFTs) provide immutable ownership to unique, distinct, and non-replicable assets and has extensive applications in the art, music, intellectual property rights, and other collectibles.
- Individuals and enterprises can own, buy, sell, trade, or offset their carbon footprint through Carbon Tokens such as Universal Carbon or Terrapass Coin.
- Enterprises can reward customers with blockchain tokens in return for their brand loyalty, or to encourage sustainable behavior.

IMPACT

- Decentralization can improve latency (through peer-to-peer transactions), reduce cost (by eliminating intermediaries through smart contracts), improve security (through cryptographically secure transactions), and increase transparency (through an immutable ledger of transactions).
- Decentralized Autonomous Organizations (DAOs) can democratize and crowdsource organizational decisions – creating token-driven trusted systems for enterprises, ventures, and charities, etc.
- Tokenization has fueled an innovative, now well-established way of fundraising for early-stage startups through so-called Initial Coin Offerings (ICOs)
- Smart Contracts can automate transactions and eliminate intermediaries, thereby reducing administrative processes and the dependence on scarce human resources.
- However, decentralization brings many challenges: fraudulent transactions, scalability, and privacy concerns. These need to be addressed to truly unleash the token economy.

TECH

- **Technologies:** Ethereum, Hyperledger Fabric, Algorand, Consensys Quorum
- **Securitization:** ConsenSys Codefi, Polymath, Securitize, Polygon
- **NFTs:** OpenSea, Rarible, Larva Labs CryptoPunks, Decentraland

YOUR BUSINESS IS A MESH

Neha Punater
Expert in Residence

Enabled by “water-like” technology, it’s easier than ever for organizations to join forces, even if it’s just for one day, for one occasion, or for one customer

Caught in a mesh? With a cloud-based infrastructure platform, agile application microservices, data sharing capabilities, intelligent automation, and hyper-connectivity as technology enablers, it’s easier than ever to collaborate with others – even if they come from unexpected sides. These thriving, always changing ecosystem-based business models can drive unique products, services and customer experiences that were deemed unlikely or impossible before, crossing the barriers of sectors, industries, and regions. Not only that, but Mesh Collaboration can also be key to address joint sustainability goals as well. Exactly the rumble organizations may be looking for.

WHAT

- "Water-like" technologies – such as cloud-native infrastructure, microservices-based APIs, secure data sharing platforms, intelligent process automation, and 5G connectivity – make it easier for organizations to partner and collaborate, even if it is in a loosely coupled "mesh," which may be ad hoc, opportunistic, or unplanned.
- Organizations navigate increasingly complex social, environmental, and supply chain challenges, which they can no longer address alone. While governments rely on market forces, private sector innovation, and the economic opportunity created by companies to improve people's lives – the success of each sector is inextricably intertwined with another.
- Creating an integrated, end-to-end consumer experience (see also Experience[2]) that wins over and retains client loyalty may require operating far beyond the edges of the organization; possibly in other sectors, or in "co-opetitive" partnerships with competitors that benefit all stakeholders involved.
- Climate change, poverty, and inequality are some of the more critical issues of our time. Cross-sector collaboration leverages the strengths of companies, governments, and sponsors to accelerate progress on these and many other complex issues in a way that can benefit everyone.

USE

- Challenger Banks in the UK and Europe have built financial marketplaces and superstores for consumers with fintech partnerships across investments, pensions, bill switching, and insurance, etc.
- India Stack launched the "Open Credit Enablement Network" to enable data sharing, distribution, and real-time monitoring of loans on digital marketplaces.
- Louis Vuitton, Cartier, and Prada have jointly formed the Aura Blockchain Consortium to provide customers with a token-backed seal of authenticity for their products.
- Major technology and automotive corporations partner to develop state-of-the-art technology for autonomous vehicles, forming the basis for safety standardization and mass autonomous vehicle production. This unique, cross-industry approach marks a starting point for a change of mindset, partnership, and collaborative competition.
- Through collaboration and a mutual desire in sustainability, clothes retailer Timberland partnered with tire manufacturer, Omni United to find a new source of rubber for their shoes using recycled tires, ensuring no tire rubber goes to waste and setting them aside for reuse under the new brand, Timberland Tires.

IMPACT

- Successful partnerships leverage combined resources to increase scale, reach more people, and amplify both impact and results. They can also help companies develop relationships in new markets.
- Sharing expertise and knowledge can spark more innovation and unlock many new, unexpected opportunities and networks.
- Coordination improves alignment and efficiency while reducing individual funding commitments.
- A unified, end-to-end user experience that joins all players for a product or service delivery lifecycle results in a vastly improved customer experience.
- Committed private sector partnerships can transform otherwise time-bound development investments into replicable and sustainable long-term, market-driven, scalable initiatives.

TECH

- **Data Sharing:** 5G Network Automation, AWS Data Exchange, Snowflake
- **Blockchain and API:** Blockchain, APIfication, Hyperledger, Ethereum
- **Identity and access management:** Kong, Ping
- **Artificial intelligence and Internet of Things:** AI, Google AI Platform, IOT, Microsoft Azure IoT Platform, Google Cloud IoT Core, AWS IoT
- **Other technologies:** Hyperledger, Codefi, Ethereum, IBM Watson, Microsoft Azure, Microsoft HoloLens, PTC ThingWorx, MindSphere, OpenAI, TensorFlow

IT'S ALL CONNECTED

Gert Helsen
Expert in Residence

In combination with IoT, AI, and Edge computing, 5G connectivity is the catalyst for technology-driven, networked business innovation

Depending on your point of view, the very notion of everything being connected may trigger spiritual or ecological thoughts. Alternatively, it may be like staring into a Black Mirror, or it may simply strike you as a worn-out cliché. But for a Technology Business, the technological capabilities to connect in real time, at high speed, to so much more than was previously achievable – including the internet of things (IoT), edge devices, and people in the field – provide unique opportunities. Data is often the keyword here, as it's easier to gather, in higher volumes, at more collection points than ever before. Share it, collaborate on it, even create AI models on top of it. Your high-speed, ultra-smart business network is here.

WHAT

- Connectivity between end user device and end point ranging from mobile cellular, WiFi, broadband, cable as well as satellite.
- 5G is the latest cellular communication standard. Capgemini's Accelerating the 5G Industrial Revolution research shows that 40% of industrial organizations expect to roll out 5G at a single site within two years.
- The new Wi-Fi 6 standard provides potential speeds up to 9.6Gbit/s with up to 75% less latency compared with Wi-Fi 5.
- In the Intelligent Industry sector, use cases demonstrate how 5G can conduct video-based quality inspections, remotely control, and operate machinery, run AGVs and other autonomous robots, and enable remote collaboration using AR/VR.
- Starlink, a satellite internet constellation operated by SpaceX, consists of over 1,600 satellites and will eventually consist of many thousands of mass-produced small satellites in low Earth orbit, aiming to provide internet access to people around the world currently living without access to high-speed internet.

USE

- Smart farming and precision agriculture incorporate 5G technology by connecting sensors and tracking devices with geographical and weather information.
- In manufacturing, 5G enables increased agility of factory operations by connecting robots and autonomous guided vehicles to run dynamic routes based on conditions.
- In logistics, smart container platforms can track individual containers rather than an individual goods vehicle, ship, or train to offer improved efficiency and insights.
- A Dutch construction company uses IoT sensors to optimize building management and maintenance, tracking energy consumption, humidity levels, and carbon emissions. The data is used to plan energy efficiency upgrades and reduce costs.
- Porsche, in cooperation with Vodaphone, has entered the 5G era offering real-time mobile communication to allow the secure and instantaneous transmission of data between car, human, and machine.

IMPACT

- Enterprises will need to rethink their business models to harness the power of IoT and 5G by collecting and aggregating huge amounts of real-time data, offering, and monetizing value-added services (levering AI and data analytics).
- Automating, tracking, and monitoring processes drastically reduces the time between an occurring event and any corrective action resulting in faster decision making as well as reduced risks and costs.
- 5G can industries to reduce greenhouse gas emissions by enabling improved energy efficiencies, smart water management, traffic management, and smart cities.
- With the volume of data collected from 5G applications, companies will need a full review of their existing data procedures and IT infrastructure.
- While it becomes easier to improve security through 5G, it will also introduce new security risks as Cloud, data, and IoT threats merge.

TECH

- **Connectivity:** LoRaWAN, Open RAN, OPC Foundation, IEEE 80X Standards, WiFi 6, 6G, EFF, Ultra Internet High Speed
- **5G related papers and standards:** 5G Industrial Revolution, 5G in industrial operations, ETSI Why do we need 5G, ITU 5G Requirements, 3GPP 5G specifications
- **Edge computing concepts:** 5G and Edge, Multi-access Edge Computing (MEC), HiberHilo
- **Satellite ground network:** Hughes JUPITER System Satellite Ground Network, Starlink, Imersat

THRIVING ON DATA

It's no wonder organizations aspire to thrive on data, to be data-powered enterprises. With every business now being a de facto Technology Business, data obviously is at its core. Dare we say, every Business is a Data Business? Look at the facts: data powers superior customer experiences, highly tuned operations, and smart, self-optimizing products and services. Data provides resilience, predictability, and effectiveness, but equally enables organizations to achieve their sustainability ambitions. It also helps their potentially scarce human resources to achieve the best, most satisfying results. With that, it's tempting to declare data to be "just" the new, corporate asset. But assets tend to be stacked, isolated, and safely put away. It's much better to see data as a first-class product; owned, managed, and activated by business domains, and shared in lively exchanges inside and outside the organization.

When dealing with data, it's good to start with proper definitions. Data is the digital representation of an organization's past and present, encompassing its processes and interactions with customers, ecosystem, and the market. Also, a "data-powered enterprise" is an organization that creates, processes, and leverages data proactively to achieve its business objectives, drive innovation, and fulfill its corporate purpose.

It is certainly advantageous to be one. Our Capgemini Research Institute noted in its Data-powered Enterprise report that the trailblazers, the "data masters," see a 70% higher revenue per employee, a 245% higher fixed asset turnover, and 22% more profitability. Even more importantly, they achieve a 20% decrease in customer churn, and a 19% increase in customer satisfaction. They also enjoy a 19% employee productivity enhancement, and 16% more operational efficiency. The list goes on – did we mention cost savings and better sales?

All the more reason for a continuous state of data-induced euphoria. If only it wasn't so difficult to achieve data mastery. Yes, many organizations create data foundations: managing data sources, implementing technology, setting up governance, assuring data quality. But ***activating data*** at the heart of the business strategy, having people in the operations to embrace, trust, and use data for all their business purposes, is a different ball game – let alone monetizing data, and building a company-wide data-loving culture.

It puts this data activation at the heart of all trends:

Sharing and collaborating on data in all sorts of different internal and external ecosystems is one way to turn data from an asset into a first-class product. It gets more value out of data, but also drives achieving key sustainability goals.

Increasingly powerful self-service tools bring data where it should be – close to the business – on an enterprise scale. This is not only instrumental to creating a data-powered culture, but it also addresses the scarcity of deeply skilled data specialists.

It goes together with the move towards federated management of data across the organization, bringing ownership and control of data to the domain where it belongs, held together through company-wide open standards and rock-solid, automated platform services.

Ever evolving algorithms – built and trained on data – show what activation really looks like. Advanced breakthroughs in technology, for example in autonomous devices and battling climate change (see our research report), are due to the latest in algorithms and AI.

Then, as its ***pièce de résistance***, AI systems work together to create and generate text, video, audio, test data, and program code. It makes humans thrive in their most creative tasks and endeavors, including those who didn't have the means or ways to do so before.

Ron Tolido
Expert in Residence

DATA SHARING IS CARING

Anne-Laure Thieullent
Expert in Residence

Participating, collaborating, or even leading in data ecosystems gets more value out of data – creating new connected products, services, and experiences, boosting enterprise performance, and contributing to a better society

What's not to like: realizing the true value of data by sharing and leveraging it in all sorts of internal and external ways? A data ecosystem thrives on the art of shared data, and a collaborative – or sometimes even "co-optetive" – culture. Done in many ways and far safer than ever before, the next generation of data cloud platforms enables trusted data collaboration without ever giving up on data privacy, security, and ownership. Data evolves from a static, anxiously guarded asset to a highly valued product, continuously expanding an organization's business scope. So, press that forward button: share the message!

WHAT

- Collaborative data ecosystems see different organizations sharing data under relevant applicable regulations to create new value for all participants. These ecosystems can occur within one organization as well, all with similar benefits.
- According to the Capgemini Research Institute, 84% of organizations will launch a new data ecosystem within the next three years; telecom, banking, and consumer goods are the sectors with most ambitions.
- Collaborative data ecosystems can take different forms: data brokerages providing aggregate data to its clients, reciprocal data sharing among supply chain partners, sharing of insights across sector boundaries among many others.
- Key decisions need to be made on what data can be shared (sourced or supplied), who the trusted ecosystem partners will be, what role an organization wants to play, and which collaboration model and business model will work best.
- Collaborative data ecosystems thrive on foundational capabilities – such as privacy, ethics, ownership, trust, compliance, and accessibility. Data sharing platforms, data collaboration platforms, data exchanges, and differential privacy support this.

USE

- The MELLODDY consortium leverages a large collection of small molecules with known biochemical or cellular activity to enable predictive models and efficiency in drug discovery – using shared decentralized data of 10 pharmaceutical companies.
- The European Open Data Portal provides access to open data made available across Europe to both organizations and the general public. There are over 1.3 million datasets from 36 countries, available across all major sectors, across 82 catalogs.
- The Mayo Clinic launched the Clinical Data Analytics marketplace, providing access to anonymized patient data – including disease patterns, diagnosis, treatments and care plans – to healthcare organizations and providers.
- Funded by the Gates Foundation, working with the Centre for Agriculture and Biosciences International, an open agricultural data ecosystem is being built to support the management, sharing, and governance of data across the agricultural sector.

IMPACT

- The Capgemini Research Institute estimates that data ecosystems have already improved customer satisfaction by 15%, improved productivity and efficiency by 14%, and reduced costs by 11% annually in the last 2–3 years.
- The research also shows that organizations using external data extensively (making use of more than seven external data sources) exhibit superior financial performance, with up to 14 times higher fixed asset turnover and two-times higher market capitalization.
- Collaborative data ecosystems are key to addressing many of the current societal challenges and organizational purposes, for example in health (as evidenced by the COVID-19 pandemic), energy consumption, agriculture, and sustainability.
- By engaging in collaborative data ecosystems, organizations are likely to find unexpected, new partners – potentially fueling new, data-powered value streams, data monetization, and even breakthrough, innovative business models.

TECH

- **Data exchanges and marketplaces:** AWS Data Exchange, Snowflake Data Marketplace, Dawex, Oracle Data Marketplace, Human Data Income (HUDI) Defi token-driven data monetization, 890 by Capgemini
- **Data sharing platforms:** Amazon Redshift Data Sharing, Microsoft Azure Data Share, Snowflake Data Sharing, Google Analytics Hub, IBM Aspera on Cloud, Oracle Blockchain Platform Cloud
- **Data collaboration platforms**: Harbr, Snowflake Data Cloud, Infosum Data Collaboration Platform, Alteryx Connect, Atlan Data Collaboration, Cinchy Data Collaboration, Omnisient Data Collaboration, Duality Data Collaboration
- **Federated learning: IBM** Federated Learning, TensorFlow Federated (TFF), Xaynet Federated Learning, Owkin for Life Science, OpenMined Private AI, NVIDIA Clara
- **Differential privacy and cryptography:** Microsoft Differential Privacy, LeapYear, Cosmian

POWER TO THE PEOPLE

Mukesh Jain
Expert in Residence

A growing scarcity of specialized skills, the need to activate data as close to the business as possible – plus powerful AI and automation tools – are all driving the unstoppable self-service data revolution

Time to fight the central power! Within a true Technology Business, everyone is part data scientist, part data engineer. Activation of data happens best in the closest proximity to the business, at the very edges of central IT and data departments. But the right skills are becoming ever rarer, and secure, high-quality access to the right data is just as difficult to find. AI and automation bring easy-to-use, self-service tools that provide the power of activating data to more people. It offloads the pressure on central delivery, deals with scarcity, and democratizes access and use of data. Something to push through the barricades for.

WHAT

- Within a Technology Business, data needs to be accessed and used – activated – near or right within the business; a Capgemini Research Institute publication shows that true "data masters" put a strong focus on data democratization.
- Data democratization requires powerful self-service tools that decrease dependency on central, scarce skills and technology, although they will just as well increase central productivity.
- Self-service tools increasingly offer natural language and other "low-" or "no-code" automated and augmented ways to access data and turn it into intelligence, analytics, and even AI – making the accessing of data a much more inclusive activity.
- These tools can only work on an industrialized, highly automated, AI-augmented platform to find and access data – from an accessible marketplace front end, all the way up to secure, enterprise-scale, factory-style data delivery.
- Individuals can also become active participants in producing and "marketing" their data for others – inside and outside the organization – both for enterprise performance objectives and for the greater societal good.

USE

- A European bank standardized and automated their client's asset allocation insights on Microsoft PowerBI, making them available as self-service to both investment advisors and their clients. This created higher engagement and client satisfaction.
- A manufacturing company empowered its business users with self-service procurement insights, demand sensing, and supplier risk assessment solutions. This allowed business users to drive their inventory management more successfully.
- A bank's marketing department identified a surprisingly interesting wealth management segment using a plain "AutoML" studio, with other business users building algorithmic models that reduced loan defaults in microfinance by 5%.
- The Damp Busters project provides Bristol citizens with sensors that gather temperature and humidity data, to understand damp conditions. Through citizen-generated data, more inhabitants are actively involved in helping to solve their city's challenges.

IMPACT

- More cost-effective, faster production of high-quality BI, analytics, and AI results, both near or within the business and from a central delivery function.
- Better and faster access for the business to more relevant data from various internal and external sources increases the delivered value from data.
- Speedier availability of new insights to the business, improving responsiveness and adaptability.
- Increasing cultural and practical awareness on the business side of activating data into insights, algorithms, and AI for their business objectives.
- Addressing the rapidly growing scarcity of specialized resources in data engineering, data science, and data visualization.
- Freeing up time for specialized data scientists and data engineers to work on the highest priority models and business outcomes and breakthrough innovations.

TECH

- **Data marketplaces:** AWS, Snowflake, DAWEX, 890 by Capgemini
- **Self-service BI and analytics:** **AWS** QuickSight, Tableau, Microsoft Power BI, Qlik, SAS Visual Analytics, Dataiku, Saagie, Google, TIBCO, 890 by Capgemini
- **AutoML:** DataRobot, Google, H2O.ai, Microsoft, AutoKeras, Databricks, Feedzai, Kortical, Oracle, TransmogrifAI, IBM, AWS
- **MLOps:** Dataiku, Amazon Sagemaker, Azure Synapse, 890 by Capgemini

DATA APART TOGETHER

Yashowardhan Sowale
Expert in Residence

A federated, actively collaborating “mesh” of data producers and data consumers – owned and governed by the business domains themselves – brings data as close as possible to where it is picked up and used, a hallmark of a true Technology Business

Poor data people in the center. Caught between a rock and a hard place. So many different sources, uses, and perspectives of data – all seemingly changing overnight. Why not fully embrace diversity, and create a much more federated business take data on? Emerging concepts such as “Data Mesh” move the ownership of data to the business domain themselves, where data is best activated. It stimulates these domains to manage data as a first-class product and share them through lively internal and external marketplaces. And all of this enabled by open, standard, enterprise-scale platform services. It really is the best of both worlds.

WHAT

- As an alternative to centralized data management, federative approaches emerge that stimulate business domains to truly "own" and manage their data and actively collaborate with internal and external partners.
- Data Mesh is a leading approach – building on the notion of loosely coupled mesh networks – shifting the ownership of data to the business domains that typically have the best subject matter expertise closest to the sources of data.
- Data Mesh also propagates domain management of data as a first-class product, not only providing quality and timeliness, but also making their data products available to internal and external consumers through a compelling, self-service user experience.
- To enable federative data management, a rock-solid platform of open standards and services is needed to make data findable, accessible, interoperable, and reusable – it's a non-negotiable prerequisite for the data autonomy of domains.
- Platform services include data catalogs, marketplaces, metadata management, graph navigation, data lineage – as well as microservices, APIs, automated data pipelines and stream processing, and data virtualization for easy access.

USE

- Online fashion retailer Zalando implemented Data Mesh principles to guarantee accessibility and availability of data at scale to the business domains – actively pushing managing data as a product by these domains.
- Using a cloud-distributed Data Mesh, ABN AMRO bank gained flexibility in managing the needs of cross-functional teams at scale while eliminating silos – acknowledging that business domains access the same data sets for different purposes.
- With a Data Mesh Platform, Netflix Studio decreased the lead time for diverse studio teams to create a new data pipeline while new support features were offered such as end-to-end schema evolution, a self-serve UI, and secure data access.
- DPG Media took an agile approach to Data Mesh through the notion of data products, domain data stores, and domain-based governance. The company can now extend its data-powered culture across the entire organization.

IMPACT

- Access and ownership of data as close as possible to the business brings increased responsiveness, responsibility, and agility, without giving up on enterprise-scale governance – it derives more value from data, closer to the business.
- Self-service and data pipeline automation increase the productivity and cost-effectiveness while decreasing time to market of creating data solutions. It also resolves the scarcity of highly skilled (central) data experts.
- Ease of finding data products within the organization enables producers and users of data products to collaborate more effectively, resulting in better business outcomes with data.
- Embracing not only ownership – and data product management – by business domains is a crucial step towards creating an organization-wide data-powered culture.

TECH

- **Data virtualization and federation:** Tibco, Denodo, Red Hat, Oracle, SAS, Actifico, Atscale, Data Virtuality, DataMeer
- **Data sharing:** Microsoft Synapse, Informatica, SnowFlake, Databricks, Baffle, Cloudera, Vendia, Delta Share, Azure Data Share, Datavant, Demyst
- **Data collaboration/Data Mesh enablers:** DataPlex, Atlan, Cinchy, K2View, IBM Data Fabric, Informatica Intelligent Data Management Cloud, Infosum, Alteryx, Snowflake, Box, Omnisient, Duality, StarDog, Harbr, TIBCO, Gigaspaces, Starbust, Dataiku, Nexla
- **Major cloud providers:** AWS, Microsoft, Google, IBM, Oracle, SAP

ERA OF ALGORITHMS

Padmashree Shagrithaya
Expert in Residence

Challenge everything you've tried so far: the next-generation AI algorithms bring brand-new, awesome ways to solve problems, innovate, and bring out the very best in humans

The age of guessing is over. The era of algorithms is here. Much of the current love for AI comes from deep learning on neural networks. These are brute force, pattern recognition machines that – if provided with plenty of training data – can go where the more traditional data science cannot. Deep learning can be combined with other technology-enabled tactics, such as reinforcement learning, to provide even more unparalleled problem-solving power. Building these algorithms is a specialized, energy-consuming task, but off-the-shelf algorithms and models provide sensible, sustainable alternatives.

WHAT

- Many current advances in AI are thanks to machine learning models on neural networks, detecting and classifying features through multiple layers of raw input.
- With abundant training data as an input, neural networks may recognize patterns much more effectively than traditional (statistical) data science approaches.
- Advances in the ability to collect, store, and access training data, plus powerful graphical processing units (such as GPUs), have been instrumental to its success.
- Reinforcement learning uses an action/reward approach to learn from interactions. This creates additional AI power in areas such as robotics, scheduling, and gaming.
- Training AI models consumes a lot of energy, but the resulting models can optimize energy consumption of a variety of business activities, providing a net gain scenario.
- Training AI models also requires highly specialized skills, but low-code AutoML (Automated Machine Learning) tools bring AI algorithms to a much wider audience.
- Approaches such as TinyML offload trained AI models to even the smallest of edge devices, relieving energy-consuming central facilities.

USE

- Microsoft developed an image-captioning algorithm that exceeds human accuracy in identifying objects, but also more precisely describes the relationship between them. It is incorporated within its assistant app for the visually impaired, "Seeing AI."
- A life science research team developed a reinforcement learning-based AI pancreas that calculates the amount of insulin needed for a diabetic patient and injects it automatically. It is hailed as "autonomous driving for the medical industry."
- Tokio Marine uses deep learning computer vision to auto process damage insurance, analyzing photos of damaged vehicles and providing recommendations on repair options, paint and blend operations, and the expected number of labor hours.

IMPACT

- Solving problems that were deemed impossible to solve – or insufficiently successful – with more classic data science approaches.
- Creating powerful, self-learning, and self-optimizing autonomous systems decreases the need for scarce onsite human resources.
- Extracting more value out of (historical) data by turning them into powerful AI algorithms that can be monetized externally.
- Acquiring access to next-generation AI algorithms without the need for scarce, specialized resources – through AutoML, low-code AI, and off-the-shelf models.
- Lowering the energy consumption of large, central AI computing environments through downloading trained "inference" models to edge devices.
- Using superior AI algorithms for optimizing scare natural and human resources, to battle climate change, and in general contribute to better societal futures.

TECH

- **Deep learning/neural networks:** TensorFlow, Microsoft Cognitive Toolkit, Theano, MXNet, Keras, Chainer, PyTorch, Gluon, Horovod, AWS Deep Learning, Caffe, Deeplearning4j, PlaidML, OpenAI GPT-3
- **Reinforcement learning:** AWS DeepRacer, Facebook Horizon, Gym on OpenAI, Microsoft Project Malmo, Google Dopamine, RLLib via Ray Project, Tensorforce, Reinforcement Learning Coach by Intel, MAgent, Tensorflow Agents, SLM Lab, DeeR
- **AI infrastructure accelerators:** NVIDIA Deep Learning, AWS Deep Learning AMIs, Google Cloud TPU, Intel AI and Neural Compute Stick, Apple Neural Engine, Qualcomm Cloud AI100, IBM Watson Machine Learning Accelerator, Inference Engine by FWDNXT, ALVEO, tinyML
- **AutoML and Low-code AI:** Microsoft Project Bonsai, Google Vertex AI, DataRobot, Microsoft Azure AutoML

CREATIVE MACHINE

Viswanathan Rajeswaran
Expert in Residence

Unleashing the generative capabilities of AI to enable individuals and organizations to express themselves better in different creative ways, even if they lacked the capabilities or manpower for it in the past

What if we told you this pitch is written by AI? It seemed the final frontier; where technology would automate our repetitive, mind-numbing tasks we would find our new forte as humans in creativity – an area where AI could never match us. Turns out that generative, creative AI systems produce increasingly spectacular results in areas as diverse as images, video, audio, text, art, products, medicines, games, program code, and test data... the list is endless. When done well, AI becomes a powerful, inclusive technology, enabling many more people to express themselves effectively, raising both the individual and corporate Creativity Quotient (CQ). Now there's a creative machine.

WHAT

- Generative, creative AI is based on the concept that – given enough training data and the right machine learning approaches – an AI system can not only detect patterns in said data, but can also produce new, synthetic ones out of the same.
- Generative Adversarial Networks (GANs) let two neural networks work together: the "generator," attempts to produce realistic data, the "discriminator" assesses how plausible it is, and a feedback loop creates increasingly realistic, synthetic results.
- Auto-regressive language models such as GPT-3, Google Switch Transformer and Megatron-Turing build on hundreds of billions of parameters and huge 'piles' of internet text to generate convincing, high-quality text, including program code.
- Many creative AI systems are based on pre-trained models – they only need to be properly "prompted" to generate results. Training creative models can therefore consume many computing resources, using them for creative purposes consumes much less.
- Generative, creative AI has a multitude of potential applications, from the design of software to interiors of houses and fashion, but also the creation of text, music, medicines, video, audio, books, art, and even test data.

USE

- AI21 Labs' online WordTune AI application uses generative language models to help people write better, richer, more varied pieces of text. It is currently exploring how to enable dyslexic people to express themselves more effectively.
- The open source GAN Zoo is a rapidly growing directory of all named GANs, covering application areas as diverse as text generation, medical imaging improvement, malware attack detection, even those creating passable works of art.
- Sogeti's Artificial Data Amplifier (ADA) enabled a Swedish government agency to build and test systems and models on generated, synthetic personal citizen data, without ever having any real personally identifiable information involved.
- Iktos and Facio Therapies collaborate to apply Iktos' AI-driven structure generation in one of Facio's drug discovery programs, aiming to expedite the identification of potential pre-clinical candidates and to identify suitable novel chemical matter.

IMPACT

- The ability to deal with the increasing scarcity of human resources and lack of specialized skills thanks to augmentation by creative AI in generating, creating, and transforming all sorts of different content and assets.
- Inclusion of more people who can express their creativity, where they did not have the capabilities, skills or means to do so before. There is also the potential to unleash hidden creative power in the company's (historical) datasets.
- Generating de-personalized, synthetic data from "real" data to address privacy, quality, fairness, bias and availability concerns of training and test data used within the organization.
- Exploring models, approaches and scenarios that would otherwise be too time-consuming or complex for humans to cover or to comprehend, for example in life science and other scientific research areas.

TECH

- GANs: StoryGAN, DiscoGAN, ArchiGAN, GameGAN, StackGAN, Google GAN, GAN Lab, GANImation
- GAN libraries: TF-GAN, Torch-GAN, Mimicry, IBM GAN-toolkit
- Language transformer models: BERT, OpenAI GPT-3, Google Switch Transformer, Microsoft Turing, NVIDIA Megatron, Microsoft/NVIDIA Megatron Turing NLG 530-B

PROCESS ON THE FLY

Strategy tends to be eaten for breakfast, by culture – but also by a lack of operational execution. Organizational aspirations simply "blah blah blah" without any ability to turn insight into action, quickly respond to events, overcome business silos, or go with whatever flow the corporate purpose supposes. And all that goodness must be delivered against a scarcity of skilled human resources and a need to reduce travel and energy consumption. This is where Process on the Fly comes to the fore and shines ever brighter. Having been consistently less in the spotlight than its complementary container, Thriving on Data (ever heard of "Big Process"?), breakthroughs within intelligent automation and a taste of touchless execution have firmly placed this container center stage. Quit talking and start doing.

In many ways, a process is really just another "thing." When equipped with "sensors," it can provide a continuous flow of data points about its status and whereabouts, not unlike the concept of a Digital Twin in the Intelligent Industry domain. With this digital twin process available, it opens up a full spectrum of possibilities to not only better understand processes, but also to experiment risk-free with alternative scenarios and options, and predict – or even prescribe – how processes will run and be managed in the future.

Then, software robots come to the aid as dependable, digital companions, automating the interaction between humans and their technology-enabled processes. This Robotic Process Automation gives us the time and freedom to think, plan and focus – while the more mundane, repeatable activities are done for us, 24 hours per day, 7 days a week, without compromise. It also helps to relieve the pressure on organizations that need to deliver more, with less.

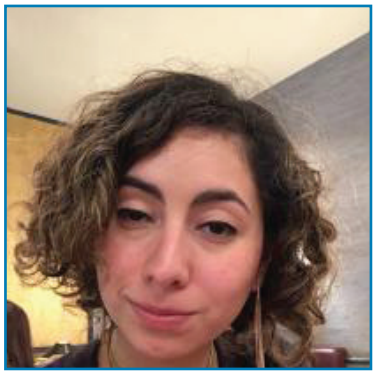
Similar technologies act as a certified Silo Buster, bridging the gaps between corporate – or intercorporate – processes and systems, without intruding upon them. It's one of the most straightforward, resource-saving ways to bring innovation to organizations: through up-cycling what is already there, rather than buying or building solutions from scratch. Add some next generation application services to the mix (see for example Mesh Up Your Applications), and any process is just an API call away.

Finally, the powerful cognitive capabilities of artificial intelligence increasingly enter the arena of process automation and management. They challenge what we used to consider as a given, replacing inflexible, human-dependent processes with powerful reasoning systems. These systems adjust to whatever situation occurs, anticipating next best actions and resources required in real-time. And while learning from what works, they increasingly become hands- and care-free, bringing organizations – and its people – on the road towards a no-touch, frictionless enterprise.

Pretty fly, no?

Manuel Sevilla
Expert in Residence

PROCESS IS MINE MINE MINE



Elle Sanchez
Expert in Residence

Using Digital Twins to inject continuous process innovation, making it the envy of the entire flock

Change can be tough, and at times may feel like trial and error. One step forward, two steps back. An improvement here or there may create a bottleneck elsewhere. But what if – by repurposing an existing technology that has been around for a while – you could prototype change in a risk-free environment? Applying a Digital Twin to a business process enables entirely new ways to digitize and reimagine how a Technology Business can identify, measure, and prioritize new ideas for process improvements. And when coupled with feedback from the operational side of the business, it really does forge a new path for continuous, enviable process innovation. You'll be ready for whatever change comes your way, so you can just keep swimming.

WHAT

- Modelling techniques can capture both the process and meta-data required to describe the characteristics of the business operations.
- Process mining technology is used to identify possible process variants (paths), bottlenecks, and exceptions.
- Task mining technology can identify manual activities performed outside core systems causing bottlenecks and consuming resource effort.
- Standardization is driven through visualization and evaluation of where you are today, compared with where you want to be.
- Opportunities for process improvements can be assessed risk-free by simulating outcomes to estimate benefits and ROI before committing to any changes.
- Agile management tools further benefit process improvement to explore, measure, qualify, and manage ideas effectively, enabling the organization to focus on the more value added and high priority initiatives.

USE

- Aker BP deployed the DecisionSpace 365 cloud application, to accelerate their delivery and increase efficiency through automated workflows, multi-scenario analysis and digital twin models.
- Vero Skatt mapped a consistent big picture of the current and target state of their processes, choosing QPR tools to identify bottlenecks and detect overlapping information systems. The organization developed uniformity in language and communication, and created a model of their operations.
- The UK Ministry of Defense (MoD) is working with Improbable to provide a next-generation communication network digital twin to enhance resilience, speed up decision making, and drive efficiencies in support of diverse digital use cases.
- The Renault Group leveraged Google Cloud's Supply Chain Twin to accelerate the digitisation of production facilities, supply chain, and Industry 4.0 transformation, bringing end-to-end visibility to their supply chains.
- Slovakian health insurance firm, Dôvera implemented UltimateSuite's Task Mining and RPA solution to optimize up to 30% of cost savings in back office processes

IMPACT

- Accelerated process design with enhanced virtual collaboration and change transparency using digital process modelling tools to model target processes.
- Higher business case and change impact accuracy by using simulation from Digital Twins to assess process improvement opportunities.
- Evidence-based analytical capabilities to identify process bottlenecks, violations and exceptions with process-mining tools, resulting in faster root cause identification and pragmatic, focused solutions to improve the process.
- A higher implementation success rate through the prioritization and management of improvement opportunities, enabling resources to focus on the highest value-added initiatives.

TECH

- **Process mining tools:** Celonis, Minit, UiPath, UltimateSuite
- **Simulation/digital twin tools:** Celonis, BusinessOptix, Improbable, Google Cloud, Landmark Solutions
- **BPMN software:** BusinessOptix, Signavio
- **Agile management tools:** Jira, Trello, Monday.com, BusinessOptix

ROCK, ROBOT ROCK

Smitha Gopalaiah
Expert in Residence

Robots become a dependable, digital companion, giving us the time and freedom to think, plan, and focus

Digital robots are among us – though they're not like the ones in the movies. These powerful software solutions are here, evolving, becoming more sophisticated by the day. We talk about them, we hype them, and we apply them. They help to eliminate the mechanistic and repetitive processes of the human workforce. They de-noise process execution leaving teams free – to think, plan, and focus. They harmonize with APIs and incorporate cognitive functions that enable more than just the "copy and paste" of old. Robots can even watch human operators doing their job – and with the magic of machine learning – decide to do it themselves and deliver. Simple, fluid, and frictionless Intelligent Process Automation. So, while Robotic Process Automation may not look like R2-D2, it will certainly speed up the flow of routine business activities. Robots work. Robots rock.

WHAT

- Intelligent Process Automation (IPA) utilizes a software system to replicate the actions of a human worker interacting with the user interface of a computer system.
- This "software robot" can be trained to use the user interface in the same way as a human would, virtually initiating input actions (such as mouse clicks and keyboard input), interpreting display output, and taking automated actions according to pre-defined rules.
- Additional RPA management software manages resource allocation, systems usage, and compliance.
- RPA solutions carry out their actions much faster, more reliably, and at a larger scale than their human counterparts.

USE

- A large services organization automated its order management process with RPA, covering the work of 800 full-time employees with just 50 software robots. The average handling time was reduced from 30 minutes to ten, and an 80% cost reduction led to a return on investment within six months.
- Arab National Bank automated 35 manual, repetitive business processes by deploying Automation Anywhere's cloud-native, AI-powered RPA solution, Automation 360, to save more than 40,000 hours of manual work.
- Swiss investment firm, Vontobel deployed cloud-based Appian RPA to automate processes such as investment assets and banking products to achieve greater flexibility and a higher return on investment.
- Irish Life deployed Ushur's Intelligent Document Automation solution to automate their complete document and customer-data lifecycle, freeing valuable resources to serve customers faster.
- Transportation company, OL USA implemented RPA Pursuit to automate their container tracking processes, enhancing shipment status visibility without any human intervention.

IMPACT

- A faster – and potentially more reliable – execution of routine human tasks carried out across a multitude of different applications, saving money, time, and resources.
- Application integration and cross-silo organization issues that are typically considered too small or too costly to address within the core application systems can be addressed and repaired.
- Due to its non-invasive nature (no applications need to be changed), benefits are delivered quickly, effectively, and without additional risk.

TECH

- **Robotic Process Automation (RPA):** Automation Anywhere, Blueprism, UIpath, Nice, Pega, Appian, NICE Robotic Process Automation
- **AI solutions moving to the RPA world:** Kryon, Workfusion, Abbyy
- **RPA platforms:** RPA Labs, Ushur, Appian Robotic Process Automation, Automation Anywhere

SILO BUSTERS

Priya Ganesh
Expert in Residence

Busting corporate silos by adding flexible process layers on top of them, rather than breaking or rebuilding already established structures

Your aging silo systems support disconnected silo processes. The souls of frustrated business users haunt you in the IT neighborhood. Who you gonna call? Rebuilding core systems is complex, risky, and expensive – both in terms of money, as in terms of scarce natural and human resources. How about some proper up-cycling instead? Business process automation technologies connect existing systems without intruding upon them. They deliver obvious, immediate benefits to the business, while buying more time to rearrange and open up the systems underneath. Pragmatic processes in action. Nothing supernatural about it.

WHAT

- On top of disconnected applications, APIs can expose core application functions to external technologies and systems, notably in process automation and process management (see Mesh Up Your Applications).
- Robotic Process Automation (for more on RPA, read Rock, Robot Rock) enables the automated integration of many siloed applications from the perspective of a human worker, without changing any of the affected systems.
- Business process management tools offer the capability to invoke various application services – offered by different core applications – as part of a modeled and managed process flow.
- Intention-driven user experiences – such as chatbots and voice assistants (see Honey, I Shrunk the Apps) can provide an alternative, unified view on disparate core application services.

USE

- Healthcare solutions provider, B.Braun deployed MuleSoft's Anypoint platform to build APIs that securely connect siloed data across disparate systems, accessing data to build solutions 50% faster, connecting to its partner ecosystem and ultimately delivering better care.
- New South Wales' Government deployed Pega's Government platform to simplify its building bond management process to achieve transparency, speed, and accountability for developers, inspectors, and building owners alike.
- A medical equipment manufacturer used RPA to seamlessly integrate all processes and data of an acquired company, creating a unified view of both businesses and enabling a global view of credit risk and customer payment behavior.
- Seven-Eleven Japan uses Google Cloud's BigQuery and Apigee to scale their platform efficiently, giving teams across the organization access to data and insights and reducing time to insight.

IMPACT

- Lifespans of aging or dysfunctional applications can be sustained without costly and risky rebuild activities.
- No rebuilding or replacement of existing core systems – but rather up-cycling them – may save precious, scare natural and human resources.
- Siloed applications are connected inside and outside the organization to create new, outside-in, end-to-end processes serving customers' and companies' digital needs.
- A high level of process flexibility and agility can be provided, without intruding on the affected application systems.

TECH

- **Analytics and BI tools:** SAP Analytics Cloud, Celonis, Minit, PowerBI, Qlik, Sisense
- **API and web services management:** Salesforce MuleSoft, Google Apigee, WSO2
- **Robotic Process Automation (RPA):** Automation Anywhere, Blue Prism, UiPath, Pega Robotic automation and workforce intelligence suite, NICE RPA, Kryon Systems
- **Business process management:** BusinessOptix, Dell Boomi, Oracle BPM, IBM Intelligent BPM, Pega BPM & Case Management, Appian

CAN'T TOUCH THIS

Manuel Sevilla
Expert in Residence

A process seamlessly adapting to its environment, optimizing itself without human intervention or support – is that even a process anymore?

When all you have is a hammer, everything looks like a nail. Optimizing processes by cutting out yet another inefficiency, leveraging yet another lean opportunity, only brings you so far. There is a limit to how classical processes can respond to complex events in real time. Driven by AI, inflexible, human-dependent processes can be replaced by powerful reasoning systems. These systems fluidly adjust to whatever situation occurs, anticipating next-best actions and resources needed on the fly. And while learning from what works, they increasingly become hands- and care-free. Stop! Hammer Time: the touchless enterprise is coming.

WHAT

- Business Rules Management System (BRMS) solutions externalize decision logic from applications, allowing both IT and business experts to define and manage decision logic. This logic can then be executed by Business Rule Engine (BRE) systems.
- Dynamic case management systems capture and process business events across process silos, providing end-to-end intelligence and optimized outcomes on a case-by-case basis.
- Any process can be mirrored and monitored through a digital twin, even when this pertains to the "classic" enterprise (ERP) management processes, such as supply chain, finance and administration, and HRM.
- Provided with enough time series datapoints, analytics and AI can increasingly enable descriptive, predictive, prescriptive, and self-learning autonomous capabilities – usually in this specific sequence.
- Combined with intelligent process automation capabilities (as a combination of process automation and AI's cognitive power), these insights can be turned into immediate, "touchless" actions within the business operations.

USE

- Commerce Bank and Copart (an online vehicle auction firm), leveraged the CommercePayments PreferPay platform to reduce the insurance salvage settlement process down from 30 to only five days.
- A Swiss insurance company plans to enhance auto claims efficiencies, and implement real-time damage assessment and estimation for enhanced speed and accuracy in the claim settlement process.
- A large consumer goods company adopted touchless process for part of the sales and operations planning, generating electronic purchase orders every day – based on real-time data.
- A US-based footwear retailer implemented touchless payment system, empowering customers to have complete control over the checkout experience, giving them the option to pay using contactless payment methods and digital wallets.
- In the US, "Alexa, pay for gas" is live at more than 11,500 Exxon and Mobil stations. On pulling up to the pump, customers can say, "Alexa, pay for gas," and Alexa will confirm the station location and pump number, before activating the pump and automatically pay after fueling.

IMPACT

- Split-second responses to high-volume data streams and events in real time, particularly regarding the IoT (Internet of Things) and online customer channels.
- Providing superior, efficient, and seamless end-to-end customer and employee experiences (see Experience²) that improve satisfaction and loyalty of both parties.
- Dealing with the scarcity of skilled and qualified human resources, not only by simply automating replicable tasks, but also by radically reimagining processes as "touchless" and "handsfree" by design.
- Eliminating the need for any human presence in business operations, improving personal safety, but also saving office space and travel – and consequently, energy consumption, and CO2 emissions.

TECH

- **Business rules and decision management:** Prowler.io, Drools Open Source, Oracle Policy Automation, Pega Customer Decision Hub
- **Complex event processing:** Amazon Kinesis, SAP Complex Event Processing, Tibco Business Events, Apache Flink, Esper
- **Process flow and automation:** Celonis, Aera Technology, UIPath

AUGMENTED ME

Lee Beardmore
Expert in Residence

Adding AI to business operations to accelerate decision-making, create a symbiotic relationship, and bring harmony to both human and machine

Assemble the minions! "Taking the robot out of the human" is an established first step towards any automation of work processes. But what about bringing AI into the equation? Mimicry is one element of mechanistic automation, but perhaps – more importantly – is the ability to augment human intelligence. Apparent from AI's mastery of natural language, and its understanding of audio, video, and images, it has an uncanny ability to observe processes in their broader context, detecting complex patterns that humans cannot even see or absorb. The resulting symbiotic relationship between humans and AI is changing the way we work, the way we organize ourselves, and ultimately, the way we do business, and live our lives.

WHAT

- Cognitive systems are mastering human conversation; processing natural language with interpretation and understanding of context, generating natural language where narratives are needed to describe raw data, or using computer vision to evaluate the quality of objects on a production line.
- GPT-3 has unlocked the most advanced means of dealing with language to date, paving the way for AI to creatively produce narratives that we typically use to tell stories about the increasingly complex environment we operate in.
- Cognitive algorithms are deriving how humans interact with applications so they can build automated routines to take over the work.
- Multi-agent systems work together to drive autonomous business operations. They focus on goal seeking, prediction and recommended courses of action to augment the human process, liberating decision makers from the labor-intensive process of preparing recommendations.

USE

- McDonald's partnered with IBM to leverage AI-powered customer care solutions and voice recognition to bring improvements to drive-thru lanes at fast-food restaurants and automate the order-taking process.
- Turkish bank, İşbank deployed H2O's Driverless AI platform to upgrade its income prediction, cash forecasting, and check default prediction applications to improve the accuracy of the bank's business planning with on-going AI projects.
- BBVA has been experimenting with an open API for GPT-3, where they managed to generate summaries identifying the core issue, the product involved, the recommendations or answers given, and its state of completion.
- Siemens partnered with Google Cloud to enable the scaled deployment of AI-based solutions for industrial manufacturing, automating tasks to empower employees and improve quality.
- US-based retailer, PetSmart implemented an AI/ML technology to aggregate millions of transactions and their outcomes, saving almost $12-million in fraud detection.

IMPACT

- Improved productivity and effectiveness through automated decision making and the availability of real-time, predictive insights.
- Human-like cognitive capabilities in end-to-end processes enhance the consumer experience.
- Mitigating the risks of attrition, aging workforce, and dependencies in areas of specialized or scarce knowledge.
- Enabling new capabilities where AI-infused processes deliver at a previously inconceivable speed, gradually approaching the era of autonomous processes and even the autonomous enterprise.

TECH

- **Platforms:** SecondMind, Aera, Microsoft, DataRobot
- **Artificial solutions:** Teneo, WorkFusion
- **Loop AI:** Loop Q, Machinify, IBM Watson, Pega
- **Adaptive learning:** FortessIQ, Celonis, Abbyy Timeline

APPLICATIONS UNLEASHED

At the heart of any Technology Business is its applications portfolio. A thriving heartbeat of the organization – part of the business, responsive to every demand. These applications mirror the new business dynamics, built and continuously changed at high speed, to a high quality, and in whatever incarnation necessary. Yet, changes are afoot, dear Watson. Many applications no longer look like the ones we used to know, as they morph into a connected mesh of microservices. And where is that old-fashioned user interface again? With agility and minimum viable products no longer the "new normal," but the "well and truly established," the quality of application services needs to be at enterprise level – with the trust balance of the organization secured by design, and a continuous, flawless deployment throughout all business operations.

The applications portfolio of a Technology Business is lightweight, free of corporate boundaries, easy to connect to, and built on cloud-native and microservice-based capabilities – all the while adapting to ever-changing needs. But achieving such a contemporary portfolio is far from easy, and several aspects need to be considered.

Simplifying, rationalizing, and ultimately decommissioning inflexible, aging applications is a daunting task that no IT expert learns in school. Yet, it is key to levelling the playing field for the next generation of application services, and as the latest Digital Mastery research shows, 64% of organizations are well on their way to migrating their legacy applications to cloud-based replacements.

When new application services are built, they must be done in an agile, continuously deliverable way – where business and IT people are in integrated teams, perfectly in sync with the actual operations. Exactly what we'd expect from a Technology Business. And, to add even more decisiveness and transparency to the mix, adopting open source principles within the organization can be a phenomenal culture-building tool too.

Having said that, why build at all if you don't have to? Building applications is a challenging, complex undertaking – and the scarcity of skilled experts doesn't help. Low-code tools provide high productivity and enable more people to develop the apps, increasingly on the business side of the wonderwall. Even more so, reusing and buying off-the-shelf apps is preferable to custom-built: it saves time, money, resources, and – yes – even energy.

The resulting assortment of application services should be a finely tuned portfolio; highly accessible and easy to connect to other services, both inside and out of the organization. Then there's the emerging concepts of the applications service mesh as an enabler to similar models in the business, where it's only a matter making secure and easy connections – in countless ways and in rapidly changing constellations.

Still, have more ambitions: look to upcycle and augment applications by adding touches of "smart" through increasingly powerful AI services to significantly prolong the life of application services, eradicating the need to rebuild or replace them. Your very own Philosopher's Stone for your applications portfolio, there to serve you – if you use it for good.

They're eagerly waiting to be uncaged. Unleash your applications!

Gunnar Menzel
Expert in Residence

KONDO MY PORTFOLIO

Thilo Hermann
Expert in Residence

Tidying up the applications portfolio in a systematic, decisive way to make room for innovation, agility, and the next generation of powerful application services

Time to find the jewels to upcycle and the rocks to grind. Battling the sprawl of applications will significantly boost the innovative power of a Technology Business. However, getting rid of old, inflexible, and costly applications requires the mindset and methods of a specialized “tidying up” guru. First, it’s a matter of commitment; a full dedication to decluttering, but also to chasing the measurable benefits of a lightweight, liberated applications portfolio. The right tools will help as well, both to identify the pieces to modernize or be rid of, and to facilitate a simple step-by-step migration. What’s left is that zen-like feeling of an applications portfolio that truly sparks joy.

WHAT

- Existing applications portfolios often commit large amounts of budget, resources, and capabilities, contrary to business value. Instead, use this budget to serve business agility and provide value.
- Few organizations master the art of systematic application rationalization. Many IT experts know how to build new systems, few know how to decommission them.
- There needs to be an end-to-end approach of replacing (or retiring) applications, including:
  - Getting support from top management to make unpopular and partly risky decisions.
  - Seeking agreement from stakeholders on the need for application rationalization.
  - Defining a new platform with a corresponding migration strategy.
  - Understanding the metrics and migration scenarios, using tools such as eAPM.
  - Leveraging the existing treasury of data as part of the modernization: retire the applications, but not the data!
  - Consolidating – where possible – to shrink the applications landscape with a strong focus on business need.
- The Capgemini Research Institute reports that 58% of the insurance sector's digital masters have already migrated their legacy IT systems to cloud-based applications, compared to an average of 35% in non-financial services organizations.

USE

- An automotive manufacturer in Germany replatformed its application portfolio, resulting in a reduced time to market, through bi-weekly deployments. Moving the new platform to open source reduced the license and infrastructure costs by more than €1 million per year.
- An OEM within the automotive industry in Germany is using BlueAge to migrate an existing mainframe application based on PL/I to Java. As part of the migration, the application itself is rearchitected, with new APIs introduced.
- The Integrate Justice Architecture Board implemented a common infrastructure, migrating its legacy systems into service oriented architecture. By modernizing the entire eJustice suite, stakeholders improved access to criminal justice information, creating uninterrupted and streamlined communication among agencies.
- GE Healthcare's, "GE Infrastructure Exchange" is a remotely managed OpenStack private cloud, which enabled GE to move 530 legacy apps to the cloud in under two years, delivering a 49% footprint reduction and annual savings of over €30 million.
- A leading life sciences company decided to consolidate and migrate its entire application portfolio. Using the eAPM tool to drive key decision making, it considered the decommissioning of more than one thousand applications.

IMPACT

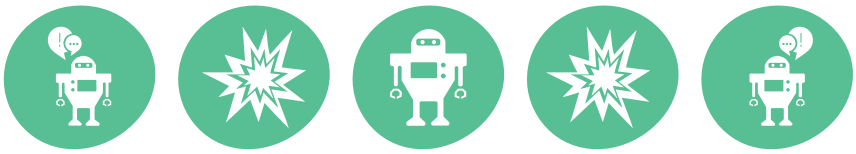
- Unification across the enterprise, enabling new business functionality and models.
- Lower cost of software development and maintenance combined with higher software quality and reduced time to market.
- Faster development and change cycles due to the slimming down and reduction in complexity of the entire application portfolio.
- Reduce technical "debt" of outdated or over-customized technology, architecture, and applications.
- Simpler operation, and faster error identification and root cause analysis due to reduced overall complexity.
- Space for innovation, both in terms of budget and available skills.

TECH

- **Replatforming:** Bluage, LzLabs Software Defined Mainframe, Capgemini eAPM, Capgemini Cloud Migration Factory
- **Agility:** SAFe, LESS (Large Scale Scrum)
- **DevOps:** Production Line, CP Innovate (e.g. DevOps-PaaS, API management)

HONEY, I SHRUNK THE APPLICATIONS

Sarah Saunders
Expert in Residence



Next-generation agile and response “light” application services are built on the concepts of Microservices, API-first, Cloud-native, and Headless

Back in the day, applications were vast, cumbersome, and bundled together with traditional user interfaces and hardcoded business logic. Applications would respond prescriptively to input, typically provided by humans via a console, web front end, or fixed user interface. Connecting to other applications was a bespoke project. Enter the science of minimization; building application services that are tiny, stateless, efficient, and scalable. They are flexible and adaptive, responding in real time to events, weaving seamlessly around new situations, needs, and means of use. The keywords that make applications shrink: Microservices, API-first, Cloud-native, and Headless. Together, they pave the way for the next generation of application services, which are ready for a variety of intent-driven user interfaces and can be connected and integrated by design. Big applications are done. Get your magnifying glass ready.

WHAT

- A Technology Business needs open, agile application services that can seamlessly address both current and future needs. A combination of Microservices, APIs, Cloud-native development and "Headless" design has emerged as the blueprint to achieve this.
- Microservices can be viewed as the result of a marriage between component-oriented architecture and service-oriented architecture. Software as a suite is composed of many small, business-driven components with very specific business-domain responsibility.
- An application programming interface (API) provides standardized, open access to an application service or data set, decoupled from the actual user interface of the application. It should be the first thing to consider, when building an application service.
- Creating application services to be deployed "natively" for the cloud means that all well-known benefits of the cloud are built-in by default, such as elasticity, adaptability, scale, security, availability, and efficiency.
- Headless application services do not assume any specific user interface, so they can be accessed in various ways, on top of the more established ones. Think chatbots, voice assistants, car systems, VR/AR and the Metaverse, wearables, and many other "things."
- The resulting application services deliver one single business capability in an independent, loosely connected, and self-contained fashion. They "do one thing and do it well."

USE

- New Orleans launched an AI-powered 311 chatbot, "Jazz," which is reachable using the city website and via text. It provides round-the clock support to citizens with information and service requests.
- Together with Microsoft and a consortium of partners, Capgemini developed the chatbot "Ave" to provide real-time information and advice about the coronavirus, answering the more trivial questions while redirecting users to a human-owned webchat when confronted with a complex query.
- Amazon.com was one of the pioneers of microservices architecture. Decoupling of services enabled the creation of one of the first automated deployment systems, and the prototype for much of what Amazon offers customers today – appropriately named "Apollo" – paving the way to creating what is now known as AWS.
- Ebay.com is also based on an microservices architecture, dividing everything (databases, application tiers, even their search engine) and implementing microservices architecture. The result: eBay could answer the arising challenges of the mounting complexity of the codebase, improving developers' productivity, and enabling a faster time to market while maintaining the site stability.
- Netflix is one of the earliest adopters of microservices. The story of Netflix turning towards microservices began in 2009, and they still are considered a leader in the field today.

IMPACT

- Faster, scalable, and intent-driven application services that are modular, sustainable, and thus fit for current and future Technology Business purposes.
- Much faster time to market for new business services and products, as the enabling application services can be rapidly selected and integrated.
- Less need for massive, troublesome upgrades of entire application suites, as minimized application services are autonomous and only loosely coupled to others.
- Better reuse and upcycling of application services, as they can be used, integrated, and interfaced in many ways, wrapping old legacy systems in peripheral microservices – allowing faster adoption, saving scarce human resources and energy.
- Our research shows that 76% of organizations have realized quantifiable benefits from their voice and chat initiatives in a variety of areas, from reducing customer service costs to increased NPS.

TECH

- **Microservices infrastructure:** Kubernetes, communicating event streams such as AWS Kinesis, Google Cloud Dataflow, Confluent, Apache Spark, Kafka
- **Voice assistant platforms**: Microsoft Cortana, Apple Siri, Amazon Alexa, Google Duplex and Assistant, Alibaba's AliGenie
- **Text assistant platforms:** WeChat Open Platform, Microsoft Bot Framework, Facebook Messenger Platform, Uipath Druid

WHEN CODE GOES LOW

Desiree Fraser
Expert in Residence

Low-code and no-code platforms make building next-generation application services a high-productivity matter, for both IT and business specialists

When code goes low, business gets on a high! You may be blessed with brilliant ideas for killer application services, but you'll need to deliver them blazingly fast and with the right quality. After all, classic software delivery based on manual work and complex programming languages will only get you so far. It is now easier than ever to construct applications without huge coding efforts. The secret is in powerful, AI-enabled tools that leverage API catalogs, prebuilt templates, and automation to the fullest extent. And these tools are so powerful – yet easy to use – that they get the popular vote of both business and IT people. Exactly what a Technology Business needs.

WHAT

- Powerful low-code and no-code platforms are available for DIY, "citizen" application development, although professional developers may be equally enthusiastic about their productivity and ease of use.
- Platforms depend on the availability of robust, enterprise-scale API and web service catalogs (both internal and external), open data sets, and tested and proven template galleries.
- Sharing of best practices and collaboratively building on each other's solutions is a crucial success driver, as also evidenced by the "Maker Culture."
- AI will quickly assist in creating even more powerful DIY applications without any need for coding.

USE

- The Dutch national railway company, NS, launched a new customer application, Treinwijzer using a Mendix low-code platform, allowing passengers to find out how busy trains are in real time and to choose a different train to avoid crowded cars, enhancing the overall customer journey and experience.
- Clothing retail company, H&M used Microsoft Power Apps to create a mobile app enabling employees to quickly update their status and location. While the solution was only initially intended for the developers' own team, word spread quickly, and has now been adopted by more than 1,000 employees company wide, proving particularly useful to manage limited office capacity during the COVID-19 pandemic.
- The Royal Navy and Royal Air Force chose Pegasystems to develop a new, joint low-code platform for candidate recruitment. The bespoke Public Sector application will provide a better experience for both candidates and recruiters, significantly improving existing recruitment cycles and providing reporting analytics for greater insights on the process.
- The city of Kobe, Japan developed a set of apps to respond to citizen calls about crisis-related assistance programs. Using Microsoft Power Platform, the apps allowed citizens to check on their status when applying for relief funds and to access pertinent information via an automated telephone app, chatbot, or website dashboard. In just one month, citizens were provided with an interface to easily access COVID-19-related information, and call volumes dropped by 90%.

IMPACT

- Increased application development productivity, on both sides of the business and IT.
- Enhanced organization agility through a significantly faster time to market for new business applications.
- A cohesive alignment between IT and business functions through personally involved and committed "citizen" application developers, using open, digital platforms.
- More innovative and higher-quality business-facing applications demonstrating enterprise robustness, combined with agile solutions.
- Dealing with a scarcity of specialized software developers, enable more people in the organization – closer to business operations – to quickly develop high-quality solutions without the need for deep skills and experience.

TECH

- **High-productivity development platforms:** Mendix, OutSystems, Microsoft PowerPlatform, Salesforce Lightning Platform, Betty Blocks, Appian, AppGyver, If This Then That, Thinkwise, Quantum, Pega, Usoft

MESH UP YOUR APPS

Sjoukje Zaal
Expert in Residence

A “mesh” of highly accessible, secure, and agile application services that are ultra-easy to connect with and combine, both inside and outside the organization

As a Technology Business becomes so much more agile, more connected, more accessible, more networked – so too do its application services. Or, might it even be the other way around, every now and then? In any case, say hello to the Service Mesh: unlocking the power of born-in-the-cloud applications, as a lively beehive of constantly evolving, changing, and “chatting” microservices. All driven by standards, and a rock-solid, secure, and scalable platform that manages and monitors the ongoing dynamics. That way, the beehive keeps buzzing with a purpose, rather than becoming a swarm gone rogue. The microservices are managed and provided as first-class products, increasingly by the business units or domains that are closest to its subject matter. It’s the API Economy, but in overdrive, opening new, agile ways of collaboration inside and outside the organization. Join the party, dance this mesh around!

WHAT

- APIs provide the building blocks for developers to compose and enrich their application, leveraging data from multiple sources. As more and more companies open their data sources using APIs, the need to build bespoke services is reduced.
- APIs can be built on top of existing applications to provide more flexible access; new applications typically come by default with a set of accompanying APIs.
- A service mesh is a platform layer on top of the infrastructure layer that enables managed, observable, and secure communication via APIs between individual services, both internally and externally.
- The service mesh's implementation is an array of lightweight network "proxies" deployed alongside microservices, without applications ever needing to be aware.
- A service mesh enables users to create canary rollouts to first deploy a small subset of applications for testing and create blue/green rollouts to reduce downtime and risk by running two identical production environments.

USE

- To help modernize its student loans service, Her Majesty's Revenue & Customs (HMRC) used Capgemini's Regenerate to migrate their platform to structured Java, shortly followed by a deployment onto a private cloud environment. HMRC modernized their IT service using a cost-effective approach, removing their dependency on legacy software.
- A US-based grocery retailer with more than 420 stores, experienced a sudden increase in demand during the COVID-19 pandemic, forcing a reinvention of its fulfillment systems to meet demand and prioritize the safety of customers, choosing Linkerd as their Service Mesh to support their critical workloads and operating environment.
- eBay implemented a centralized cloud platform using Kubernetes – using Istio as a Service Mesh – to meet their high availability requirements across the different data centers.
- Service New South Wales (NSW) adopted Salesforce and MuleSoft as the agency's front end and leveraged APIs to expose data from disparate systems across the NSW government in a scalable manner. Citizens now experience a one-stop-shop, omnichannel access to approximately 800 different services, resulting in a 97% customer satisfaction rating from more than two million citizens.

IMPACT

- Simplify the cloud-native and microservices-based application portfolio, and provide flexible access to existing and new application services for both business and IT.
- Monetize and enrich application services through the publication of APIs to customers, partners, and external developers.
- Leverage internal and external API catalogs for ready-to-use application functionality.
- Split the business logic, networking and security policies from any application using a service mesh, to connect, scale, secure, and monitor your microservices.
- Provide effective transparency and improved security for complicated service-to-service interactions.

TECH

- **Dedicated Service Mesh platforms:** Istio, Linkerd, Consul Connect, Apache Mesos, Kuma, Maesh, ServiceComb-mesher, Network Service Mesh (NSM), AWS App Mesh, OpenShift Service Mesh by Red Hat
- **Dedicated API management platforms:** Mulesoft, Dell Boomi, Microsoft Azure API Management, Oracle API Platform, WSO2, Kong, Tyk, Apigee, IBM API Connect, API management, AWS API Gateway
- **API management open standards:** The Open API Initiative
- **API marketplaces:** Programmable Web, AWS Marketplace

APPS ♥ AI

Pierre-Adrien Hanania
Expert in Residence

Systematically infusing new and existing applications with AI capabilities, making them smarter, autonomous, valuable, with a positive impact on society and the environment

AI sometimes appears to be the domain of mad data scientists and highly specialized, secretly initiated experts. But actually – through simple APIs and webservices – every application can benefit from touches of "smart," without any black magic involved. AI disrupts every industry with intelligent platforms and solutions. Surf the applications portfolio to find the application moments that would profit the most from added AI capabilities such as image recognition, natural language understanding, automated decisions, predictive analytics, and recommendations. Use benefits logic to prioritize the cases and leverage a catalog of ready-to implement AI services. Application users will love all that extra intelligence.

WHAT

- Many AI and cognitive capabilities can be easily accessed through web services and APIs, including image and voice recognition, intelligent automation, natural language processing, conversational systems (bots), plus predictive and prescriptive analytics.
- Often, these capabilities come with pre-trained models, eradicating the need to acquire training data and build algorithmic models.
- Applications become "smarter" and "ultra-speedy," creating more value for users with enhanced performance and speed.
- To effectively incorporate AI, new and existing applications portfolios need to be systematically reviewed to find added value opportunities while considering benefits.
- Metrics-based portfolio management tools such as eAPM can enable creating this "Apps AI" shortlist.

USE

- The Institute for Medical Microbiology, Immunology and Parasitology at the University of Bonn developed a solution to better combat river blindness caused by parasitic worms, together with Capgemini and the Drugs for Neglected Diseases Initiative in Geneva. With the help of AI, sections of worm nodes in tissue are identified by machine, enabling drug tests to be standardized and significantly accelerated.
- Capgemini's own solution, Project FARM 2.0 is an intelligent data platform aiming to resolve global food shortages and help local farmers with predictive, diagnostic, and advisory functions. Microsoft's Anomaly Detector embeds anomaly detection into apps, to quickly identify potential problems, select the best-fitting detection model and ensure accuracy.
- Google's Cloud Vision Product Search can be added to any commercial website, allowing users to upload an image of what products they want it to match in their catalog.
- Capgemini's Digicare platform for medical staff features a patient interface and core functionalities such as a real-time monitoring of the patient situation, a therapeutical education, and recommendation engines for the medical staff.
- Capgemini developed an intelligent data solution for marine biologist Lisa Steiner. The model is designed to accurately identify sperm whales using AI.

IMPACT

- Extend the lifespan of existing applications by adding "smart" functionality.
- Increase the adaptability of applications and automate manual activities that originally required cognitive, "human" capabilities.
- Equip developers with a toolset to build powerful cognitive capabilities, without the need for a deep background in data science and analytics.
- Create a more compelling, personalized user experience in both business and consumer-oriented applications and mobile apps.

TECH

- **Toolkits and platforms:** Capgemini PerformAI, Microsoft Cognitive Services, IBM Watson APIs, AWS AI Services, Pega Real-Time AI, Salesforce Einstein Language API, Rainbird, Google Cloud AI Building Blocks, TensorFlow, PyTorch, RapidMiner, Keras, Wit.ai

INVISIBLE INFOSTRUCTURE

O' Infrastructure, Where Art Thou? The odyssey towards a truly invisible IT infrastructure may still be ongoing, but progress is made. For many organizations, the pandemic era accelerated a move towards the public cloud; a signpost of increasing "invisibility." It is now the default choice amid a diverse range of cloud deployment options. To keep up with the pace of a Technology Business – or rather, being its pacemaker – IT infrastructure needs to fluently adjust to changing needs and the whimsical ways of the time. A software- and AI-driven, nearly autonomous supply chain – with reliability engineered within – is key to that. It also deals with the scarcity of skilled experts and excess energy consumption. But IT infrastructure also expands its reach, integrating Operational Technology and "things" at the edges of central IT, showing yet again that "Infostructure" is not a spelling mistake.

Technology Business operations cannot be successful without up-to-date, reliable, and secure IT infrastructure operations. They are more or less one, inseparable by definition. This is evidenced by the "All Ops" movement (such as DevOps, DevSecOps, DataOps, MLOps, ChatOps), in which IT operations are fully integrated in business change and solutions development. Not as an afterthought, but by design.

The quality levels, availability, and elasticity of such an IT Infrastructure platform can increasingly only be provided by the Cloud. It is not a surprise that our latest Digital Mastery research shows Cloud services are projected to more than double by 2023, growing at a five-year CAGR of 32%. For new solutions, Cloud is the de facto choice, but a diversifying range of deployment options – typically involving multiple providers and locations, including regional sovereign clouds, which – based on Capgemini's recent research – will be adopted to ensure compliance with government regulations and standards, reduce exposure to extra-territorial laws and provide a trusted safe environment for data.

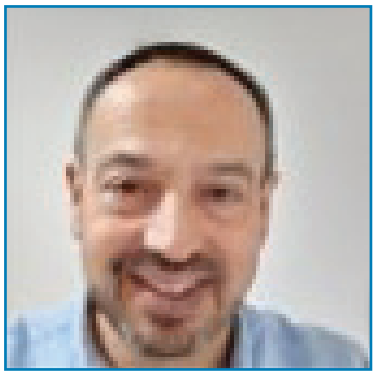
Software-driven configuration and execution, standardization, and simplification technologies such as containers, AI-driven intelligent automation, plus built-in cybersecurity and reliability, all add to the secret of having a scalable – always available – resilient IT infrastructure. One that makes IT infrastructure move and morph in exactly the same cadence as the business operations it enables.

But there's more to achieve. Our recent Sustainable IT research found that only 43% of executives are aware of their organization's (often considerable) IT carbon footprint. So intelligently optimizing the use of available IT assets – and recycling them whenever possible – not only brings cost benefits and agility, but also raises the corporate ESG score.

Finally, as our latest Digital Mastery research report shows, 62% of organizations are already implementing Internet of Things (IoT) technologies in their operations. And, no longer is it just the Intelligent Industry realm in which innovations at the "Edge" drive new business. Operational Technology fuses with Information Technology everywhere, creating an all-encompassing "Infostructure" that securely manages brand new loads of networking, compute, data, events, application services, and devices.

Dapo Adekola
Expert in Residence

LORD OF THE CLOUDS



Daniel Koopman
Expert in Residence

Cloud adoption moves far beyond the middle-earth realm of cloud migration, now also driven by sustainability, distribution, sovereignty, “FinOps” and multi-cloud forces – all for that precious, better business flow

The cloud cannot be commanded to turn back. It has set on a journey – accelerated by the pandemic – only further building strength and velocity. It infuses all areas of an organization, weaves its way through to the core, and applies itself through varied interconnected and distributed cloud options. A static, eternal place around the central throne is no longer a given for the cloud. To flow with the business is a matter of seamless fusion between technology and operational capabilities – driving innovation, growth, agility, trust, financial transparency, and sustainability. Now there’s a quest worth embarking on.

WHAT

- Different regulatory requirements, the need for unique services, and the emergence of more loosely coupled, "mesh" business models drives the move towards truly hybrid, multi-cloud and non-cloud mixes.
- With connectivity infusing every aspect of business, a single cloud and network is bound to be flooded. Workloads must be more distributed to industry-focused platforms, sovereign clouds, and operational technology edge devices.
- As around $25 billion is spent on cloud every quarter, a unified perspective ("FinOps") is needed towards transparent financial cloud controls – balancing business impact, accountability of stakeholders, manageability, and budget flows.
- A growing proportion of global electricity is consumed by established data centers. In contrast, cloud-native suppliers see massive reductions in carbon emissions, marking the way towards a more sustainable, zero-carbon computing future.
- High-performance, distributed ledger technologies emerge as agile alternatives to industry leading "Hyperscaler" cloud platforms, focusing on personal sovereignty and privacy, built-in security, superior sustainability, and cost.

USE

- Google is using AI to optimize geothermal plants and wind farm efficiency and distribute workloads to the location of cleanest energy, aiming to be carbon-free by 2030.
- In Singapore, two universities within the Sustainable Tropical Data Centre Testbed are looking to cut energy consumption and greenhouse gas emissions by up to 25%.
- Atlassian, a collaboration software company, created a visual indicator of where reserved instances coverage becomes high enough to yield significant savings.
- Microsoft's real-time visual analysis allows researchers to assess biodiversity and inner-city traffic patterns by tying cloud, edge, and high-speed networking with AI.
- Capgemini, Orange, and Microsoft created a French cloud service to meet sovereignty requirements of the French State through a "Cloud de Confiance."
- Google Data Centers reduced the amount of energy used by 40% by leveraging DeepMind's machine learning system.

IMPACT

- Optimized cloud usage – especially when achieved in conjunction with Artificial Intelligence – will deliver significant savings in energy consumption, reducing carbon emissions.
- Through cloud financial management ("FinOps") and better visibility of cloud usage, significant cost reductions can be achieved. Wildlife Studios managed to cut their cloud costs by 45%.
- A hybrid mix of cloud options enables sovereignty, trust, and data ownership. This enables an agile, unified ecosystem of cloud and data services – where applicable – protected by data protection laws.
- A multi-cloud setup – in combination with software-driven Site Reliability Engineering (SRE) – not only delivers agility, but also boosts cloud user satisfaction, easy access, and versatile changes of scale when business so dictates.

TECH

- **Sustainability tools:** Microsoft Sustainability calculator, CodeCarbon, SIMAP, Google Cloud Picker
- **Hybrid, multi-cloud tools:** Google Anthos, Azure Arc, Sentry, Backstage, Crossplane, Cilium, Kubevela, RedHat Advance Cluster Manager, Embotics, Scalr, OpenNebula
- **Industry and sovereign clouds:** Lumen platform, IBM Satellite, ONAP, Azure Germany, GAIA-X
- **Cost management ("FinOps"):** Apptio, Spot.io, Harness Cloud Cost Management, Kubecost, Cloudhealth by VMWare
- **Distributed cloud and application ledgers:** Solana, Dfinity, Akash

CROUCHING TIGER, HIDDEN CONTAINER

Ben Scowen
Expert in Residence

All the complex infrastructure an application needs, nothing to see but next-generation, energy-saving containers that will run anywhere, delivering multiple critical consumer-facing business services

Infrastructure shows its claws through different versions of operating systems, devices, connections, configurations, files, middleware, and data interfaces – all needed to run an application. Even the tiniest change can bring the mightiest application down. Enter containers! They package an application with all the relevant platform components into a standardized box that runs anywhere, in any Cloud. And through efficient scheduling, containers not only bring agility, portability, scalability, and security – they also consume less energy. Never underestimate what's hiding backstage: containers are the uncontestable silent masters of infrastructure.

WHAT

- Container technology allow software products and applications to be packaged with all their needed infrastructure elements into self-contained "box" components that are easy to deploy, scale, and update.
- In a way, containers are quite like shipping containers used to package and distribute goods around the world – leveraging all the benefits of standardization, such as agility and optimization of transport options.
- Special container management and orchestration platforms ease the job of distributing containers, keeping them up to date and guaranteeing security, performance, optimized use of available resources, and scaling up and down with changing demand.
- Containers allow to use – potentially scarce – server resources much more efficiently. For example, utilization and load density of a server can be optimized by hosting more containers simultaneously on it. This contributes to decreased energy consumption.
- Furthermore, container orchestration engines efficiently move container workloads between servers, further adding to resource optimization and considerably helping to drive the zero-carbon journey.

USE

- In a case study from NordStorm, the average utilization of their cloud servers went from 4% to 40% after the implementation of Kubernetes. This translated into NordStorm reducing their original virtual machine and volume, and consequently reducing their carbon footprint by 90%.
- A "low-carbon Kubernetes scheduler" has been incubated at both Bristol and Leeds universities, moving container workloads to the most energy-efficient servers and data center regions, demonstrating a 10-20% reduction in server energy usage.
- Tesla Energy uses containers to provide a digital twin of the energy grid, leveraging the Internet of Things and providing grid resilience.
- NASA is accelerating research with a containerized ML application running aboard the International Space Station (ISS). The Spaceborne Computer-2 edge device runs ML code on one-node Kubernetes Container clusters, driving edge analysis, and providing the results in real time to both ISS personnel and scientists on the ground.
- As part of its digital transformation to open new revenue streams, FreightWays' DevOps team has developed a new API platform leveraging a container management solution on public cloud to facilitate customer integration and courier observability, driving increased revenues while reducing platform costs by 90%.

IMPACT

- Containers deliver a significant reduction in infrastructure usage, energy consumption, carbon footprint, and costs.
- Containers are key to portability, scale, security, and cloud-native innovation for the next generation of application services.
- Containers facilitate cloud transformation and migration, as well as IT modernization in general. They also enable hybrid and multi-cloud strategies.
- Companies that take a strategic, visible approach to containerization will enhance their reputation with technology-savvy customers and attract scarce top IT talent.
- Containers pave the way to intelligent automation of software delivery and a pervasive microservices architecture, delivering speed and agility to the business.

TECH

- **Kubernetes-as-a-Service:** Azure AKS, Azure OpenShift, Amazon ECS and EKS, Google GKE, Platform 9, Digital Ocean, Redhat OpenShift Dedicated, IBM Redhat OpenShift
- **Kubernetes software distros:** RedHat OpenShift, OpenSource, Mirantis, VMware Tanzu, Rancher
- **Industry standards:** CoreOS containers, Docker software containers

SIMPLY THE EDGE

Bernd Wachter
Expert in Residence

Intelligent devices, at the “edge” of central IT and close to operations, add a powerful dimension to the existing IT infrastructure

It’s quite the page turner: we are standing on the edge of a precipice. And, it’s a promising one too. Edge core technologies – such as 5G, IoT, and embedded AI – are pushing the boundaries of central IT infrastructure further and further, closer towards the “real” world of business operations. And the tipping point is right here; where compute, storage, and processing power join at the source of data collectors, sensors, and actors – that’s where innovation ignites. Simply put, with IT infrastructure now turning into a genuine “infostructure,” it’s so much better than all the rest.

WHAT

- An IT infrastructure needs to be fluid, requiring data to flow seamlessly from the central cloud, to its periphery at the edge ("fog"), and all the way to the inside of devices ("mist") – enabling a new generation of application services and solutions.
- The interfaces between Operational Technology (OT) and Information Technology (IT) keep improving, easily connecting physical assets and devices to IT systems, often in real time, and secured with zero-trust capabilities at the edge.
- Digital twins of edge devices pop up in all major industries, but more notably in "intelligent industries" such as manufacturing and utilities, where OT and IT merge most naturally.
- The combination of high-performance 5G networks and hyperscaler-quality edge services enables new applications and solutions that were previously technically unfathomable.
- Add while we're at the edge, add AI to the mix – through TinyML, Tiny Machine Learning – and a new world of potential business models arises, from household and wearables, to industrial devices and installations, connected cars, and even professional healthcare.
- Applying DevOps principles to the edge ("EdgeOps") guarantees a secure, continuous delivery of up-to-date solutions and services up to – and beyond – the very edges of the existing IT infrastructure.

USE

- Vodafone Germany deployed a private 5G network at the Porsche Development Center, enhancing Porsche's framework conditions for the strategic development of new vehicle systems and functions at the industrial facility.
- Aramco leveraged the FogHorn Lightning Edge AI platform to build edge-powered solutions across multiple sites, improving safety, facilitating proactive monitoring for equipment failure, as well as automating drilling equipment and processes.
- Thailand's Medical Services Department partnered with Huawei to offer 5G technology to public hospitals to launch smart telemedicine services, leveraging digital technologies using 5G infrastructure, AI, Big Data and Cloud Edge Computing.
- Working with IBM, NASA plans to use edge computing capabilities in space to implement live DNA sequencing and data analysis of microbes directly on the International Space Station to keep astronauts safe from contamination.
- Mastercard partnered with Verizon Business to build transformational solutions for its payments and commerce ecosystem. 5G and edge computing are integrated with Mastercard's retail solutions to enable autonomous in-store checkout.

IMPACT

- The edge is where IT and OT merge, thus becoming a key enabler for discrete and process manufacturing plants to become intelligent ("Industry 4.0") players, benefiting from increased adaptivity, flexibility, and responsiveness.
- The same principles of Intelligent Industry can be applied to other sectors (for example through Society 5.0 for the public sector or retail), reaping comparable benefits of fusing "cyberspace" and "physical space."
- There is infinite potential to add value to all kinds of physical products, from the provision of usage analytics to customers, autonomous driving cars, or even to mitigate forest fires with IoT sensors on trees.
- The way to a more sustainable world is opened: fully utilizing intelligent, collaborative IoT and edge services that can develop energy-efficient manufacturing plants, develop smart cities that optimize traffic movement, and so much more.

TECH

- **Building the edge:** GE Predix, Siemens MindSphere, Cisco Edge Intelligence, IBM Edge Application Manager, Microsoft Azure Stack Edge, Azure ARC, AWS Snowball Edge, AWS Wavelength, AWS Panorama, Google Edge TPU, Google Anthos, Fledge, Nvidia EGX, Eclipse ioFog
- **Connecting the orbit:** AWS Groundstation, Azure Orbital, SpaceX Starlink
- **Standardizing the new:** IoT Consortium, IoT Talent Consortium, Open Connectivity Foundation, The Open Group IoT Work Group, Industrial Internet Consortium, Platform Industry 4.0
- **Pushing boundaries even further:** KubeEdge, EdgeX Foundry, Akraino, Project EVE, Fraunhofer AIfES

OPS, AI DID IT AGAIN

Indu Malhotra
Expert in Residence

AI renders IT operations fluid, proactive, and resilient, improving efficiency and reliability while it learns – on its way to full, handsfree autonomy

So many platforms, applications, services, and edge devices to securely take care of. And all of that in an increasingly hybrid, multi-cloud context. Enough to lose your senses. It's the perfect playground for AI to take charge of the complexity. AI recognizes patterns, generates insight, and detects disturbances in real time. Then it looks through even the opaquest of systems, predicting what will happen to allow for timely measures, and suggesting what should be done. And all the while it learns, becoming more and more autonomous in running its IT operations. Oops, is that infrastructure taking care of itself?

WHAT

- AI for IT Operations ("AIOps") collects and analyzes data, from sources such as system log files, incident tickets, network traffic and sensory data – all in real time – to continuously improve observability, security, performance, and resilience.
- AIOps can replace traditional monitoring tools, driving a cross-domain cohort of observability across complex landscapes with microservices, applications, containers, servers, and multiple platform services hosted in hybrid, multi-cloud environments.
- Integrating AIOps with DevOps, quality assurance, and Site Reliability Engineering (SRE) not only reduces complexity, but also drives high-frequency, high-quality, and cost-effective platform delivery across applications and infrastructure.
- Previously focused on scripting and automating IT-driven business process, Robotic Process Automation (RPA) now also enables more effective IT operations, increasing speed, agility, and cost effectiveness. The next step: (semi-)autonomous operations.
- Similarly, automated incident intervention and sentiment analysis – using analytics and Natural Language Processing (NLP) expands from customer scenarios to frictionless IT service desk engagements with (remotely working) business users.

USE

- A US media giant leverages AIOps, moving from "alert fatigue to actionable operational insights" across its interdependent media services, hosted on public and private cloud, bringing a 99% "alert" noise reduction to IT operations.
- A US State applies AIOps to provide its citizens with reliable access to the state's unemployment insurance portal, bringing real-time visibility of the key service, resulting in significant reduction of IT issues and performance degradation.
- A large US-based animation production firm optimized production for its creative teams during the pandemic, allowing digital production of petabytes through a digital data pipeline, using AIOps to predict and proactively address IT operational issues.
- A Nordics-based automotive manufacturer extended its AIOps capability with analytics to address the verification challenges of autonomous driving on highways and confined areas, such as mines and quarries, exposing bugs and edge cases.

IMPACT

- Routine, repeatable IT operational tasks can be automated to provide a frictionless service while reducing costs and a focus on more strategic, value-adding activities.
- Real-time handling of events in a converged IT operations and cyber-threat prevention framework, ensuring business resilience, continuity, and stability.
- A rapid diagnosis and resolution of IT operations issues ultimately leads to higher customer and employee satisfaction and retention.
- Dealing with the scarcity of skilled SRE and DevOps resources, AIOps can reduce the quantity of expert resource required to run critical services.
- Adoption of AIOps drives IT Operations from predictive, to prescriptive and even autonomous ways of working, where systems can not only self-analyze, but self-heal.
- Extending beyond the realms of IT, AIOps can predict customer behavior, proactively and seamlessly fixing cyber threats, contributing to business resilience and growth.

TECH

- **Observability:** AppDynamics, Splunk Enterprise, Datadog APM, Sumo Logic, Dyntrace, TrueSight Operations Management, New Relic One, BigPanda, Helix Platform, DX Operational Intelligence, StackState,
- **AIOps:** MoogSoft, Splunk Cloud, Aisera, ScienceLogic, IBM Cloud Pak for Watson AIOps, BigPanda, Sumo Logic, Helix Platform
- **Chaos:** ChaosIQ.io, Steadybit, VMWare Mangle
- **SRE & Application Operations:** PagerDuty, ServiceNow, FireHydrant, Honeycomb.io, Splunk On-Call, Buoyant.io

SILENCE OF THE SERVERS

Cornelia Görs
Expert in Residence

Building a highly automated, self-optimizing IT infrastructure that is so entwined with business operations, that it is no longer distinctly noticeable

You're in your IT estate, you wake up in the dark. You hear absolutely nothing. Not a single hum of a server, and certainly not the screams of frustrated users. Now operational business continuity fully entwines with IT operations, there is a reliance on intelligently automated, software-driven, "zero-touch" IT infrastructure platforms. Various innovative technologies and practices combine to provide infrastructure services as fluent as possible – without the need for fixed assets or scarce, specialized personnel. With that, the vision of a truly invisible infostructure is near real. Worthwhile celebrating with a nice bottle of Chianti.

WHAT

- An agile organization that frequently delivers and renews its products and services, needs a matching IT infrastructure. Key components include hybrid cloud, Platform-as-a-Service (PaaS), serverless computing, event-driven architecture, and containers.
- This next-generation IT platform stack will while supporting existing heritage/legacy systems, likely hosted on premise.
- These IT services are designed and managed as first-class products and seamlessly made available to Technology Business users through automated, agile, self-service consumption options.
- DevOps practices pervasively interweaving applications and platform delivery, paving the way for fully integrated solution delivery, featuring both functional application and data development, as well as platform-focused engineering and operations.
- Site Reliability Engineering (SRE) reduces toil, avoids technical debt, balances reliability, and enables velocity, successfully driving IT operations for an agile, high frequency and resilient enterprise.
- AIOps, intelligently automated workflows, and an API-first "infrastructure as code" approaches all contribute to building resilient, autonomous, hands-free IT infrastructure services that move as one with the Technology Business operations.

USE

- DB Systel GmbH, IT service provider for Deutsche Bahn and its companies, abolished the classic pyramid and the associated functional lines, moving towards a hierarchy-free, autonomous, and networked world of work.
- Singaporean multinational banking and financial services corporation, DBS Bank Ltd, created an SRE task force comprising leaders from various tech teams and enabling platforms. As its initiatives grew, it moved to a hub and spoke model.
- BBC Online uses serverless functions to scale up fast and reduce the operational complexity of running the service. Serverless functions are ideal for handling unpredictable traffic volumes, as cloud providers operate these at a large scale.
- Rakuten Mobile implemented a fully automated, zero-touch operational environment for its cloud-native 4G and 5G network services. Optimizing the company's OPEX, it can deliver rapid service innovation and network operations.
- A global technology services company has launched the Robotizing Data Centers project. Here robots are trained to take on central tasks in data centers autonomously and reliably.

IMPACT

- Customer-centric culture is a core focus across organizations, and this also pertains to employee centricity. Successful front-end experiences are intrinsically integrated with both back-end business and IT operations.
- The responsiveness and availability of organizations is improving, driving on resilient IT platform operations that enable new, online channels and agile product/service delivery options.
- Service management is delivered in real time, covering areas such as event aggregation and correlation, major incident management, and service request management – all across multi-cloud platforms.
- Through the optimization of IT platform operations, the usage of scarcely available physical resources can be optimally managed, saving on energy consumption, transport, housing – and contributing to a zero-carbon mission.
- Hands-free, autonomous IT operations provide one of the most promising ways to deal with specialized skills shortages, making room for specialists to focus on more challenging, strategic, and satisfying tasks.

TECH

- **Cloud operating models:** Operating Model Comparison, Cloud Operating Model for Multi-Cloud
- **SRE:** Google, State of DevOps, Blameless
- **Event-driven architecture:** Amazon EventBridge and Amazon SNS, Solace, Hazelcast
- **Serverless and Function-as-a-Service (FaaS):** AWS Lambda, Google Cloud Functions, Azure Functions, webtask.io, hook.io, IronFunctions, OpenWhisk
- **Zero-Touch:** IBM Cloud Pak for Network Automation, Zero-Touch-Provisioning
- **Tools:** Datadog, PagerDuty

BALANCE BY DESIGN

The essence of designing a Technology Business is to find and preserve several balances in parallel: balance between the interests of stakeholders, between short and long term, centralized and decentralized, friendly and authoritative, purposeful and spontaneous. Besides the WHAT of technology trends, TechnoVision offers a view of HOW to shape these balances within the organization – by purposeful design. The principles within this container aim to provide control questions for executives, a bouquet of perspectives for architects, and a systematic checklist for anybody involved in a Technology Business portfolio, program, project, or initiative.

Presented on a single page, each **principle** is deliberately contrasted with an **anti-principle:** the opposite of the principle, a statement that may strike the reader as uncomfortably familiar. **The context** then positions the principle, before living the principle shows how we can apply it on a continuous basis, and finally **the openings** propose the potential first steps for any organization, like the opening moves of a chess game.

We start with **Technology∈Business** (pronounced as "Every Business is a Technology Business"), which makes the case for not "just" aligning business and technology, but fully unifying the two – achieving full transformational impact across the entire organization.

We continue with **Adapt First**, as we still need "water-like" capabilities to seamlessly adapt to whatever changing circumstances may occur inside and outside the organization. Hence, Adapt First is a mantra that cannot be chanted enough.

Being open to any expected or unexpected partnering opportunity out there is now the hallmark of a true Technology Business and being **With Open Arms** means transforming your platform into a true business magnet.

With sustainability now featuring as one of the top of corporate priorities, **Do Well, Do Good** suggests boosting the organization's societal purposes by saying "Yes" to technology that fosters sustainability, and "No" to what is energy-wasting or non-essential.

As trust levels ebb, Technology Businesses must respond with a powerful **Trust Thrust**, which unifies business and technology strengths to carry the torch for trust, protect the corporate foundation and propel business growth.

To deal with the irresistible ascension of data-fueled Artificial Intelligence, **IQ CQ EQ Up** promotes a proper balance between relying on data and algorithms – increasingly for creative purposes – and the emotional curves of all involved. We're only humans after all.

Or are we? Our last design principle of **No Hands On Deck** tantalizes us with the prospect of a fully automated, hands-free business while suggesting a stepwise approach to getting there (if we ever do).

Each of the seven principles is designed to provide guidance on its own. Embrace all seven as a set, make them your Technology Business seven-league boots!

Pierre Hessler
Expert in Residence

TECHNOLOGY ∈∋ BUSINESS

Robert Kingston
Expert in Residence

THE PRINCIPLE

Move from alignment to unity of business and IT, creating a seamless Technology Business strategy and operations.

"Every business is a Technology Business" is how our odd, slightly misused mathematical notation should be read. With the ever-growing dependence on technology, the worlds of IT and business have migrated – sometimes reluctantly – from isolated compartments to fully-aligned entities. But now, an "All Ops" approach is required with full, mutual, and deliberate convergence of business and IT without friction or middle persons. They move and act as one.

THE ANTIPRINCIPLE

Cherish the red tape of requirements and specifications-driven communication channels between business and IT, facilitated by specially assigned intermediaries.

THE CONTEXT

The water-like levels of responsiveness, speed and adaptability needed to thrive in today's Technology Business context do not allow any obstruction, delay or noise between the stakeholders involved. Any Technology Business strategy should be deployed, both fluidly and rapidly, in both business and IT operations as it evolves and iterates repeatedly and continuously. This "All Ops" approach – continuously adjusting and delivering on strategy – cannot afford any loss in translation along the way. Cross-disciplinary teams work jointly on products – rather than on projects – with a potentially unlimited lifecycle, guided by shared budgets and tangible business value streams. Technology becomes be more and more democratized – then internalized – as all involved will learn from each other's roles, perspectives, and skills.

LIVE THE PRINCIPLE

1. **Empower the business:** Shift ownership of, and responsibility for Technology Business solutions, products and change towards the actual business domains.
2. **Create Technology Business product teams:** Move to continuous product delivery, driven by cross-organizational, autonomous, "All Ops" teams with allocated budgets.
3. **Democratize technology:** make self-service of IT capabilities by the business the default, for example in areas such as data, application services, and process automation.
4. **Promote a "With Open Arms" platform:** drive and support open standards and a versatile digital platform inviting Technology Business teams to work quickly, securely, and consistently.
5. **Go beyond the conventional governance:** Enable Technology Business product teams to act quickly and autonomously, on top of predefined policies and authority levels.

THE OPENINGS

- Build generic enabling platform services but make absolutely sure one or more business domains sponsor, adopt, and apply each service right away.
- Transition incrementally, introducing Technology Business product teams one at a time – considering the availability of relevant platform services.
- Make Technology Business product teams the default for new corporate products and services, especially when new, innovative technology enables them.

ADAPT FIRST

Thilo Hermann
Expert in Residence

THE PRINCIPLE

Move adaptability from afterthought to prime time.

Being like water: such a gripping, relevant metaphor. Businesses need to stand up to change; to adapt quickly, again and again, or otherwise be condemned to irrelevance. And now that every business is becoming a Technology Business, ensure adaptability is a joint, shared responsibility of both business and IT. It should become a leading design principle flowing throughout the organization, not another brick in the wall.

THE ANTIPRINCIPLE

Build only the exact operations and solutions that are being asked of you, leaving all future changes to your successor.

THE CONTEXT

Crises will occur. Failures will strike. Opportunities will arise. Change will come, often in unexpected, unplannable ways. Adaptability is essential to deal with it. In a Technology Business, a business's agility largely depends on its technology agility, but it is way too late to change systems only when the need arises. Systems must be built by design to deal with disturbance and change. A variety of technologies enables this, from "mesh" API services and self-improving IT operations to open data sharing, and autonomous systems. It's also about the mindset: the Technology Business context will always, routinely, shift, break and change. Only come to action when it occurs, and you are kicked around by the circumstances. Embrace it, and you become the change.

LIVE THE PRINCIPLE

1. **Change is not the enemy:** the business context changes continuously, and so should technology; welcome comfortable and uncomfortable change, don't demonize it.
2. **Architect to adapt:** follow architectural patterns that enable an agile, distributed mesh, such as microservices; look for AI to drastically improve responsiveness.
3. **It will break:** assume processes and systems will be disturbed – even break. Build in measures throughout to deal with failures and learn from them to improve resilience.
4. **Search the sweet and sour spots:** maintain a heatmap of potential changes, for example due to legislation, future products and services, or new partners.
5. **Prepare your Change A-Teams:** set up unified, cross-organizational teams that can absorb continuous change and act right away, especially when it was not planned.

THE OPENINGS

- Move from project to product thinking: realizing that operations and systems always evolve – rather than end up in a final state – trains the adaptability muscles.
- Move from solution to platform thinking: a solution becomes only a temporary aggregate, built on a catalog of agile platform services and capabilities.
- Bridge strategy and operations: apply an integrated, DevOps-style mindset to continuously operationalizing strategy in business and IT systems.

WITH OPEN ARMS

Patrice Duboë
Expert in Residence

THE PRINCIPLE

Upgrade your technology platform to the ultimate Technology Business platform: a superior, open set of attractive services, acting as a magnet for active collaboration, internally and externally.

New clients, new customers, new opportunities, new hires, new partners, new resources, new collaborations, new ways of doing business: they come as quickly as they go. Your platform must be ready when opportunity knocks, not only when you plan for it. And remember, you're not the only game in town, just being "open" is not enough to beat the competition. Offer the best from Technology Business services and create an irresistible business magnet.

THE ANTIPRINCIPLE

Your Technology Business platform is a custom-built stronghold, doors closed, only opened when new requirements dictate so.

THE CONTEXT

A differentiating, unified experience – for customers, partners, and employees – requires easy connectivity between organizations, sectors, and industries alike. As players move in their own, idiosyncratic ways, it is hard to predict what the network opportunities and challenges may look like at any given point in time. It can be difficult to find a unique position for your Technology Business to stand out above the melee. A Technology Business platform must have attractive openness built in, not as something that is only reluctantly – and painfully – added when new circumstances arise. A cloud-native infrastructure, API-first application services, robust data sharing capabilities, distributed networking: they all make for the most alluring front doors around. Spread the word, and don't be shy promoting them either.

LIVE THE PRINCIPLE

1. **Re-name** your platform to **Technology Business platform** – designed, developed, and operated with, and for technology-driven business purposes.
2. **Re-architect** your platform to evolve easily and integrate new partners, outside resources, providers, clients, and new services in the shortest time possible.
3. Systematically **adopt** open standards and state of the art technologies – as a standing invitation card.
4. **Augment** the business value of your APIs and data sharing services – evolving from technology-coupling systems into business-partnering vehicles.
5. Encourage top management to make its Technology Business platform one of the **hallmarks of the company: *"With Open Arms."***

THE OPENINGS

- Promote your Technology Business platform's capabilities and attractions as you would when promoting the glamour of a new product.
- Introduce objectives and key results that speak the language of open connection: business value, time-to-react, fluid workforce, environmental contribution.
- Make it common practice to be irresistible to scarce human resources – not just providing security and comfort but offering the best balance between work and life too.

DO WELL, DO GOOD

Michiel Boreel
Expert in Residence

THE PRINCIPLE

Boost the organization's societal purposes by saying "Yes" to technology that boosts sustainability and say "No" to what is energy-wasting or non-essential.

You can't have it all. Not everything that is technologically possible is socially desirable. As tempting as Technology Business initiatives may seem, many of them demand a great deal of energy, time, and scarce, natural resources. Carefully choose less-demanding initiatives that hold sustainability at heart. Consider the Total Social Impact of initiatives and look for technology that actively benefits societal purpose. Make the world a better place and serve the wellbeing of every human being. Feels good doesn't it.

THE ANTIPRINCIPLE

Aim to satisfy as many technology needs from the organization as possible without consideration. Only consider the sustainability impact as an afterthought.

THE CONTEXT

IT solutions are an exciting business change enabler, yet they can consume energy, natural resources, and increase CO2 emissions. Indeed, current estimates state that 3.7% of global CO2 emissions comes from IT. If IT industry were a country, it would be the third largest electricity consumer in the world. But sustainability is so much more than just ecological sustainability. The UN's 17 Sustainable Development Goals (SDGs) recognize the critical factors required for societal good: ending poverty deprivation, improving health and education, reducing inequality, and spurring economic growth – all while tackling climate change. IT has the potential to not only cut carbon emissions, it can also be purposeful and offer a positive societal benefit that serves the wellbeing of all stakeholders. Time to make a contribution: refrain from hording data, using damaging materials, child labor or adding to the plastic soup of the oceans. There is so much good IT can do if we do it well.

LIVE THE PRINCIPLE

1. **Understand your current landscape** by assessing your current sustainability footprint. Check your as-is, include "built-in" CO2 emissions of assets, and consider what happens following their five or seven-year life span.
2. **Identify areas where IT can contribute**, such as consolidating your application portfolio, or by using new technology to reduce environmental impact or provide a societal benefit.
3. When designing, **consider the 17 Sustainable Development Goals as a Non-Functional Requirement.** Always take environmental impact and societal good into account and balance it with availability, stability, cost, and quality.
4. **Build credibility by making IT sustainable**, and questioning a design's impact: "is this truly increasing sustainability?" "What actions can we take now, to improve sustainability in the future?"
5. **Say no to non-sustainable business ideas and technology.** Teach colleagues to see the advantages of "yes" today versus "no" to avoid sustainability issues in the future.

THE OPENINGS

- Become the guardian of people's digital happiness and incorporate SDGs as Non-Functional Requirements throughout the organization.
- Launch a "retirement contest" for marginal or obsolete applications.
- Retrospectively and demonstratively apply Do Well, Do Good to your top three current developments.

TRUST THRUST

Rajashree Das
Expert in Residence

THE PRINCIPLE

Power up the entire trust ecosystem – from the organization's core to its edges – securing your existing business and pushing forward to its next permutation.

Technology Businesses must be trusted by customers, clients, shareholders, employees, partners, networks, and authorities alike – or there is no business. Period.

Simply put, trust is an imperative. It must permeate business and technology operations alike. And trust us on this one: when applied well and pro-actively, it becomes an innovative business accelerator too.

THE ANTIPRINCIPLE

Trust your ability to fix issues only as they arise, kicked around by security, privacy, and ethical circumstances; or alternatively, hide behind an impenetrable wall of distrust.

THE CONTEXT

All for trust, and trust for all. With hybrid work models and their reliance on digital, trust is a critical corporate asset, affecting the entire business ecosystem. It pertains to cybersecurity, guaranteeing users uninterrupted access to secure and trusted data. It also pertains to data privacy, where the proper, transparent use of personal data is always under scrutiny. And don't forget the ethics of AI is a serious part of the Trust equation as well, ensuring it is human-centered and serving positive futures. It is tempting to delegate the enforcement of trust to technology (such as zero-trust platforms, AI and even quantum computing), but in the end, trust only creates a differentiating thrust if it is entwined with all aspects of Business Technology change, humans included.

LIVE THE PRINCIPLE

1. All business strategies and initiatives **fully embed and address technology-supported trust,** as well as the human-centered dimensions of it.
2. **Trust is an integrated part of the solutions lifecycle,** architected, designed, and deployed throughout – rather than check-listed at the very end of a lifecycle iteration.
3. **All solutions development "A-teams" contain cybersecurity/privacy and ethics experts,** ensuring the other team members appreciate and embrace trust topics as well.
4. **Establish a continuously evolving trust model** with principles, guidelines, training, and communication to all levels, using impactful narrative.
5. **Use the organization's built-up trust as a differentiating quality** towards the wider business ecosystem, clients, consumers, and potential new employees.

THE OPENINGS

- Expand the solutions development teams to include experts around cybersecurity, data privacy and ethics, promoting a cross-fertilization of skills.
- Bust your biggest distrust generator, whether it is in cybersecurity, data privacy, or ethics – and ensure its resolution is widely communicated.
- Find an organizational system that can safely pilot zero-trust technologies, to try a radically different approach to trust and learn from it.

IQ CQ EQ UP

Ron Tolido
Expert in Residence

THE PRINCIPLE

Ensure a properly measured and monitored balance between three – sometimes conflicting – assets: the corporate Intelligence Quotient, Creativity Quotient, and Emotional Quotient.

The only way is up! On the road to becoming a Data-powered Enterprise, every initiative should increase the corporate IQ, noticeably through new knowledge, insights, and algorithms. Also, AI systems can now increasingly generate new, unique content from organization data, bolstering their creative powers (CQ). However, humans stay at the center of the enterprise's raison d'être: a demonstrably growing corporate EQ will prove it.

THE ANTIPRINCIPLE

Harvest and use data to the max, automate at will, leverage AI for cognitive and creative purposes; don't worry about the people, they will adjust – as always.

THE CONTEXT

It doesn't take much convincing for organizations to focus on extracting more value out of data. It is used to share – both inside and outside the organization – for specific purposes, and to base better, fact-based decisions and actions upon. Data is also increasingly used to train AI models that bring additional predictive, prescriptive, and even autonomous capabilities to the business. And this data melting pot becomes all the richer with generative AI, which builds on (organizational) data to produce synthetic, creative content. So far, much of this has been considered the exclusive forte of humans. All the more reason to not focus on the organization's intellectual and creative capital alone, but responsibly – and measurably – balance it with the emotional curve of every individual, and the organization as a whole.

LIVE THE PRINCIPLE

- **Understand your data assets**, assuring all data, whether coming from inside or outside the enterprise, is continuously identified and cataloged for easy access and reference.
- **Activate data** through insights, algorithms, and AI – focusing on putting them at the very core of the business strategy, objectives, and daily operations.
- **Take advantage of data**, applying a systematic framework to identify external (and possibly internal) monetization opportunities for the corporate data assets.
- **Unleash human creative energy** by scanning data for creative potential, building new content, or augmented innovative products and services through generative AI.
- **Adapt to emotion**, ensuring the right emotional curve of all stakeholders involved in the (data-powered) transformation is recognized and respected.

THE OPENINGS

- Publish an alternative Corporate Intelligence annual report that describes data-powered measures and achievements, including a financial value analysis of data assets.
- Mine existing data assets and knowledge bases – structured or unstructured – for the first compelling opportunities to generate new synthetic, creative content from it.
- Consider technology solutions that help monitor, analyze, and improve the commitment and motivation of humans involved in all transformation initiatives.

NO HANDS ON DECK

Aliasgar Muchhala
Expert in Residence

THE PRINCIPLE

Assume full, hands-free automation as the default for all new Technology Business processes.

Advances in AI and intelligent process automation make us fundamentally rethink the human-factor in any aspect of business, while the scarcity of human skills and resources adds a renewed sense of urgency to the pursuit. Some dream of an entirely hands-free enterprise. But we should not move so fast – just yet. For now, let's benefit from autonomous technology: make it your first choice for all new processes and learn about a renewed "hands off deck" approach, by not doing.

THE ANTIPRINCIPLE

Apply AI and intelligent automation to marginally improve existing manual, human-dependent processes; firmly keeping all hands on deck!

THE CONTEXT

By all means, let's take Copernic's advice, and reverse our perspective. We should no longer add snippets of automation and AI to established, human-driven processes, only pretending to enjoy the meager benefits of stepwise optimization. It would be like creating the ultimate horse and cart, applying innovative technology to it (maybe the latest lightweight carriage), and then being genuinely disappointed when it loses in a drag race with a Tesla. Grafting human intervention onto fully automated, AI-centric business processes should be the exception – not the rule. That way, we get maximum impact out of intelligent automation. And it may be the only way too, as human resources and skills are scarcer by the day. Hire AI as your main resource, while virtualizing and augmenting your human talent. Learn from your IT teams, who are already surfing the wave of AI-boosted automation and apply what you learn to your Technology Business processes.

LIVE THE PRINCIPLE

- **Transform** your IT automation platform into a fully connected **business operations platform**, bringing together all underlying business events.
- **Mine your processes:** insights enable action; by capturing and analyzing process data, you find the best opportunities for breakthrough automation.
- **Challenge the heritage:** even the most established business rules and best practices should be reconsidered for relevance in the era of autonomous systems.
- **Think autonomy levels:** similar to the 5 levels of autonomy for self-driving cars, you can apply different ambition levels in the move towards a hands-free enterprise.
- **Keep it human-centered:** even if no humans are involved, the ethical and emotional checks and balances of the organization must be carefully managed at all times.

THE OPENINGS

- Easy gains can be made with Robotic Process Automation (RPA). Although this merely optimizes existing processes, it still is a tangible step forward.
- Processes that are unsafe to humans, consume excess energy, or are particularly error-prone may be viable early candidates for a hands off-deck initiative.
- Use hands-free technologies for processes that require scarce skilled resources, not only to have a viable pilot ground, but also to effectively deal with the challenge.

A Few More Things

If Marty McFly travelled back from the future with a TechnoVision report in his back pocket rather than a sporting almanac – what would it say? Unfortunately, no one has a DeLorean time machine, so it seems impossible to envisage the future accurately. Yet, what we can see, is the emergence of key trends we believe will further shape our technological horizon. Maybe not this year, but soon. Very soon.

METAVERSE
The metaverse may just look like a newfangled version of Virtual Reality 2.0 (or even worse, a reload of Second Life) – but many consider it to be the future of the internet. A space where mixed reality augments our own selves, allowing us to socialize, learn, and collaborate in ways far beyond what we envisioned before. Bigger than just a single enterprise or industry, the distributed Metaverse may be created, used, and enjoyed by people all over the world, without exclusion. Yet, still very much in its infancy, no one can accurately predict where the Metaverse will take us, and when. What will our lives look like inside the Metaverse of the future? How can we trust its content and its participants? Will blockchain come back with a vengeance within this context? No one knows, there is no precedent. The one thing for certain: it is definitely one to watch. You hear that Mr. Anderson? That is the sound of inevitability!

THE QUANTUM EQUATION
Quantum computing is maturing, arguably like a fine malt. A technology which is still giving off its angel share, unpredictably unstable, not yet operational for mainstream use. But as a quantum of solace, exploration and experimentation are ongoing (Capgemini deploys its own Quantum Lab). No longer is the question a matter of "if", but "when." Or is it? Quantum computing is already a key consideration when thinking about the future of Cybersecurity and encryption. And hopefully, it will be pivotal to address some of our biggest societal challenges, such as the climate crisis and public health as well.

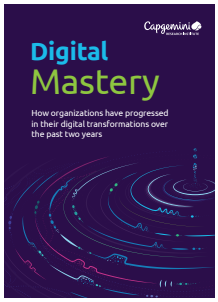
PERMACOMPUTING
Like the frugal qualities of Jugaad? Take a further look at "Permacomputing": aiming to counteract the wastefulness of the computing world. Until now, only a fraction of electronic waste is recycled. Aside from the clear environmental burden, that's tens of billions of gold, silver and other high-value, recoverable materials that could have been collected and reused – a sum greater than the GDP of most countries. Permacomputing extends the lifespan of hardware, reducing the carbon footprint of what is already produced. Reducing the energy consumption of software (both when building and using it) is another aspect, viewing resources as precious, to be used as effectively as possible, only when necessary. The circular economy is coming, make sure it also pertains to IT.

CREATIVE AI
Competitive language transformer models outgrow each other month on month, our fascination by the evolution of generative and creative AI grows even more intense. Yet there is much to consider. Soon, it could be almost impossible to distinguish real from fake – even more so within the Metaverse. Furthermore, training generative AI models consumes a lot of expensive and wasteful computing resources, in direct contrast to our pleas for frugal, upcycled computing (admittedly, applying the models once trained is much better for the carbon balance sheet). Finally, now creative AI has firmly arrived in the once human-only realm, the quest for staying human-centered becomes more relevant than ever.

PURPOSE INTENSITY
For a Technology Business to excel, organizations must now consider the importance of purpose directionality, continuing with their digital strategies while keeping a clear view on the shifting values of society, and what is deemed socially desirable innovation. The more technologically nimble – "born digital" – giant corporations may dominate the marketplace, but they also display a remarkable lack of understanding when it comes to purpose intensity. To outcompete these corporate colossi, incumbents are increasingly adopting a strong purpose directionality. Yet, it is the CIO's responsibility to translate the corporate purpose statement into thought-provoking technology choices. Every technology needs to be tested against the purposeful objective of what role the organization chooses to play in the digital society that is being created. Impact on the environment, the inclusion of the digital have-nots, racial equality, and gender balance – to name only a few – suddenly become factors for consideration in decisions that were once purely technological.

In any case, a more sustainable world where no one is excluded may very well depend on our ability to augment ourselves with advancing technology. Now that sounds like a future you definitely want to go back to.

Further research

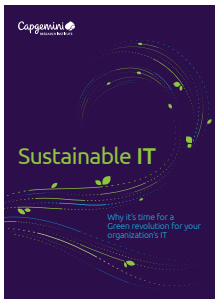


Digital Mastery

Circular Economy for a Sustainable Future

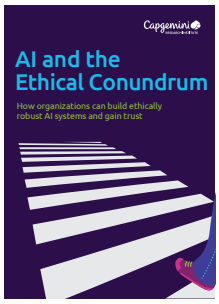
Data Mastery

The Data-powered Enterprise



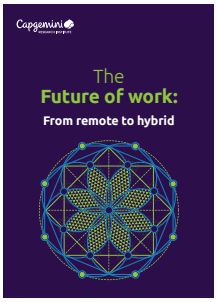
Sustainable IT

Climate AI



AI and the Ethical Conundrum

Sustainable Operations



The Future of Work

Next Destination: Software

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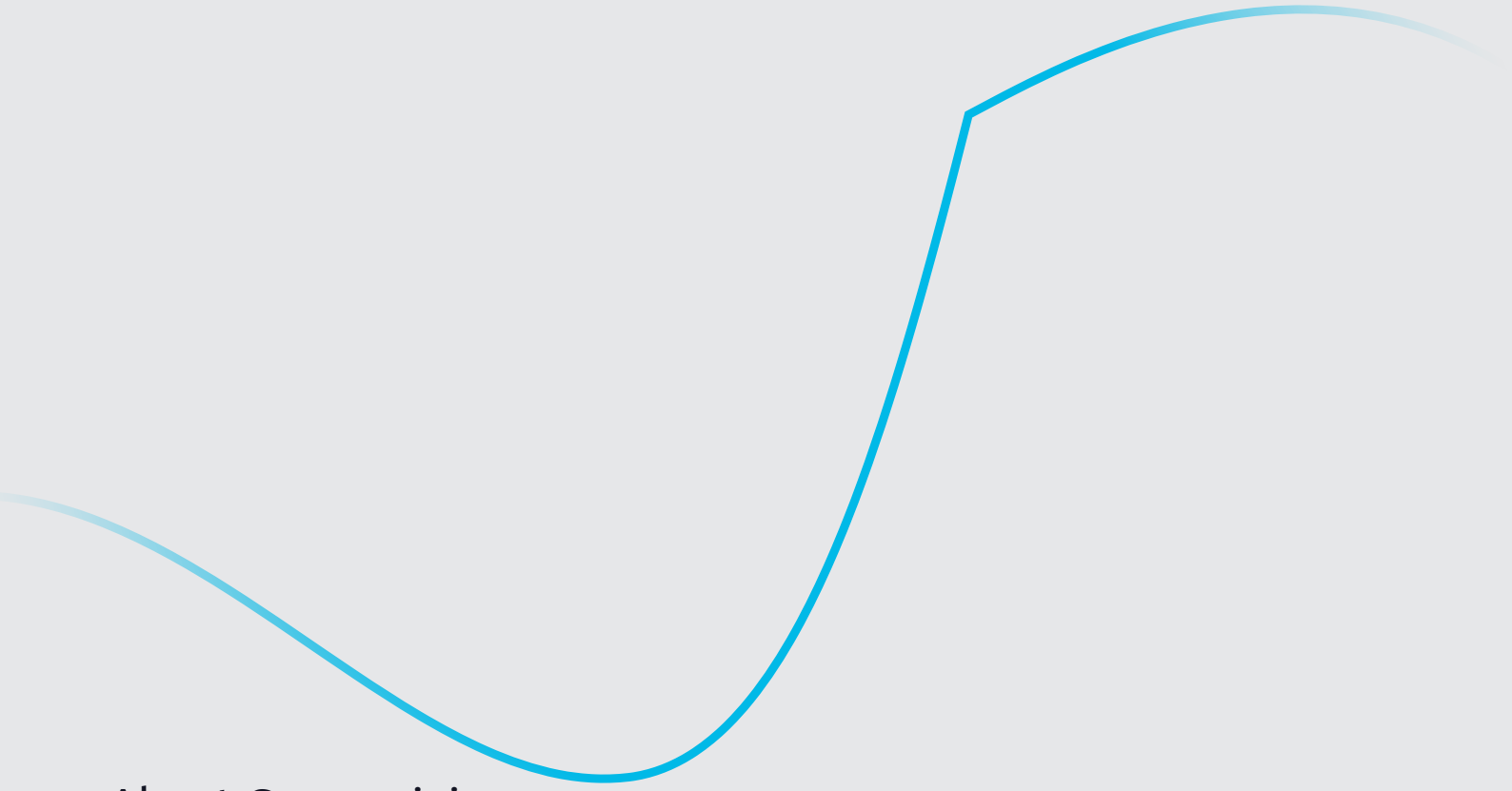

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