
Capgemini
RIGHT THE
TECHNOLOGY
WRITE THE
FUTURE
TechnoVision
2023

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FOREWORD

PASCAL BRIER

Group Chief Innovation Officer, Capgemini

The beautiful, intriguing artwork of this TechnoVision 2023 edition makes me watch it again and again. Take the front cover. Is it a mirror, or a doorway, or both? Do we see forward to what is coming, or backward to what has been? Is the future bright and established, or still an empty slate waiting to be written on?

It also seems to ask us what kind of future we want. Will it be a future in which technology constrains business, or empowers it? One where you choose profit over planet or find profit in sustainability? A technocratic future, or one in which we always put humans first? Will we use technology for resilience and agility, new ways of growth, doing things differently, or something else?

Whatever scenario pans out, we know technology is an integral, indispensable part of the equation. So, if we indeed aspire to thrive on technology, what are the options that help us build a better world, a more successful enterprise? And what are the delicate trade-offs to be made when we realize that applying technology requires human and natural resources that are increasingly scarce, and that certain technology options even may have an undesirable societal impact – for example on the environment or in terms of ethics?

Choices, so many choices.

This is where TechnoVision comes in. A trusted and insightful guide, it helps making the right choices, devises technology-enabled enterprise strategies and transformation plans. True to its unique nature, it is accessible, playful, and actionable – making it suitable and relevant for both business leaders, CIOs, and technology practitioners.

Driven by the technology execs of our Technology, Innovation and Ventures (TIV) council, it leverages an international network of experts who monitor, assess, and synthesize technology evolutions across various domains. It is coordinated by our Technology Assessment Service (TAS) that distills this tidal wave of information into Tech Radars, a foundation for our trends analysis. It is activated by our phenomenal architects community, putting the TechnoVision framework into practice every single day.

By the way and in case you wonder, the visuals of this edition are completely generated by Artificial Intelligence. Given the skyrocketing evolution of generative AI models such as chatGPT, DALL·E and Midjourney, this may no longer strike you as ground-breaking. But to me, this exercise brought an unexpected extra insight. If you want the system to provide the best results, you need to become skillful in ‘prompt engineering’: articulating through a chain of carefully selected words what your intention is.

Selecting the wrong words leads to unexpected results and adding more words to the prompt is not always helpful. Context and sequence can be all-determining.

Not so different from today’s technology business reality, in which TechnoVision 2023 can help you find the right ‘tech prompts’ that shape the future you want. Enjoy engineering them.

INTRODUCTION

When we showed an early draft version of the first TechnoVision document to one of our most senior executives 15 years ago, his assessment was brief and relentless: "It's neither techno nor vision". And although it was a tough pill to swallow at the time, in hindsight it turns out he was right.

Sure, TechnoVision brings a fascinating array of up-to-date, key technology trends, but it also zooms in on the business impact of each of these trends and illustrates the value with many use cases and best practices. And yes, TechnoVision provides overarching themes that underpin many of the trends, and thus can be considered as a vision document, but it is first and foremost an actionable framework and toolkit that is used daily across the globe for ideation, digital storytelling, and all-other-things innovative.

Talking about overarching themes: we have seen our 2021 'Be Like Water' leitmotiv resonating very well with both our clients and our own professionals, to the extent that we prolonged the theme for another year through the slight variation of 'Being Like Water' in 2022. It was a plea to apply technology to make businesses more agile, adaptive, responsive, resilient, and creative – all necessary in the era of Uncertainty[2] in which the economy, society, and technology potentially change overnight, again and again.

And although 2023 promises to be yet another unpredictable year – with 'Being Like Water' arguably more relevant than ever – we felt the current technology business context needs a new theme, a new motto. With 'Right the Technology, Write the Future', we make "a call to action" to be respectful of the increasingly scarce resources we have at our disposal. We believe the challenge is in selecting the *right* technology solutions and innovation initiatives that not only contribute best to the organizational future but also have a clear, positive societal impact.

Furthermore, as innovative technology itself tends to be quite hungry for energy and other scarce resources, we suggest IT people *drink their own champagne*, and be both more frugal and more creative in choosing the resources they really need: this is all about righting the technology, for better futures.

Upcycling is one of the best ways to achieve this, reusing existing solutions and technology to create something of higher quality or value than the original. In fact, we decided to apply the concept of upcycling to this year's TechnoVision as well. You will recognize many of your favorite technology trends from last year, as they are still highly relevant – but they've been upgraded with the latest insights, use cases, and technology examples.

There are quite a few new trends as well this year, which reflect the overall theme of 'Right the Technology, Write the Future'. We see industry-specific clouds emerging as a way for organizations in a sector to lessen the burden of legacy IT landscapes while boosting collaboration in areas such as CO_2 reduction and innovation. We see green software engineering shaping and reshaping the applications portfolio in a sustainable way. We see net-zero data emerging as a route to corporate net-zero and as a plea to battle data waste. Meanwhile, we envision the Internet of Twins approach evolving to create extended, mixed realities in which we travel less, occupy fewer offices, and still achieve more. And then there is the distributed, decentral 'mesh' web that relies much less on leaders, fixed assets and structures, yet creates more value. And do we even need to point out how 'creative machines' such as chatGPT will make us more productive with less resources?

So, something 'old,' something new – but TechnoVision remains true to its vision: an accessible, well-structured, actionable framework, describing 37 technology trends, which are based on the contributions of Capgemini experts all around the world, from many different domains. There is something in each trend for everyone, whether you are an IT expert looking for the serendipity of unexpected angles, or a tech-curious businessperson wanting to understand the buzz. If nothing else, TechnoVision brings you some fresh thinking to address the technology business issues of today, and helps you design, plan, and ultimately, write the future you want.

Sounds about right, doesn't it?

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RIGHT THE TECHNOLOGY, WRITE THE FUTURE

Benjamin Franklin, one of the founding fathers of the United States, was what you could call a polymath: an individual who masters a wide variety of subjects and is able to tap into all of them to solve specific problems. Just like other polymaths – think Leonardo da Vinci, Al-Biruni, Leibniz, Hildegard of Bingen, Rabindranath Tagore – he covered areas as diverse as science, technology, engineering, mathematics, and the arts. He was an influential writer, scientist, inventor, statesman, diplomat, printer, publisher, and political philosopher. Today, he would no doubt have been an accomplished data scientist, software engineer, and enterprise architect as well. Portfolio management might even be his forte, as he has been credited as the inventor of the Pro & Con list, which is still an effective decision-making tool.

He would also have been a popular *meme-maker* on social media. Always quick with a bon mot, he produced an impressive longlist of quotes: “Haste makes Waste”, “If you desire many things, many things will seem few”, “Lost time is never found again”. These are just a few examples of his one-line wit that remain as relevant as ever.

DO WELL BY DOING GOOD

Then there is a quote that is usually attributed to Franklin but cannot be validated as his: "Do Well by Doing Good" – to achieve social or financial success because of a charitable and/or benevolent disposition toward others. Selfish altruism, as some would call it.

Whether it comes from Benjamin Franklin or not, the quote is perfectly illustrative of the Technology Business landscape of 2023. We see the world straining; its natural and human resources are no longer able to sustain our current levels of living and consumption. The scarcity of almost everything is now a determining economic and social factor. We see continuously rising pressure on the climate, resulting from an excess of carbon emissions. We see inequality, food shortages, and a lack of medical care and education in many places across the globe. All of this takes place within an obviously shaky geo-political context, driving unprecedented disruption potential.

Organizations in this Technology Business landscape see their purposes evolve. From 'simply' creating revenue, profit, shareholder value, and superior performance to actively contributing to society and addressing the big challenges of our time, shaping better futures. One thing leads to the other: the Capgemini Research Institute has found organizations that actively pursue sustainability goals achieve more revenue, are more profitable, and enjoy more customer loyalty. Also, the next generation of workers carefully considers the kind of organization they work for, actively seeking compatibility with their own values, such as sustainability, diversity, and inclusion. This is even more crucial in a time where scarcity of committed skilled people is a given. Doing the right, good things thus leads to organizations doing well.

KID IN A CANDY STORE

With *every business now being a technology business* – or '*Technology∈Business*' as we like to put it in TechnoVision – technology is an integral, fully entangled part of whatever business scenario pans out. Yet in 2023, the range of technology options to choose from is more dazzling than ever before. We might feel like a kid in a candy store if we look at the transformative power of technology that is already looming on the horizon in areas as diverse as creative / generative AI, cloud, edge computing, the Internet of Things, microservices, data sharing, AI, the Metaverse, Web3 (or the 'Mesh Web' as we prefer to call it), intelligent process automation, team collaboration, autonomous systems, and even biotechnology and quantum computing.

We believe there is not one of the United Nation's 17 Sustainable Development Goals that would not benefit from – and even be enabled by – technology. Equally so, a compelling vision – such as the Japanese 'Society 5.0' ("a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space") – can only be built on top of the smart connected products and technology-enabled operations of Intelligent Industry.

So many opportunities, so many options. TechnoVision is a framework that helps you to navigate key technology trends, put them together, and craft compelling digital stories. It is a tool to enable smart choices, identifying the right technology drivers for doing well by doing good and doing the right things.

LESS WITH LESS

However, as abundant as these technology drivers seem to be, the resources they require are no longer copious. This scarcity applies to any resource needed for a successful technology business transformation: natural resources (including chips), energy, reliable supply chains and transport, 'cheap,' low-interest money, simply enough time, and – arguably above all – skilled, experienced, and committed people.

In this context, and as counter intuitive as it might sound initially, TechnoVision 2023 therefore makes a plea for doing 'less with less'. *Right the technology* – as part of our main theme this year – not only suggests choosing the right (and good, more beneficial) technology options, but also to *right-size* and rationalize both existing and new technology solutions, potentially even *down-sizing* them, to create better balances between the positive and negative impacts of technology.

Furthermore, whatever future a business wants to write enabled by technology, it might need to consider the harsh realities of a time in which scarcity of all key resources determines success or failure. Shaping a lean portfolio of well-chosen, smart initiatives might work better within this context than following the established digital innovation motto of 'letting a thousand flowers bloom' (itself a common misquotation of Mao's 'let a hundred flowers blossom' quote).

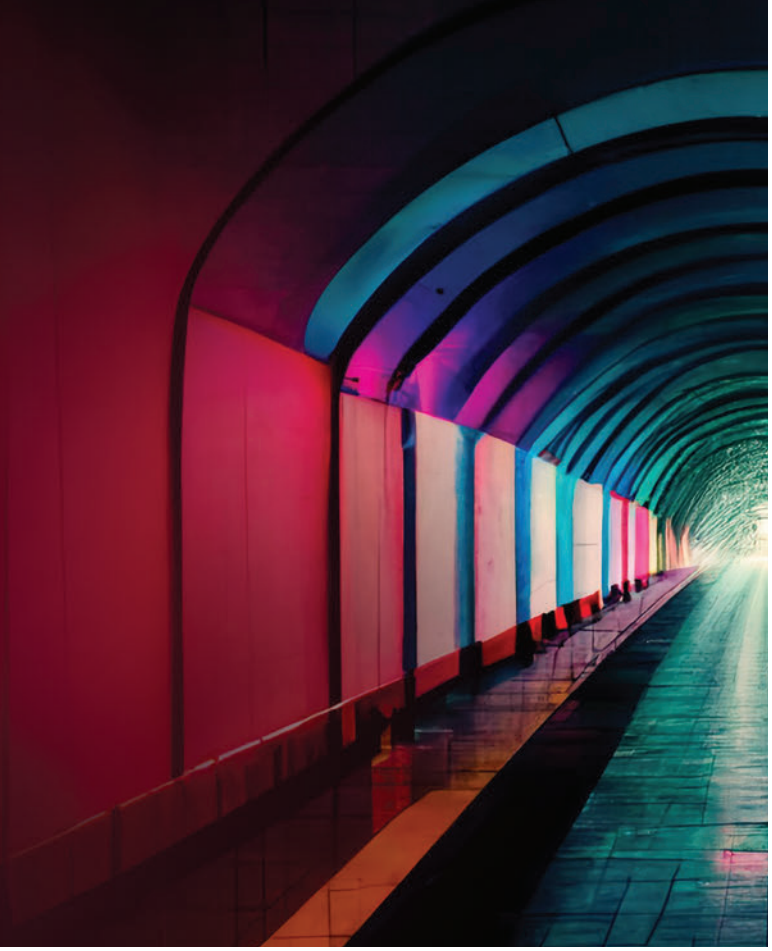
So, in many ways, there's *More to Less.* Let's further explore this sentiment a bit.

TECHNOLOGY FOR POSITIVE FUTURES

In previous editions, we have highlighted how innovative technologies can create better, customer-first businesses, improve enterprise management, even build a next generation of intelligent industries. We have also shown how technology can make organizations more 'water-like': achieving the agility, adaptiveness, responsiveness, and resilience that are needed to deal with a highly unpredictable economic and societal context. The TechnoVision sector playbooks have further illustrated this fluidity with hundreds of sector-specific, best-practice uses cases.

However, the anticipated scarcity of *everything* and the increasing scrutiny on climate impact means it is now vital for everyone to tune and optimize business operations on using less resources while being more sustainable. Many technologies described in TechnoVision 2023 are of major help here. Let's look at some examples.

In the field of infrastructure ('Invisible Infostructure,' as we call it in TechnoVision), we see the emergence of industry clouds that enable companies within sectors to benefit faster from innovative solutions that deal with shaky supply chains, limited availability of natural resources, and measuring, managing,



and acting on emissions data. Also, *industry clouds* help organizations to lessen the weight of their existing, custom-built IT landscape, becoming less dependent on the scarce resources that still master that legacy. Finally, the further evolution of the Internet of Things and edge computing brings solutions much closer to where the action is happening – in a factory, at a farm, on the road, at work – so that real-time, smart algorithms and intelligent automation (such as to save energy or reduce CO_2 emissions) can be applied to greater effect.

A combination of AI, intelligent automation, the Web3 'mesh web', and even *self-driving*, self-optimizing autonomous business processes and installations, can lead to value chains that continuously tune themselves. This optimization is done increasingly without the need for human intervention, costly travel, and energy-consuming assets, while achieving objectives that are key to the company's purpose.

The same premise pertains to the extended realities of the Metaverse and the related concept of Digital Twins (the 'Internet of Twins'): they provide ways to conduct key business or consumer activities without the potentially negative impact of excess physical presence and movement.

According to recent Capgemini research, data shared in business ecosystems plays a key role in the journey to net-zero emissions. Related research shows how Climate AI reduces greenhouse gas emissions and improves power efficiency. Similarly, the intelligent data platform of Project ENHANCE addresses food security. As food decisions impact our environment, it's aiming to minimize the negative impact on it (with regards to its recipients), making the solution more sustainable while providing policymakers with better insights.

Hence, more technology leads to less pressure on scarce resources and less environmental and societal impact: more technology indeed creates positive futures.

RIGHTSIZING TECHNOLOGY

However, while technology innovations might make businesses more sustainable and able to thrive using less resources, they come with their own substantial footprint as well. Think about the machine-learning systems that underpin next-generation AI solutions: a single training cycle for a large natural language transformer model (such as GPT-3) emits as much CO_2 as five American-built cars during their entire lifetimes. The blockchain-based distributed ledgers of Web3 are also hungry for energy: maintaining the public blockchain requires as much energy as powering a country the size of Austria. And then there's the compute-intensive, extended reality of the Metaverse, which will no doubt require similarly high levels of resources.

We already know that the scope 1, 2, and 3 emissions generated by the IT industry are responsible for 4% of CO_2 emissions globally – one and a half times more than those generated by the aviation industry. What's more, this level of emissions is projected to grow steadily in the forthcoming years, up to 14%. And then we are still leaving out primary energy usage, water usage and rare earth materials needed for manufacturing of all smart devices. Aging hardware leads to an ever-growing heap of e-waste. Meanwhile, ever-increasing application sprawl and a relentless hunt for 'bigger' data creates an appetite for resources that may no longer be balanced by the values they deliver to business and society.

We must be smart when selecting, implementing, and delivering technology, carefully balancing the expected positive business impact with the resulting externalities. The same principle applies to rationalizing and decommissioning existing applications, datasets, and infrastructure: a less densely populated, more lightweight IT landscape – 'righted' to balance the value it creates – is a crucial element of rightsized technology.

Finally, those professionals who deliver technology need to drink their own champagne. After all, IT processes are 'just' another set of business processes. The phenomenal potential of AI, intelligent automation, and self-optimizing technologies should be considered to deliver next-generation innovative solutions with less (highly specialized) people and less environmental impact. The benefits of this approach can be seen in technology areas such as infrastructure (software-driven platforms and AI that autonomously runs IT operations and security), applications (low- and no-code development, increasingly with generative AI), data (automated machine learning and self-service Business Intelligence), and service management (automated onboarding and ticket resolution). A special place in TechnoVision 2023 is reserved for insights around 'Green Software Engineering', which points to approaches and tools that can minimize the environmental impact of both existing and new applications.

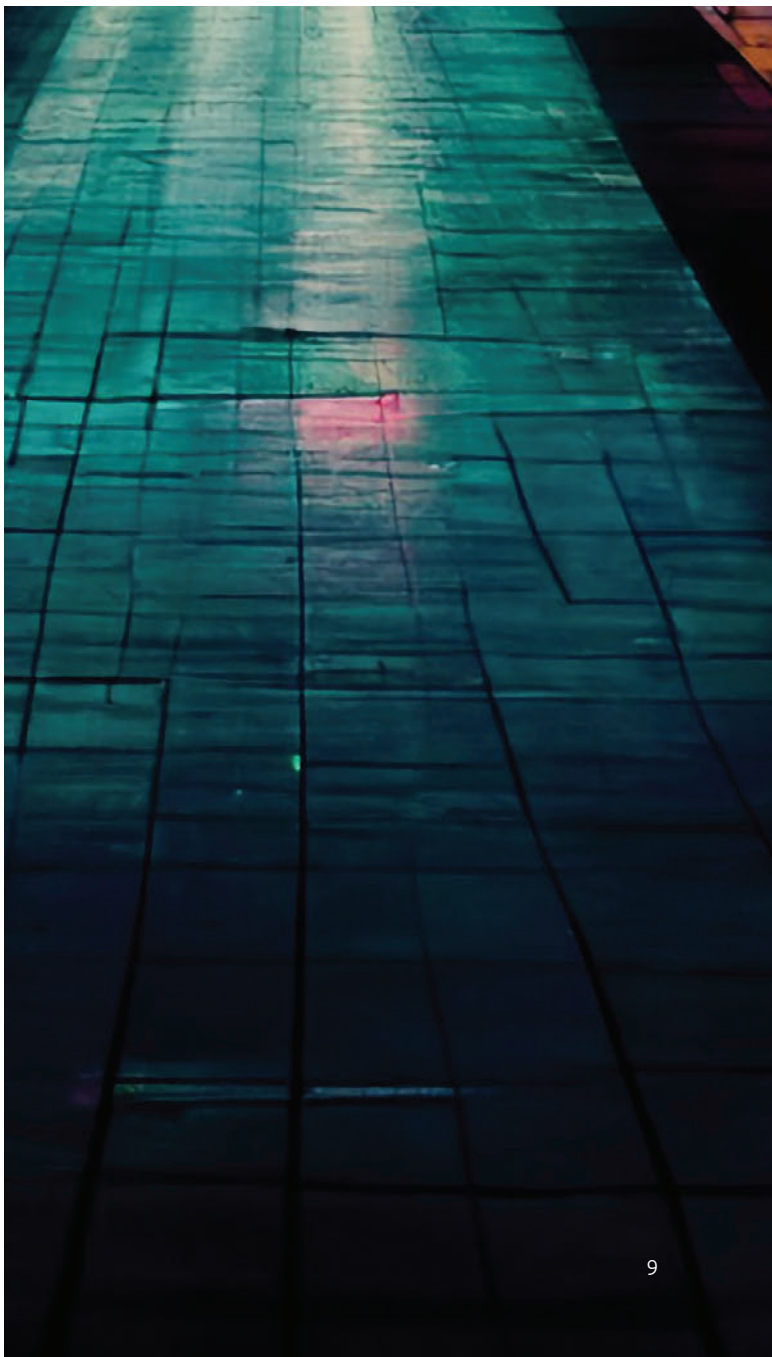
LEAN PORTFOLIO, LIGHT TECHNOLOGY

Clearly, we are not suggesting businesses 'do less,' stop growing or even decrease their business activities and volume (although it could be a strategic direction for some). We do promote the sense that organizations should be smarter and more selective about the innovative technology business initiatives they pursue. In times of abundance and relatively low risk, many businesses could take the opportunity to start a variety of digital initiatives, with "failing fast and failing often" as the ubiquitous mantra. Now, with the combined pressure of overall societal impact (including sustainability) and scarcity of resources, more careful, better-informed balances are needed between what innovation initiatives will deliver to the business and society – and at what total cost and impact.

We have entered a time in which, in terms of technology, much that we once dreamed of has become possible. From a financial point of view, many of these dreams have also become feasible (not in the least because of the easy availability of solutions through the cloud). But now attention shifts towards the social – and sometimes even ethical – desirability of what we are creating. The question is no longer 'can we build it?' or 'can we afford to build it?', but 'should we build it?'

When it comes to providing answers to those questions, 'Just Say No' might well be a perfectly healthy stance. A leaner, smarter portfolio will be the result. TechnoVision 2023 is designed to help shape that approach.

It's important to note that the concept of 'lean' does not only apply to the portfolio of solutions: it applies to the solutions themselves as well. TRIZ, a world-leading engineering-driven approach to innovation, defines the 'Ideal Final Result' of a product, system, or process as having all the benefits, but none of the initial harm and costs. This approach might lead to a 'pure function' that no longer occupies space, has no weight, requires no labor, requires no maintenance, and delivers benefits without harm. Many trends in TechnoVision 2023 help to achieve this optimal business innovation by *doing less*, as illustrated by 'touchless' processes, 'frictionless' customer experiences, 'handsfree' industrial installations, autonomous devices, and even 'leaderless' business models.



Indeed, the concepts of 'less' and 'no' have consistently played a key role in TechnoVision over the years. But in this year's edition, they take center stage in many places. This centrality is not only apparent in leaner, lighter business models and activities. These concepts also pop up in technology. Take, for example, 'serverless' computing in IT infrastructure, 'headless, 'shrunken' services in applications, the shift from 'big' data to 'less' or even 'tiny' data and 'touchless' process automation, all the way up to the 'frictionless,' emphatic interfaces that emerge around user experiences.

These examples all help to illustrate why a plea for 'lean portfolio & light technology' makes perfect sense in an edition of TechnoVision that is nevertheless full of innovative ideas.

NEED TO UPCYCLE

With a focus on both achieving sustainability and addressing the scarcity of resources, we should aim to recycle and reuse more, rather than giving in to Pavlov's urge to rip and replace systems for every new initiative. By transforming the linear take-make-waste system to a more regenerative process (also illustrated by the ideas behind 'permaculture'), everyone and everything can benefit, not least the corporate agenda. Then, if we unleash our creative and innovative powers, recycling even becomes upcycling: creating products and assets of higher quality or value than their originals.

In last year's TechnoVision edition, we referred to the Indian concept of "*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 various parts of the world – is an infinite source of examples and inspiration. Applied to IT, it helps us find ways to tease more life out of technology in business. 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 life, to reuse, and even upcycle the technology we already have.

STILL BEING LIKE WATER

We could have easily held on to the key theme that has dominated the TechnoVision editions of the past two years: 'Being Like Water' is still a key mantra for organizations in 2023. Disruptions in the economy and environment, around geopolitics, but also in terms of social dimensions and technological evolutions: they all come together in a melting pot we have come to identify as Uncertainty[2] (although by now Uncertainty^n might be even more to the point). This disruptiveness makes the quest for a 'water-like' technology business that is agile, adaptive, creative, responsive, and resilient – yet always flowing – even more relevant. The uncertainty we all face today still calls for a 'StratOps' approach to the continuous implementation of strategic, organizational change.

The mantra of Being Like Water builds on three foundational technology business concepts that manifest themselves through many key trends in 2023, showing how technology and business concepts are merging into one:

- ***Mesh*** - Originating in loosely coupled, lightweight networks of autonomous nodes, 'mesh' has expanded to the world of applications, data, user experience, and even complete business models. Mesh emphasizes the power of decentralization and federated ownership, rather than monolithic command and control.
- ***Edge*** - 'Edge computing' emerged from the Internet of Things. As IT and OT (Operational Technology) fuse, devices are increasingly enchanted with sensors, storage, networking, intelligence, and automation. Innovations appear magically ever closer to the distributed edge – away from the center – where the rubber meets the road.
- ***Augment*** - AI and intelligent automation bring augmentation of humans across the full spectrum of technology. From smart products and services, intelligent applications and killer algorithms, to 'self-driving' business processes and even creativity (as evidenced by the spectacular rise of generative AI such as chatGPT). The scarcity of talent in major business areas desperately needs AI and intelligent automation for powerful, sustainable fixes.

For much more on these concepts, we refer the reader to our TechnoVision Being Like Water 2022 edition, which we believe will remain relevant for years to come.

JOURNEY WITH BENEFITS

Doing well, by doing good. We combined this desire with a plea for a more selective, smart, and frugal approach to innovation and turned it into the key design principle of TechnoVision 2023: *Do Good, Do Less, Do Well*. Doing the right things for society and the company's purposes – enabled by innovative technology – is a journey in itself. But it turns out to be a journey with benefits. As we clean up and modernize our IT infrastructure and applications landscape, get our data skills to the next level, learn how to benefit from intelligent automation, create new ways to collaborate, and provide immersive user experiences, we realize all aspects of our technology business are boosted by doing the right things, including 'mundane' elements such as revenue growth, profit optimization, cost-effectiveness, and overall corporate performance. Now, who could be against that?

Didn't Dave H. Comins once say "People will accept your idea much more readily if you tell them Benjamin Franklin said it first"? Never mind that. We will tap one more time into the almost infinite pool of (attributed or less attributed) quotes from our archetypical polymath: "Look before, or you'll find yourself behind." Sounds about right. *Right the Technology, Write the Future*. Nothing less.

7 QUESTIONS TO ASK

Mastering a Technology Business is not only about understanding trends and their overarching themes. It's about making it work, moving from articulating aspirations to actually righting the technology and writing the future. 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:

1. **Do plans and actions contribute to societal good?**

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

2. **Are business and technology the same?**

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

3. **Do systems and processes change naturally?**

   Move adaptability from afterthought to prime time.

4. **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.

5. **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.

6. **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.

7. **Are all hands-free perspectives considered?**

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

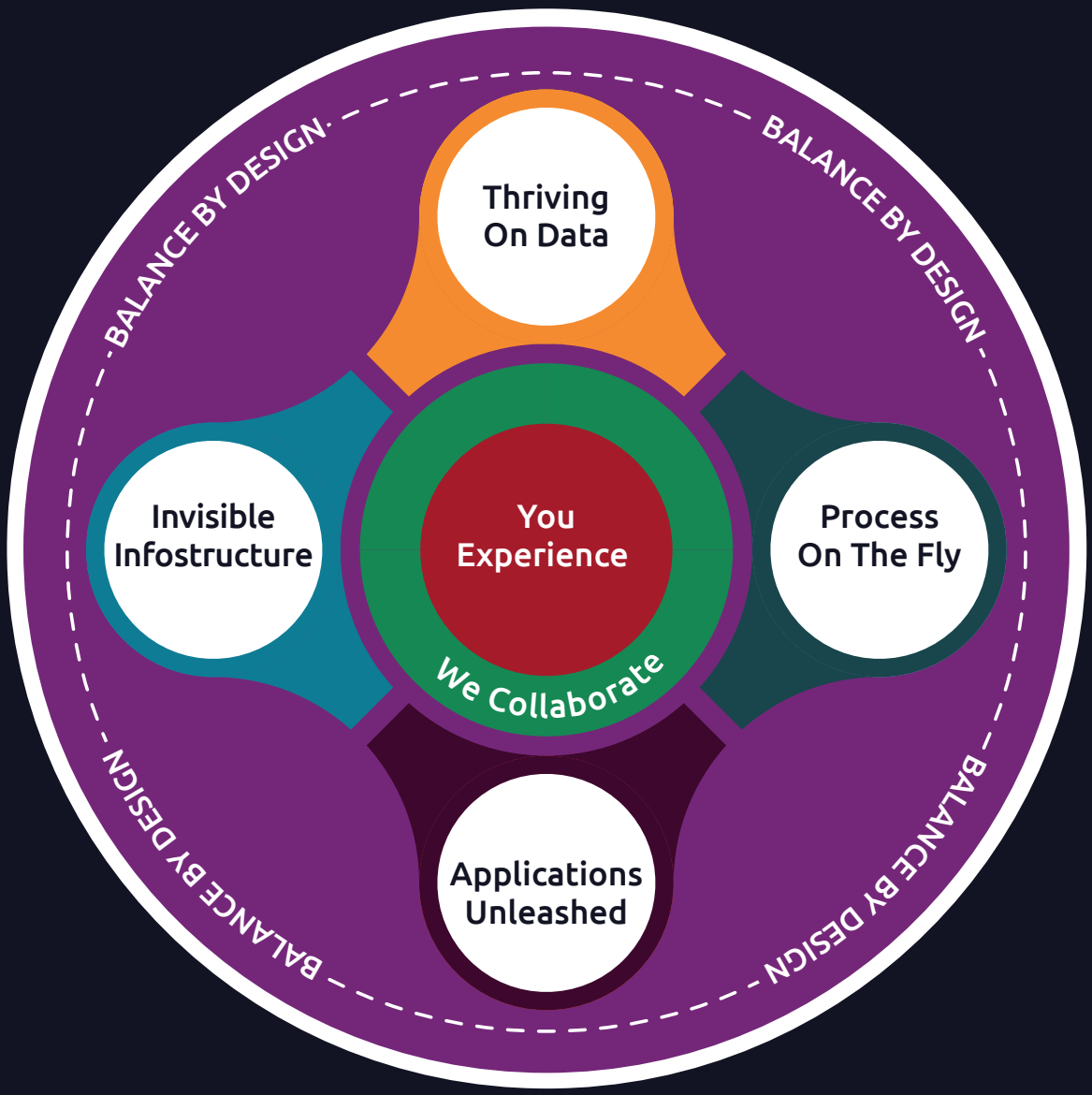
OVERVIEW OF TECHNOVISION

TechnoVision categorizes technology trends into six 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 the trends and create transformational impact (the "how"). These principles help to build a sharp mindset, ready for any portfolio, program, project, architecture, innovation initiative, or idea.

You Experience and We Collaborate are 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. This collection of trends is all wrapped up with Balance by Design, as the overarching container to be considered while working with the others.

Within each container, five key trends are presented as one-page summaries, designed to be crisp and to-the-point, yet appetizing enough to warrant further study. They all feature a 'What' section that describes the trend, a 'Use' section with best practices and use cases, an 'Impact' section that exemplifies the change potential of the trend, and a 'Tech' section that provides links to key technologies and standards. Each trend also mentions an 'Expert in residence' that anyone can connect to if they want to know more about the topic.

Balance by Design – our overarching container – follows a slightly different setup to the other six, offering views of how to shape balance within an organization using seven clear design principles – including 'anti-principles' that are sometimes easier to detect than the principles themselves.


BALANCE BY DESIGN
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Thriving On Data
Invisible Infostructure
You Experience
We Collaborate
Process On The Fly
Applications Unleashed

You Experience: immersive, low-touch, emphatic

The established customer experience now is intwined with employee and partner experiences, achieving common goals of attraction, retention, and engagement. All expect a better experience, with a positive impact on society and the environment. When it comes to providing these superior, compelling experiences, the Metaverse is the place to look at. It shifts retailers and brands from sellers to companions and reshapes the employee's workplace into a new and attractive virtual realm. All of that takes place while meeting sustainability and inclusivity objectives. And what if these experiences extend to industrial and business operations? Enter the Internet of Twins, which is designed to build highly efficient real-world operations in the most sustainable way.

- **Experience²**
- **Me, Myself and My Metaverse**
- **Internet of Twins**
- **No Friction**
- **I Feel for You**

We Collaborate: teamed, distributed, creative

How businesses operate and collaborate has changed irrevocably. Many aspects of value delivery are now entirely independent of location and time. People work together in teams in diverse ways, increasingly at the very edges of what used to be considered the 'core organization'. Consumers and employees expect creative, integrated experiences, which require 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. Future organization structures will thus evolve towards a decentralized mode of operation, demanding fewer physical assets, less energy, less travel, less command and control, maybe even fewer leaders.

- **Fluid Workforce**
- **The Team is the Canvas**
- **Taken by Tokens**
- **Your Mesh for Less**
- **No Leaders**

Thriving on Data: federated, shared and fostered

It is 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 also enables organizations to achieve their sustainability ambitions. It is therefore time to see data for what it is: a first-class product; carefully and sustainably owned, managed, and activated by business domains, while shared in lively exchanges inside and outside the organization.

- **Data Sharing Is Caring**
- **Power to the People**
- **Data Apart Together**
- **Net Ø Data**
- **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 are 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 both human resources and natural resources, plus the drastic need to reduce travel and energy consumption. This is where Process on the Fly comes to the fore and shines ever brighter. Breakthroughs within intelligent automation and a taste of touchless execution have firmly placed 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; the 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 and 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 lightweight, more sustainable microservices. With agility and minimum viable products as established concepts, 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**
- **Apps ❤ AI**
- **Little Green App**

Invisible Infostructure: omnipresent, autonomous, invisible

The odyssey towards a truly invisible IT infrastructure is ongoing. The cloud, a signpost of increasing 'invisibility' is the default choice with a diverse range of deployment options. Plain acceleration has given way to a focus on value extraction, sustainability, industry contextualization, technology debt removal, and security, all while maintaining operational resilience. A software- and- AI-driven, nearly autonomous supply chain is key to that, providing an approach to deal with both the scarcity of skilled experts and excess energy consumption and CO_2 emissions. But IT infrastructure also expands its reach, integrating Operational Technology and 'things' at the edges of central IT, showing that "Infostructure" never was a spelling mistake.

- **Lord of the Clouds**
- **My Industry, My Cloud**
- **Ops, AI did it Again**
- **Simply the Edge**
- **Silence of the Servers**

Balance by Design: overarching, righting, purposeful

The essence of designing a Technology Business is to find and preserve the right balances: between the interests of stakeholders, both short- and long-term, centralized and decentralized, friendly and authoritative, purposeful, and spontaneous, value-delivering and sustainable, innovative and trustworthy, fact-driven, and empathic. Therefore, besides the 'what' of technology trends, TechnoVision offers a view of 'how' to adapt, to help shape balances within the organization – by purposeful design. Exploring technology drivers can be an enticing exercise but applying these principles will determine the actual success of the transformation afterwards. Here, we offer control questions for executives and a bouquet of perspectives for architects, or anybody involved in a Technology Business portfolio, program, project, or initiative.

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

As will be obvious from some of the trends above, our authors have stayed true to the playful nature of TechnoVision by using references to rock, pop, movies, and other cultural and societal phenomena. It turns out this playfulness makes the trends more accessible, more compelling, and easier to remember. Also, as our authors will testify, it's good, clean fun creating these headings. Readers are challenged to find as many of these 'Easter Eggs' as possible.

The TechnoVision 'expert in residence' community caters for a variety of detailed posts and articles about your favorite 37 building blocks. We encourage you to read the accompanying report 'Applying TechnoVision' for various means of using and playing with TechnoVision in a unique and entertaining way. Finally, to dive even deeper into the TechnoVision universe, watch out for the sector-specific playbooks: released throughout the year, they provide numerous sector cases and best practices, positioned within the TechnoVision framework.

YOU EXPERIENCE

ALEXANDRE EMBRY
EXPERT IN RESIDENCE

Last year, we introduced the concept of Experience², in which the established customer experience strategy is intwined with employee and partner experiences, achieving common goals of attraction, retention, and engagement. All audiences expect a better experience, while also contributing positively to society and the environment. So, where do we go next? When it comes to providing seamless experiences that boost loyalty while addressing key environmental and societal challenges, we need to look at the advent of the Metaverse. It shifts retailers and brands from sellers to companions and reshapes the employee's workplace into a new and attractive virtual realm. All of that takes place while also meeting sustainability and inclusivity objectives. And what if these experiences extend to industrial and business operations? Enter the Internet of Twins, which is designed to build highly efficient real-world operations in the most sustainable way.

Frictionless, low-touch AI-driven experiences have in many ways already proven successful in enabling authentic, cohesive, and emotional connections between organizations and customers or employees. Yet, more can be achieved. Organizations are now reflecting on what matters to their audiences in new ways. These audiences want better experiences, but with lower impact, such as a reduction of gas-guzzling travel. If virtual testing of products by the audience is allowed, only specific types and amounts will be manufactured. This targeted approach will reduce waste and the net impact will trigger sustainability benefits, customer acquisition, cost savings, and improved loyalty along the entire value chain.

The Metaverse promises to address these issues in a single shape. Initially, user experiences might get the focus. But when it comes to the improvement of customer loyalty, the backcloth of this trend is a new philosophy: the community-driven approach. This attitude conveys the idea of giving ownership to people that design or customize a brand's products without being part of the organization. The resulting feeling of belonging is a real catalyst for the brand's adherence and self-promotion. Pretty smart approach, right?

And the new user experience strategy does not only address people. The strategy also covers physical assets and 'things', for example in complex industrial, engineering, and urban environments. With the ability to create digital twins of 'any thing', we see the Internet of Things (IoT) evolve into quite a different IoT: the Internet of Twins. By enabling realistic simulated experiences – in addition to all other travel-, asset- and handsfree-benefits of the Metaverse – the Internet of Twins supports the mastery of efficient, secure, and sustainable operations. This evolved IoT will contribute to optimal resource utilization, reducing the need to travel. Advanced simulation models, which cut requirements for physical testing, will make products more sustainable and desirable, with much less environmental impact.

So much more to experience. Maybe we should start talking about Experience^{n}?

YOU EXPERIENCE

Experience²

Me, Myself and My Metaverse

Internet of Twins

No Friction

I Feel for You

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 even more on online interactions, our expectations are evolving rapidly. 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 beliefs are understood and supported. Fail, and their loyalty might be at risk. Employees want to feel a sense of purpose, empowerment, and enablement. Fail, and they might easily change employer. Addressed through an all-encompassing approach that covers disciplines, channels, business units and partners, the net effect is differentiating and competitive. Combine this approach with the latest in no-friction UX technology, and the 'Experience Squared' is manifest.

WHAT

- Customers, employees, and partners are much more aware – and critical – of an organization's positioning on key societal themes (such as sustainability). The brand and the delivered experience must embody those beliefs and purposes.
- Virtual, mobile, and distributed user experiences have become the norm. With the pandemic as a hyper-accelerator of both adoption and acceptance, expectations concerning ease of use, value, and effectiveness continue to rise.
- The customer and employee experience jointly and compositely allow brands to be far more flexible in how they deliver experiences. This shift requires a unified experience strategy that approaches user interaction design holistically.
- Designing an experience across the silos of customers and employee experiences requires a deep understanding of the end-to-end journey, involving the feelings, emotions, and associations that determine signature moments along the way.
- An increasingly diverse mix of UX/UI options will power alternative ways to deliver intent-driven, conversational, and low/no touch interactions…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 (including VR and AR) that will shape the future 'Experience²'.

USE

- **ABFRL,** a fashion retailer, partnered with Algonomy to deploy its hyper-personalized solutions to leverage real-time shopper behavior.
- **Empresas DBS,** a beauty company, integrated Perfect Corp's AI & AR virtual try-on tool (VTO) into its online makeup shopping experience that allows users to digitally try-on select products from their mobile or desktop devices.
- **Holiday Oil Company** installed self-checkout solutions across its network of 67 stores located in Utah, NA.
- **PepsiCo** partnered with Ultraleap to deliver touchless vending using gestures in response to Covid and hygiene sensitivities.
- **Tommy Hilfiger Brazil** generated clout by bringing its brand to the Metaverse and Burberry recently shared some of its experiments at the Leeds Digital Festival; including in-store experiences, product customization, and commerce.

IMPACT

- Increased loyalty – Customers will return for compelling, personalized, and valued experiences that match their interests as they search for purposeful brands, products, and services.
- Maximizing value – Automation and augmentation will support the worker and free their time for higher-value activities, such as customer engagement, field service tasks, etc.
- Maximizing new revenue opportunities – By creating touchless and self-service experiences, from finding and selecting products, checking out, payments, and onto customer service.
- Improved reach and awareness – Attracting and accessing new audiences by harnessing the channel and immersive experience explosion by engaging them in the channels of their choice. This reach will be also possible by providing orchestration across all brand touchpoints.

TECH

- **Customer Experience Management:** Usermind, Highspot, Uxpressia, Invision
- **Real-time journey management tools:** Kitewheel, Alterian, Pointillist, Thunderhead, Usermind; Adobe Journey Optimiser, Salesforce Personalization, Braze
- **Customer platform technologies:** Salesforce Clouds, Adobe Marketing Cloud, SAP CX, Pega, Usermind, Cemantica, Acoustic, Hubspot, Threekit, Genesys, NICE CXOne
- **Virtual and augmented reality:** PTC, Unity, Meta Quest, Hololens, Perfect Corp, Varjo, Nvidia,
- **Customer data technologies:** Tealium, Salesforce C360 / CDP, Microsoft Dynamics 365 CI, Adobe AEP, SAP CDC, Segment, Treasure Data, Bloomreach, Algonomy, Oracle Unity CDP
- **Automation and customer process management:** Microsoft Dynamics 365 & Viva, Salesforce Clouds, Pega, Automation Anywhere, UIPath, ServiceNow
- **Mobile engagement platforms:** Braze, Moengage, Vibes, Airship

ME, MYSELF AND MY METAVERSE

SURABHI GAWDE
EXPERT IN RESIDENCE

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

The Metaverse has moved on from being a buzzword to new experiences, new capabilities and new revenues. 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 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 is not new. It has been imagined in fiction, fantasy, history, sci-fi cultures, art, gaming, and so on, thereby impacting realism.
- Avatars, Non-Fungible Tokens (NFTs), and digital fashion have surged in use, going beyond gaming and powering the Metaverse to create digital assets and trade value.
- Metaverse adds a burst of color to personal choices – the choice of self-expression, ownership, identity, visual appearance, expression, entitlements, digital objects, or assets; it opens a new gateway for unmet needs, unexamined human behaviors, unspoken fears, and layered thoughts, irrespective of gender, socioeconomic background, class, or color.
- Ownership makes every individual a micro-enterprise to exchange value within nano-cultures, and global pop art cultures. Several immersive platforms, applications, AI art tools, and accelerators have been popping up to enable the creator economy.
- Immersive technologies and Wi-Fi/5G connectivity enable businesses to communicate and inspire in new ways, and to provide personalized user experiences.
- The Metaverse is still developing. Approaches for data privacy, content moderation, and ethical and regulatory policies – using it for good, positive futures – are to be considered, determined, and socialized.

USE

- Just do it in the Metaverse. With $185 million in NFT revenues and 21 million visitors at Nikeland, a virtual store on Roblox, **Nike** has one of the most exemplary Metaverse strategies, stitching together RTFKT, branding, and continuous customer engagement.
- **Tommy Hilfiger** walked into New York's Fashion Week 2022 with a new logo, a strategic 'reinventing-market' focus on Metaverse ambitions. Its athleisure pieces were available as avatars with an interoperable Ready Player Me platform.
- **Time magazine's** NFTs called TIMEpieces offer access to content and invitations to exclusive online and offline events. Their August 2022 cover page depicted a digital NFT character of a black kid, 'Aku', asking 'Can astronauts be black?'
- New digital fashion designers, such as Placebo Digital Fashion House, have non-binary avatars for inclusion in the Metaverse. 'We are ageless, we are sizeless, we are genderless' – exhorts the MetaGenesis collection inspired by Yuval Harari. And it is created from only 1.5 meters of fabric without water.
- **AB InBev,** the world's largest beer brewery, moved into an Ethereum-based game for horse-racing platform Zed Run, with virtual experiences and real beer gifts for friends. This shift is the Metaverse-based extension of the horse-focused associations of its brands: Stella Artois with Ascot racecourses and Budweiser's campaigns with Clydedales horses.

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 available globally without the need for experts to travel to (or from) any given location.
- 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.
- Community-driven values, interests, and goals can bring people and experts together online – they can experience and participate in real time, without having to travel.
- Brands can listen to communities quicker, understand their choices in real time, and be more inclusive. As the Metaverse is shaping our interactions, fashion trends, bolder choices, new behaviors, and products, in turn it leads to new use cases and additional creations.

TECH

- **NFT-based Metaverse platforms:** Decentraland, The Sandbox, Axie Infinity, Sensorium, Somnium Space, Cryptovoxels, Sorare, Ethverse, Unity, Upland, Illuvium, Spatial
- **Virtual collaborative platforms:** Facebook Horizon, Microsoft Mesh, AltspaceVR, Mozilla Hubs, NVIDIA Omniverse, Second Life, VRChat, Glue, Party.Space, Yulio, Arthur
- **Avatars:** ReadyPlayerMe, Soul Machines Digital DNA platform, Microsoft Rocketbox, Wolf3D, Avatarsdk
- **AI art tools:** Midjourney, DALL-E 2, Stable Diffusion, Deep Dream Generator
- **VR trade fairs and conferences:** Virbela, HexaFair, vFairs, Hopin, MootUP, EventX, 6Connex, GTR
- **Virtual gaming platforms (non Web3 metaverse):** Roblox, Fortnite, Minecraft

INTERNET OF TWINS

JACQUES BACRY
EXPERT IN RESIDENCE

Digital twins – virtual representations of real-world entities and processes – deliver better mastery of real-world challenges, with less strain on resources and energy

Definitely no evil twins involved here: the objective of the digital twin is to create the most realistic representation of real-world entities and operations – one that is as close to the real experience as possible. It enables different simulations of different kinds of objects that communicate together, such as cars interacting in traffic, a factory with a range of equipment, or a train with a network of signals. These levels of experience require the interconnection of digital twins with the right supporting protocols, which turns the Internet of Things (IoT) into an Internet of Twins. This twin network will be key to reducing the complexity of operational challenges, easily exploring and testing alternatives, and converging virtual and real-world experiences. All while consuming fewer resources and less physical space.

WHAT

- The Internet of Twins will increase collaboration between digital twins, so they can capture the most realistic experiences and master the complexity of operations they represent through a global network.
- There are several levels of digital twins, which are related to different industries. The combination of virtual and real-world experiences in digital twins allows individuals to take better decisions quicker because they can observe realistic and holistic patterns from experiences directly.
- The translation of experiences into a digital twin is one of the main obstacles that needs to be overcome to maximize the use of resources and the optimization of automation.
- The IoT is not a new marketplace or a new way to manage sites on the internet. The IoT must be seen as a fresh approach that can enable the sharing of capitalized experiences dynamically during their lifecycles. Using the IoT in this way will also allow us all to discover new experiences.
- Moreover, twining capability is not just reserved for physical objects but could also be extended to the collaborative processes that simulate collaborative practices in the Metaverse.

USE

- **KLM Royal Dutch Airlines** adopted Matterport Digital Twins to improve operating efficiencies. The company used the technology to train ground crews and provide an immersive virtual experience to customers.
- **Hamad International Airport (HIA)** launched an innovative digital twin initiative as a part of its smart airport program. The development combines 3D-modeling techniques, data analytics, and AI to enable improved, faster, and data-driven decision-making.
- **SSE Renewables and Microsoft** used digital twins to monitor changes in the atmosphere, reefs, marine, and bird life around wind farms.
- **Australian Antarctic Division** is planning to develop a digital twin of Antarctica. This twin will support its scientific and geopolitical interests in the Southern Ocean, amid increasing competition in the region.
- **Airbus Industrial** digital twin is an enhanced approach that models the complete industrial system of the factory.

IMPACT

- We are at the beginning of the story. The impact of digital twins will grow step by step, but dramatically. Some actors have started to position themselves as digital twin manufacturers and have forecast that this area could represent as much as 25% of their revenues during the next five years.
- This 'alternative IOT' will also combine several kinds of simulations from discreet industries and process industries. This advancement will have a huge impact on sustainability (thanks to simulation), with better predictions at scale that help to ensure resource consumption is always minimized during production.
- Impact will not be confined to an individual organization. With new levels of realistic collaboration, all members of an industrial ecosystem will leverage their virtual interactions, reinventing how they create and share the value they receive. However, this value-creating process will be possible only if people can adopt those new experiences effectively, both socially and cognitively.
- One of the main benefits of a digital twin is being able to test the scope and variability of an object in a short period of time. This mechanism sponsors a drastic decrease in the consumption of resources. Digital twins will allow industrial partners to research alternative approaches in a cost-effective manner.

TECH

- **Digital Twin platforms (generic):** Matterport, Microsoft Azure, AWS, IBM Digital Twin Exchange, Siemens, Bosch, Oracle, Dassault Systems, ANSYS, PTC, COSMO TEC
- **Utilizing Digital Twin technology to optimize city traffic:** MGrant to Support Research at the COSMOS Testbed
- **DNA-Based Digital Twin:** Predictiv

NO FRICTION

ANDREAS SJÖSTRÖM
EXPERT IN RESIDENCE

The Experience Economy becomes real, enabling businesses to provide genuinely 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 are relentlessly focused on the customer and employee, no questions asked.

WHAT

- According to Capgemini's research into customer experience for Financial Services, 78% of consumers expect to use more touchless interactions through voice assistants, facial recognition, or apps.
- Using AI and intelligent process automation, actions can be executed in real time without latency or unnecessary friction points. User engagement requires much less human intervention, becoming autonomous and 'hands-free'.
- 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 combines 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 meet customer expectations quickly, **TAB Bank** created an open-banking platform to streamline lending processes. By using MuleSoft's Anypoint Platform, the bank enabled loan processing for SMEs that was 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 retail chain **Żabka** launched its autonomous NanoStore, which uses AiFi's AI platform to create a checkout-free and convenient shopping experience for customers.
- **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, which offer timely personalized suggestions and updates, further driving customer acquisition, retention, and brand loyalty.
- Haptics and sensory technologies help implement touchless interfaces – a post-pandemic prerequisite – but which also help 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, 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, Matroid
- **Web3:** Circle, Alchemy, Polygon, Bitwave

I FEEL FOR YOU

KRYSTIANNE AVEDIAN (SHE/HER)
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

'New scarcity' has driven us into the hands of technology. Even though technology hasn't surpassed humans in intelligence, it is striding closer and closer. 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 experiences 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 technology has come a long way, even if it's 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. Now, it's more than a feeling. Technology, I think I love you.

WHAT

- Empathy and emotional intelligence work together, enabled by caring, to produce long-lasting relationships. Together, they form the foundation of trust.
- Now more than ever – as businesses redefine their ways of working, technology set-up, and organization 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. CX and PX are the new top priorities across all organizations today. The focus is on the collective capacity of an organization to demonstrate empathy to all stakeholders, as well as a commitment to develop an understanding of customer needs.
- Emotion AI offers new insights to understand people and customers. Industries are finding ways and identifying areas to integrate emotional intelligence, such as chatbots, virtual assistants, and facial recognition.
- However, Emotion AI requires transparency. For Emotion AI to work and not have the opposite effect, it is crucial to communicate digital ethics and be transparent about what data is collected, for what purpose, with what access rights, and how long it will be stored.

USE

- **Microsoft** filed a patent for AI technology, which focuses on giving Xbox games the ability to collect audio streams from voice chat and analyze a player's emotions to help identify potential issues in people with heightened emotions.
- **Armenia** launched Robin the Robot to comfort kids at US clinics during the pandemic.
- Indian online-tutoring platform **Vedantu** leveraged an Emotion AI solution to optimize its educational content. The system relied on eye-tracking and facial-coding algorithms to map user journeys and analyze emotional triggers to generate metrics on engagement, attention, and fatigue for students and tutors.
- **Startup Find Solution,** based in Hong Kong, launched 4 Little Trees software, which uses Emotion AI in schools to identify the emotions of students, targeting knowledge gaps and offering game-style tests designed to make learning fun.
- **Hyundai Motor** unveiled a mini EV, which is 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 well-being 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 and telesales employees. AI analyzes the quality, tone, and pace of the individual, and trains them to speak with more empathy, confidence, professionalism, and efficiency where needed.
- AI-based approaches can easily detect human expressionism, 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.
- Ion recognition technology is being used widely 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 analyzers:** Watson Tone Analyzer, Emoshape, Cognito, Amazon Connect, Modulate-ToxMod

WE COLLABORATE

SUDHIR PAI
EXPERT IN RESIDENCE

Collaboration has always been a place of magic. But it sure starts to look different when it's accelerated by breakthroughs in technology. Working together is now de facto, independent of location and time. This technology-enabled collaboration is reimagining the future of the workforce. Take the example of career fairs in the Metaverse, which demonstrate how organizations can source talent for hybrid ways of working. Hybrid now defines the professional workplace, where people collaborate in various ways and with various means, increasingly at the very edges of what used to be the 'core organization'. This disparate form of teamwork aims to get the best results from an increasingly scarce workforce, requiring a new level of cross-organization and cross-sector partnering. Here, collaboration moves from an afterthought to being fully ingrained in new business models – by design. Future organization structures will evolve towards a decentralized mode of operation, demanding fewer physical assets, less energy, less travel, less command and control, maybe even fewer leaders. Indeed, a kind of magic.

As the world is emerging from the other side of the pandemic, it is becoming increasingly clear why moving forward with hybrid ways of working goes a long way to meeting not just business but also sustainability goals. Organizations have shown the tenacity to deliver results while facing what seemed like unsurmountable odds, working from anywhere, with limited means. 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 – and collaborative style of working is breaking barriers of geography and time zones.

It's redefining what we call "just another day at the office".

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 competitors. It's also by far the best way to achieve joint targets for sustainability and areas of social good: rethinking the way resources are consumed and produced, with resiliency and sustainability taking the front seat. What becomes paramount is needs-based production, combined with effective business and technology operation models, designed to consume less across the enterprise lifecycle.

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.

Future organizational structures will take the best of decentralized organizations and traditional ones. While traditional institutions might be hesitant at the prospect of decentralization, forward-looking firms will look at decentralized use cases through a centralized lens to enable the transformation journey. This blended approach will allow organizations to focus on the business at hand, while leveraging the best technologies – a true marriage of business and technology.

WE COLLABORATE

Fluid Workforce

The Team
is the Canvas

Taken by Tokens

Your Mesh for Less

No Leaders

FLUID WORKFORCE

ABHIJITH REMANAN
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

- 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 are now customizing hybrid work models, with clear demarcation of the extent of remote work allowed for employees based on their roles and responsibilities.
- 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. This culture connects digital communities, activates purpose, and creates 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, and encouraging autonomy and transparency. Data-driven collaboration platforms enable workers to achieve results in new, agile ways.

USE

- In collaboration with **WorkJam**, a digital workspace platform, Priceline Pharmacy, Australia developed a program to improve collaboration between franchise partners, corporate stakeholders, and employees. The platform, expected to be used by more than 5,500 employees across Priceline's 470 stores nationwide, will be enabled by WorkJam's tailored Learning and Assessment, Rewards and Recognition, Task Management, and Communication tools and functions.
- **Turing** is an international hiring platform that brings together remote software developers to work for small and large companies. The Palo Alto-based company is well-positioned to cater to a distributed workforce by vetting and hiring software developers who can work from anywhere.
- **Nasdaq** employed Culture Amp to establish an 'employee listening strategy'. The company ran an in-depth Retention Analysis using data from past 360-degree reviews, engagement, exit, and pulse surveys to curb attrition rates by re-aligning the roles of managers within the organization.
- **Asda,** the supermarket chain from the UK, has chosen Workday to simultaneously develop a unified view of its workforce and personalized experiences for its employees. Staff will be able to use a single system to track and manage their time off, grow and develop skills using tailor-made content, and serve customers better by leveraging data-driven insights.
- **Virtus Health,** Australia's largest assisted reproductive services provider, will leverage the single data architecture offered by Dayforce, a platform from Ceridian, to bring together existing silos within the organization – HR, payroll, workforce, talent management, etc. – to deliver a full cloud HCM experience.

IMPACT

- Our Fluid Workforce research show benefits such as improved time to market and agility, better alignment of talent with the business imperatives, enhanced customer satisfaction, and improved brand perception and sales.
- The research also highlights how 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 getting work done.
- The potential for flexibility in work location creates an opportunity for organizations to attract more external talent while reducing office space, saving costs and cutting travel requirements.
- However, rising stress levels are a factor to be considered within hybrid working and need to be managed proactively. More than half of employees refer to higher stress levels and are concerned about their networks shrinking due to remote working. Choosing 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, Dayforce HCM, Infor Workforce Management (WFM), Blue Yonder Workforce Management, Oracle Fusion Cloud HCM, WorkAxle, Reflexis ONE, UKG Dimensions, UKG Ready
- **Digital workplace solutions:** Microsoft: Microsoft Office 365, G Suite, WorkJam Digital Workplace
- **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

GERT HELSEN
EXPERT IN RESIDENCE

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

We are all social animals. We work best when we connect. Now that working online is the accepted standard, we are shaping the canvas on which we work to ensure that it optimizes our individual and team requirements. Modern collaboration platforms provide the means to create a new canvas that is virtual, distributed, and asynchronous at times. This canvas 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, enabling smooth collaboration across a global ecosystem of partners and clients, far beyond the boundaries of a single organization.
- Collaboration platforms can be customized and extended easily, with a range of third-party modules, low-code tools, and process automation tools to increase the productivity of teams.
- Supported by AI, mini-surveys, and online, on-demand learning environments, these platforms can be used to improve a team's skillset on a continuous, often just-in-time process as the team progresses towards achieving its objectives and key results.
- Hybrid meeting rooms are equipped with plug-and-play technologies that can be used to connect an audience seamlessly, whether individuals are in the office or joining remotely. The Metaverse will take this connectivity to the next level.
- Our research, "The Future of Work: From remote to hybrid", illustrates how hybrid work has also created new types of challenges around workplace culture that company leaders will have to address.

USE

- **Barclays Bank PLC** adopted Microsoft Teams as its preferred collaboration tool for over 120,000 colleagues and partners around the globe. Doing so allowed Barclays to simplify and harmonize its communication and collaboration landscape.
- **Paragon Law,** a UK-based law firm, introduced both GoTo Connect and GoTo Meeting to engage with clients and colleagues easily and securely from any location, using any device.
- **Munich Re** leveraged Miro for its design-thinking activities. Miro, with its extended set of collaboration features, proved to be the right tool for facilitating brainstorming within small and bigger groups.
- **John Wallis Academy**, a UK-based school, chose Avaya OneCloud UCaaS to connect the entire school across disparate locations and to put in place a coordinated digital environment.
- **Black & Veatch**, a US-based engineering and construction company, collaborated strategically with Avatour to increase the engagement between on-site and remote professionals. This hybrid approach had a positive impact by breaking down traditional meeting barriers, reducing risk, and improving projects.

IMPACT

- Modern collaboration platforms allow teams to shape their workplaces according to their preferences, leading to more team autonomy and motivation, increased productivity, and better retention of scarce human resources.
- With less dependence on being together in a physical setting – but still being able to produce excellent results – there is less need for fixed office space and travel, which ultimately helps organizations meet corporate sustainability goals.
- Where collaboration platforms and augmented reality provide the means to bring people closer, leaders have a key role to play in safeguarding the culture of the workplace and creating opportunities for teams to connect outside their day-to-day context.
- Remote work presents an opportunity for different cultures and ecosystems to come closer together, which boosts the diversity of teams and increases cross-organizational collaboration.

TECH

- **Collaboration platforms:** Humanity Platform, Microsoft Teams, Microsoft Viva, Avaya OneCloud, Slack, Google WorkSpace, Asana, Trello
- **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, Google Jamboard
- **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 they're being used in currency or real estate, digital music, the Metaverse, or even World Wide Web source code, tokens bring a 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 medium using distributed ledger technology. A token is a digital asset, stored securely on the blockchain.
- Tokens are mostly associated with cryptocurrencies, such as Bitcoin or Ether tokens. However, they can relate to anything, from votes to licenses and onto carbon credits and access rights, and even the ownership of a song or digital assets in the Metaverse.
- There are broadly three categories of tokens: payment tokens serve the function of money (digital currency, cryptocurrency, etc.); 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

- **More than 100 central banks** around the world are exploring central bank digital currencies (CBDCs) for wholesale, retail, and cross-border use cases. CBDCs offer 24/7 availability (offline payments), programmability (smart contracts and automated payments), instant finality (real-time settlements), and interoperability.
- **SWIFT**, in collaboration with Capgemini, successfully demonstrated interoperability between multiple CBDC networks as well as fiat-to-CBDC interlink, making cross-border payments more seamless and frictionless through a single gateway.
- Digital asset custody is becoming mainstream among private and institutional investors with large banks, such as **Société Générale**, **BNY Mellon**, and **Citi**, all forming strategic partnerships to offer custody services.
- Tokenization of carbon credits is finding accelerated adoption amid raising concerns around sustainability and climate change. Large institutions such as the **World Bank** use tokenization as a trusted and transparent means of registering carbon credits.
- **Non-Fungible Tokens (NFTs)** are poised to have an increased utility with the accelerated adoption of the Metaverse, in addition to finding unique value in the art, music, gaming, and ticketing industries.

IMPACT

- Tokenization and Web3 ('mesh web') technologies will play a pivotal role in shaping the future of regulated markets by helping to bridge the gap between traditional models and decentralized modes of operations.
- 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).
- Tokenization has fueled an innovative and currently 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 challenges need to be addressed to unleash the token economy in a true sense.

TECH

- **Technologies:** Ethereum, Hyperledger Fabric, Algorand, ConsenSys Quorum, Solana, Cardano, Circle, Ripple, Contour Blockchain
- **Digital Asset Custody and Wallets:** Metaco, Fireblocks, HexTrust, Settlemint, MetaMask, Tokeny, Anchorage, Komainu
- **Securitization:** ConsenSys Codefi, Polymath, Securitize, Polygon, Progmat
- **NFTs:** OpenSea, Rarible, Larva Labs CryptoPunks, Decentraland, Sandbox, Unity, Centrifuge

YOUR MESH FOR LESS

NEHA PUNATER
EXPERT IN RESIDENCE

Enabled by efficient 'mesh' technology, it's easier than ever for organizations to join forces, even if it is lightweight, 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, it is easier and more efficient than ever to collaborate with others – even if they come from unexpected sides. 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 also addresses challenges around sustainability and scarcity of resources. Exactly the rumble organizations are looking for.

WHAT

- 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 might 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.
- The design phase needs to address the resource footprint of products and services. Mesh-style collaboration is key to increasing the product lifecycle, and its reusability, while reducing consumed energy and resources throughout that lifecycle.
- Developing innovations through cross-industry partnerships must involve coordinated data collaboration. Organizations must establish certain structures and processes to facilitate and operationalize learning across industry boundaries and create support systems within the organization.

USE

- **Mercedes-Benz** and Microsoft collaborated to boost efficiency, resilience, and sustainability in car production. Mercedes-Benz introduced the MO360 Data Platform, connecting passenger car plants to Microsoft Cloud, which will help in the dynamic allocation of resources to prioritize meeting low-emission targets and to allow logistics teams to solve supply chain bottlenecks faster. Production teams can access the self-service portal, with a Microsoft Power BI dashboard, from any device. Vehicle production efficiency is expected to improve by 20% through 2025 via this collaboration.
- **The Tropical Landscapes Finance Facility** (TLFF) was established by the UNEP, The World Agroforestry Centre, BNP Paribas, and ADM Capital to raise funds for long-term sustainability initiatives and to promote green growth and sustainable rural lifestyles across Indonesia's 17,000 islands. TLFF's inaugural transaction is a US $95 million Sustainability Bond arranged by BNP Paribas and issued by TLFF to help finance a sustainable and natural rubber plantation on a heavily degraded land.
- Intelligent identity provider Ping Identity partnered with **Flinks**, a Canada-based open-banking platform, which made it possible for millions of customers in the US and Canada to link their financial accounts to FinTech apps using open-banking API technology and to take advantage of new, streamlined banking experiences securely and legally.
- To boost productivity, reduce costs and energy use, and lower emissions and carbon footprint in its operations, **MG Motor India** has partnered with Siemens. The software will create a 15% improvement in the future pre-treatment and electrocoating paint process due to its ability to integrate plant assets and processes and deliver insights into more efficient paint processes.
- **The Snowflake Healthcare** and Life Sciences Data Cloud now offer customers a smooth integration and out-of-the-box experience, thanks to the technology company's partnership with Sigma Computing. To safely centralize, integrate, and share sensitive and critical data at scale, the Data Cloud provides healthcare companies with a unified, integrated, and cross-cloud data platform that breaks down technical and institutional data silos.

IMPACT

- Increased scale – Successful partnerships leverage combined resources to reach more people and amplify impact and results. They can also help companies develop relationships in new markets.
- Reduced costs and better efficiency – Shared resources and sustainable consumption and production practices can help organizations reduce their operating and product development costs. Dedicated tools and data platforms make it easier for organizations to gain cross-sector collaboration capabilities much more quickly.
- Collective Impact – Collaboration for systems change can help to align diverse stakeholders to achieve a collective impact and share outcomes while dealing with their objectives.
- Simplified data-sharing practices – The relevant data, which is stored in different formats and types, can be accessed and shared by all partners easily.
- Improved customer experiences – Through the creation of a unified, end-to-end user experience that ties together all players in the product/service delivery lifecycle.
- Replicability and sustainability – Committed private sector partnerships can transform an otherwise time-bound development investment into a long-term, market-driven, scalable initiative.

TECH

- **Data sharing:** Automation, AWS Data Exchange, Snowflake
- **Blockchain and API:** Blockchain, APIfication, Hyperledger, Ethereum, IBM Blockchain
- **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, MindSphere, OpenAI, TensorFlow

NO LEADERS

SURABHI GAWDE
EXPERT IN RESIDENCE

Leveraging autonomous, decentralized, token-enabled platforms to achieve joint objectives – but without the typical red tape of corporate leadership

Follow the leader? Well, not so fast. What if trust and funding, the essential foundations to set up any organization, are coded in smart contracts and are publicly verifiable? Enter the world of tamper-proof global entities called DAOs (decentralized autonomous organizations). Distribution of power in these DAOs is collective and 'heterarchical': cooperation without subordination – without the overhead of central leadership – solely focusing on value creation and achieving joint purposes. DAOs lead to unique, lightweight yet robust governance models, with a group of committed contributors, driven by common values. Now, that surely is a concept that – excusez le mot – leads the way.

WHAT

- Squads and tribes have existed over thousands of years – from the paleolithic era until now. Networks have also existed over time. DAOs resemble the cooperatives and the guilds of massively multiplayer online games (MMOs), with more equitable organizational economics powered by the token culture.
- A DAO is a collectively owned, blockchain-governed, transparent organization that is working towards a shared mission across various fields with a focus on investments, grants, protocols, services, art, media, music, developer communities, education gaming, and social impact.
- It is entirely up to the token holders to decide upon the proposals generated by community members. Smart contracts lay the foundational rules and execute the agreed-upon decisions relating to the future operations of the projects, such as technical upgrades or treasury allocations. Some DAOs suffer from abandoned proposals, power concentrations, or tokens not giving back to the contributors.
- Different DAO membership models exist, including token-based membership for governance and share-based membership for charities, collectives, and investment clubs. Reputation-based membership is designed for participation to be the only way to accrue reputation, not influence, power, or connections. There is no special centralized authority, such as a CEO or CFO, to modify the rules of a DAO.
- There are more than 860 DAOs at the time of writing and over 350 DAO tools for treasury management, access control, onboarding, talent hunt, and management and overall governance, with a focus on investments, grants, protocols, services, art, media, music, developer communities, education, gaming, and social impact.

USE

- **MakerDAO** is a decentralized governance community that oversees the decentralized stablecoin, DAI. Banks such as Société Générale and Huntingdown Valley Bank have partnered with MakerDAO to explore new business streams. MakerDAO has invested $500m in US treasuries and bonds to diversify its portfolio.
- **CityDAO** is building a network of assets on a chain, starting with a single parcel of land in Wyoming, US. Each parcel of land is an NFT that can be owned collectively. It gives people 'citizen's' rights to vote on policy changes, regulations, and the law, and these citizenships have tiers with different privileges.
- **LinksDAO** is on a mission to create the modern golf and leisure club – and to reimagine the country club. The LinksDAO NFT acts as a member's card for the DAO and grants members-only perks, including governance rights, access to the community Discord, physical events, and the right to purchase a membership at the first physical club that LinksDAO acquires.
- **Nexus Mutual** is the first decentralized mutual insurance incorporated as a cooperative and driven by a DAO. It offers smart-contract cover against potential bugs in code, DAO hacks, or parity multi-sig wallet issues. Premium management and claims-processing handling are decided by community members.

IMPACT

- DAOs are more democratic with one token, one vote, as compared to cooperatives that are typically one member, one vote; allowing DAO members with a greater financial stake to have proportionally greater influence.
- DAOs might herald a new era in organizational economics, transforming the global corporate landscape from hierarchical organizations to democratic and distributed organizations powered by entrepreneurship and innovations.
- Tokens with governance rights can be sold on secondary markets, unlike the shares of cooperatives. However, DAOs can learn from cooperatives' emphasis on long-term, limited transferability, or other experimental mechanisms.
- DAOs offer a route to greater transparency, trust, adaptability, and speed. Rapid experimentation and the potential to direct activity towards a multiplicity of goals with sub-DAOs and structures for streamlining are also possible.
- However, some degree of centralization is required. DAOs currently deal with issues of governance, voter engagement, power concentration, cybersecurity, and more. They also face regulatory fragmentation and uncertainties.

TECH

There are various DAO tools for DAO development, governance, treasury management, compensation, onboarding, project management, security, analytics, access control, and so on:

- **DAO development:** Squads, Tribute Labs, Tribute DAO, Superdao, Radicle, Aviyel
- **Governance:** Aragon, Colony, SubDAO, DaoKit, Myco, TributeDAO, Paladin
- **Skills and recruitment:** Talent, DAOvelopers, Meritverse, Rabbithole
- **Project Management:** Dework, HackMD, Clarity, Wonder, CharmVerse
- **Compensation:** Fuse, Roketo, Suberra, RollFi, WorkDAO, SnowConeDAO, Rabbithole
- **Access Control:** MintGate, Guild.xyz, Cabin, Unlock, Grape Protocol
- **Analytics:** Uniwhales, Deep DAO

THRIVING ON DATA

ROBERT ENGELS
EXPERT IN RESIDENCE

It is 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, creative machines and smart, self-optimizing products and services. Data provides resilience, predictability, and effectiveness, but also enables organizations to achieve their sustainability and societal good ambitions. Data powers creative machines to help increasingly scarce human resources to co-create the best, most satisfying results with high efficiency.

It is certainly advantageous to be a data-powered enterprise. In our Data-powered Enterprise report and follow-up research, we conclude 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.

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, and assuring data quality. But activating data at the heart of the business strategy, having people in the operations embrace, trust, and use data for all their business and purposes, is a different ball game.

Data mastery 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. This approach gets more value out of data, but also drives achievements in key sustainability and societal goals.

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

Self-service 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.

All businesses need clarity on their CO_2 emissions and the impact of their sustainability actions. As our recent Data for Net-Zero research shows, data is key to delivering on net-zero ambitions. This trend exemplifies the need for organizations to become a data master, getting essential data foundations and behaviors in place. But data itself needs to be sustainable too, as data-related activities themselves may lead to excess energy consumption and CO_2 emission, adding to a growing heap of E-waste and data waste. 'Big data?' Maybe not such a huge thing anymore.

Then, as the pièce de résistance, AI systems rapidly increase their ability to create and generate text, video, audio, art, test data, and program code. What was state-of-the-art only a few weeks ago is already overtaken by the next AI even before you know it. And this pace of innovation is not expected to slow down soon. These systems facilitate humans in their most creative tasks and endeavors by proposing and co-creating content while speeding up processes by taking over up to 80% of the work, leaving only the performing of a final check and adding dazzling shine to the process! And these efficiency-boosting generative machines rapidly become even more relevant, as we face a growing scarcity of skilled people in most business activities.

THRIVING ON DATA

Data Sharing Is Caring

Power to the People

Data Apart Together

Net Ø Data

Creative Machine

DATA SHARING IS CARING

ANNE-LAURE THIBAUD (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 enable 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. And it is key to achieving industry-wide objectives, in terms of sustainability and doing good for society. So, press that forward button: share the message!

WHAT

- Collaborative data ecosystems that have different organizations sharing data under 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 the most ambitions.
- Collaborative data ecosystems can take many different forms: examples include data brokerages providing aggregate data to their clients, reciprocal data-sharing processes among supply chain partners, and sharing of insights across sector boundaries.
- 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. These capabilities are supported by data-sharing platforms, data collaboration platforms, data exchanges, differential privacy, and federated learning.

USE

- **Fugro** partnered with European Marine Observation and Data Network (EMODnet), expanding private sector collaboration and marine data sharing in support of a sustainable blue economy.
- **Rhino Health** launched Federated Learning for a medicine consortium named FL for Medicine along with seven global healthcare institutions, enabling healthcare AI development on distributed patient data securely.
- **Ford** joined Catena-X Automotive Network to improve sustainability across the automotive supply chain through continuous data exchange and the Responsible Supply Chain initiative, which provides tools to achieve a sustainable supply chain.
- **Salesforce** partnered with JetBlue to leverage travel data and technology to help bring air travel into a Net-Zero future. JetBlue will use Net-Zero Cloud to make travel emissions data available to the airline's Sustainable Travel Partners.
- **Ericsson** partnered with Uppsala University in Sweden to research air quality prediction using Machine Learning (ML) and Federated learning (FL).

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 during the past three years.
- The research also shows that organizations that use 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, public and citizen services, 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, Siemens Design Data Exchange, Narrative, Harbr Enterprise Data Exchange, Data Interchange, Safe Software, Informatica Data Exchange
- **Data-sharing platforms:** Amazon Redshift Data Sharing, Microsoft Azure Data Share, Snowflake Data Sharing, Databricks Delta Sharing, Google Analytics Hub, IBM Aspera on Cloud, Oracle Blockchain Platform Cloud, Adlink Data Sharing Platforms, Quantiphi Enterprise Data Sharing Platform, Datalink, eightwire
- **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, Oracle Enterprise Data Management, Hex
- **Federated learning:** IBM Federated Learning, TensorFlow Federated (TFF), Xaynet Federated Learning, Owkin for Life Science, OpenMined Private AI, NVIDIA Clara, Microsoft FLUTE, Intellegens Ichnite, FedML
- **Differential privacy and cryptography:** Microsoft Differential Privacy, LeapYear, Cosmian

POWER TO THE PEOPLE

PADMASHREE SHAGRITHAYA
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 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. Self-service 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 it will also increase central productivity.
- Self-service tools increasingly offer natural language and other low code/no code automated and augmented ways to access data and turn it into intelligence, analytics, and even AI – making the access of data into a 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 frontend, 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

- **Cardinal Health** leveraged Google BigQuery and AtScale's Semantic Layer to access data using business intelligence tools to drive advances in healthcare through self-service data analytics.
- **Dams Safety NSW (DSNSW)**, a NSW Government agency, partnered with Microsoft and Datacom to enhance its auditing, compliance, and water-management processes by migrating Microsoft SharePoint workflows to Microsoft's Power Platform.
- **Zurich, the international insurance company**, partnered with low-code platform Mendix to simplify the workflow for more than 700 underwriters by replacing critical legacy application with the new Terrorism Data Capture solution.
- **Ford** adopted the citizen development solution using Pegasystems' low code/no code platform to streamline its onboarding and offboarding process.
- HDFC, an India-based bank, partnered with **Mulesoft** for its innovative API-led integration approach coupled with low code integration capabilities to connect the bank's backend and frontend systems.

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, which 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, business outcomes and breakthrough innovations.

TECH

- **Data marketplaces:** AWS, Snowflake, DAWEX, 890 by Capgemini, Oracle Data Marketplace, Reply.io
- **Self-service BI and analytics:** AWS QuickSight, Tableau, Microsoft Power BI, Qlik, SAS Visual Analytics, Dataiku, Saagie, Google, TIBCO, 890 by Capgemini, Google Analytics, Salesforce Einstein Analytics, SAP Analytics Cloud, Sisense
- **AutoML:** DataRobot, Google, H2O.ai, Microsoft, AutoKeras, Databricks, Feedzai, Kortical, Oracle, TransmogrifAI, IBM, AWS, JADBio AutoML, BigML
- **MLOps:** Dataiku, Amazon Sagemaker, Azure Synapse, 890 by Capgemini, H2O MLOps, Neptune.ai, MLflow

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 to take data on? Emerging concepts such as 'Data Mesh' move the ownership of data to the business domains themselves, where data is best activated. It stimulates these domains to manage data as a first-class product and share it 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 are emerging that push business domains to truly own and manage their data and its uses, and actively collaborate with internal and external partners.
- Data Mesh is a leading approach, building on the notion of loosely coupled mesh networks, which shift the ownership of data to the business domains that typically have the best subject matter expertise and are closest to the sources of data.
- Data Mesh also propagates domain management of data as a first-class product, not only providing trusted data and freshness but also making data products available to internal and external consumers through a compelling, self-service data productization 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, and data lineage – as well as microservices, APIs, automated data pipelines and stream processing at operational speed, and data virtualization and query federation for easy access.

USE

- Google Cloud collaborated with **H&M Group to develop an enterprise data** backbone that includes the establishment of a new data mesh to make all types of data and events accessible from multiple sources.
- **BT** is adopting a data mesh approach to deliver commercial services while maintaining good governance, since use cases for data storage and analysis are moving closer to the network edge.
- **Warner Bros**. partnered with Alation and Snowflake to enable a smooth data mesh framework. Through data mesh, Warner Bros. is offering federated access as the culture of monolithic data warehouses is eliminated.
- **Deutsche Bank** used Dataplex to enable centralized governance for its distributed data. Dataplex formalized its data mesh vision and provided the right set of controls for cross-domain data organization, data security, and data quality.
- **Amazon** collaborated with Stellantis to migrate its vehicle data pipeline into a cloud-based data mesh, making use of AWS advanced capabilities for scalable and durable real-time data streaming.

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 at required times on demand.
- Self-service and data-serving pipeline automation increase productivity and cost-effectiveness while decreasing the time to market of creating data solutions. Automation also resolves the scarcity of highly skilled (central) data experts.
- Easy-to-find data products within the organization enables producers and users of data products to collaborate more effectively, resulting in better business outcomes with data.
- Embracing 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, RedHat, SAS, Actifico, Atscale, Data Virtuality, SAP, Informatica, VMware, Data Virtuality
- **Data sharing:** Microsoft Synapse, Informatica, Snowflake, Baffle, Cloudera, Vendia, Databricks Delta Sharing, Azure Data Share, Demyst, Adlink Data Sharing Platforms, Quantiphi Enterprise Data Sharing Platform, Data Republic, Salesforce Meet Data Studio, Sifox Data Sharing platform, metaphacts, Denodo Platform, Teradata
- **Data collaboration/Data Mesh enablers:** DataPlex, Atlan, Cinchy, K2View, IBM Data Fabric, Talend, Cloudera, Dremio, Nexla, Denodo, Keboola, Informatica Intelligent Data Management Cloud, Infosum, Snowflake, Box, Omnisient, Duality, StarDog, TIBCO, Starburst, Dataiku, Alteryx Connect, Hex, Splunk, Datastreams, Databricks
- **Major cloud providers:** AWS, Microsoft, Google, IBM, Oracle, SAP, Alibaba, Tencent

NET Ø DATA

ROOSA SÄNTTI
EXPERT IN RESIDENCE

Zero is everything! All businesses need clarity on their CO_2 emissions and the impact of their sustainability actions. Data is key to delivering net-zero ambitions. But data itself needs to be sustainable, too: the battle against data waste is on

You can't manage what you don't measure. To build and adjust their net-zero strategies and overcome major sustainability challenges, businesses need to build skills, tools, and culture to measure, forecast – and act on – their emissions levels across the whole value chain. For companies, collaboration with their supply chain ecosystem is critical to access reliable data – especially scope 3, which lies outside the boundaries of an organization. But collecting, storing, accessing, and utilizing data comes with its own sustainability price, too. It's a matter of being smarter about what data is really needed, picking up the quest against data waste, and realizing that 'big' data is not always 'better' data.

WHAT

- Data is a significant lever in accelerating the journey towards net-zero: increasing visibility of baseline emissions and identifying emissions hotspots, improving existing business processes by streamlining carbon-intensive activities, and predicting and prescribing business outcomes to drive net-zero performance.
- According to a Capgemini Research institute study, 45% of organizations with net-zero targets only use emissions data for mandatory reporting. Most organizations recognize the value in emissions data but are not well positioned to use it.
- Because scope 3 data is not usually owned by the company itself, co-creation and data sharing across the data ecosystem is critical to meet net-zero ambitions.
- Businesses, therefore, need a data strategy to lead the way forward, as well as a robust foundation for emissions data management – e.g., a sustainability data hub to automate data collection and enable analytics, carbon management, and reporting.
- Although often positive, the impact of data and AI on the climate is a two-sided coin. The development of AI, its interaction with carbon-intensive applications and its lock-in effects has potential negative impacts on the climate; the same applies to a growing heap of 'data waste'. Big data is, therefore, not always huge anymore. Businesses must become smart about their data use, and that all starts with understanding the data they have, its environmental impact, and ends with them getting rid of data that is not needed.

USE

- **Thales** is developing low-energy algorithms as an integral part of the design of neural network architectures. It is also shifting attention from Big Data to Smart Data, favoring quality over quantity, and for an efficient electronics design.
- **Grupo Bimbo** deployed Microsoft Cloud for Sustainability, a comprehensive solution for automated sustainability management, to streamline data collection, integration, analysis, and reporting.
- **Capgemini** supported the **BMW Group** with a cloud-native analytics platform, which evaluates real-time IoT-based data to monitor vehicles precisely throughout the distribution process.
- **ArcelorMittal** utilizes new models and analytics to review waste heat at its industrial sites as well as potential solutions to recover this lost energy.
- **Capgemini** supported the **Volkswagen Group's** involvement in setting up the Mobility Data Space, launching the first car data use cases, and onboarding new mobility ecosystem partners.
- Canadian Technology Company **TELUS Taps** Salesforce Net Zero Cloud for Emissions Reporting.
- **Google** is now focused on achieving the goal of 24/7 carbon-free energy by 2030 by setting up clean energy projects across Belgium, Denmark, Chile, and Finland to decarbonize grids across the globe.
- **Kayrros**, a France-based data analytics company, collaborated with the European Space Agency to establish the satellite-enabled Methane Watch, which uses satellite data and the latest algorithms to detect and quantify methane emissions.

IMPACT

- According to a Capgemini Research Institute report, 53% of organizations have experienced faster progress towards their net-zero goals when embedding emissions data in decision-making processes; on average, companies are seeing a 4.6% reduction in emissions as a direct result of emissions measurement and analytics.
- Innovating for process efficiency and product development is accelerated when organizations are equipped with the understanding of net-zero goals, skills and tools to implement data-powered business decisions.
- Working in global cross-sector and industry-specific alliances with like-minded organizations is key to developing standardized emissions measurement methods. These approaches will help build more reliability into scope 3 emissions measurement in the future.
- Building data management capabilities to manage emissions data will greatly strengthen a company's overall data mastery.
- Reducing data waste has a positive impact on the organizational carbon footprint, but also increases the overall level of data mastery.

TECH

- **ESG data performance:** MSCI, AWS, ISS ESG Index solutions, Microsoft Cloud for Sustainability, Electricity Maps, Ethos ESG, CSR Hub
- **Sustainability Data Hub:** Microsoft Cloud for Sustainability, Salesforce Net Zero Cloud, Oracle Cloud sustainability, Leafcloud, AWS, Snowflake, SAP, Google Cloud Platform, Triggermesh, Edgeworx, Pensando, IBM Cloud Pak for Data
- **Carbon AI & Analytics:** AWS Customer Carbon Footprint Tool, Normative, IBM Environmental Intelligence Suite, Cloud Carbon Footprint, Google Carbon Sense suite, Anaplan, SAP Product Carbon Footprint Analytics, Seivo, Microsoft Emissions Impact Dashboard, IQSpot, Klimametrix, Equilibrium, Kayrros

CREATIVE MACHINE

MARK OOST
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; when technology automates 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 content of all kinds.
- Auto-regressive Large Language Models (LLM) such as GPT-4, Google Switch Transformer, and Megatron-Turing build on up to hundreds of trillions(!) of parameters and vast amounts of text to generate convincing, high-quality text, including poems, program code, and songs. We have already seen a quick uptake, not only in generating synthetic content but also moving beyond that and speeding up innovation in material and life sciences.
- 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.
- 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 a large amount of computing resources, while using them for creative purposes consumes far fewer.
- Generative, creative machines have 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. Creative machines also assist in co-creating new products such as vaccines and materials.

USE

- **OpenAI**´s instant success with ChatGPT overshadowed its predecessor DALL-E 2, a transformer model with 3.5 billion parameters designed to create realistic images from text descriptions. And recently, Stability AI launched Stable Diffusion, a deep-learning, text-to-image model released by startup StabilityAI. Meta announced Make-A-Video and, just days after, Google announced that it is almost ready with its own AI-powered text-to-video generator, which it is calling Google Imagen Video. Buckle up, innovation in AI is taking off!
- **Mila**, a deep-learning research institute, partnered with **Maket**, a generative AI startup, to bring AI-powered architecture, engineering, and construction industry solutions to the market.
- **Iktos and Teijin Pharma** partnered to combine Iktos' generative-modelling technology and Teijin Pharma's small molecule drug discovery projects to expedite the identification of potential pre-clinical candidates.
- **Insilico Medicine** collaborated with the University of Zurich to apply Insilico's generative Artificial Intelligence platform to the discovery of potential therapeutics for Cystinosis.
- **MIT researchers** developed a generative AI model that requires far less memory to store or share than a dataset and can learn to identify images using synthetic data, which can then train another model for vision-related tasks.
- **The University of Florida's** academic health center **UF Health partnered with NVIDIA** to develop a neural network that generates synthetic clinical data to train other AI models in healthcare.

IMPACT

- The ability to deal with the increasing scarcity of human resources and a 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

- **Language transformer models:** ChatGPT, BERT, OpenAI GPT-3, Google Switch Transformer, Microsoft Turing, NVIDIA Megatron, Microsoft/NVIDIA Megatron Turing NLG 530-B, Hugging Face
- **AI Generated Art and text-to-image generation:** Midjourney, Dall.E 2, Stable Diffusion
- **GANs:** StoryGAN, DiscoGAN, ArchiGAN, GameGAN, StackGAN, Google GAN, GAN Lab, GANImation, HyperGAN
- **GAN libraries:** TF-GAN, Torch-GAN, Mimicry, IBM GAN-toolkit, pygan, StudioGAN, Keras-GAN

PROCESS ON THE FLY

MANUEL SEVILLA
EXPERT IN RESIDENCE

Strategy tends to be eaten for breakfast, by culture – but also by a lack of operational execution. Organizational aspirations are 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 both human resources and natural resources, plus the drastic need to reduce travel and energy consumption. This is where Process on the Fly comes to the fore and shines ever brighter. Breakthroughs within intelligent automation and a taste of touchless execution have firmly placed this container center stage. Quit talking and start doing.

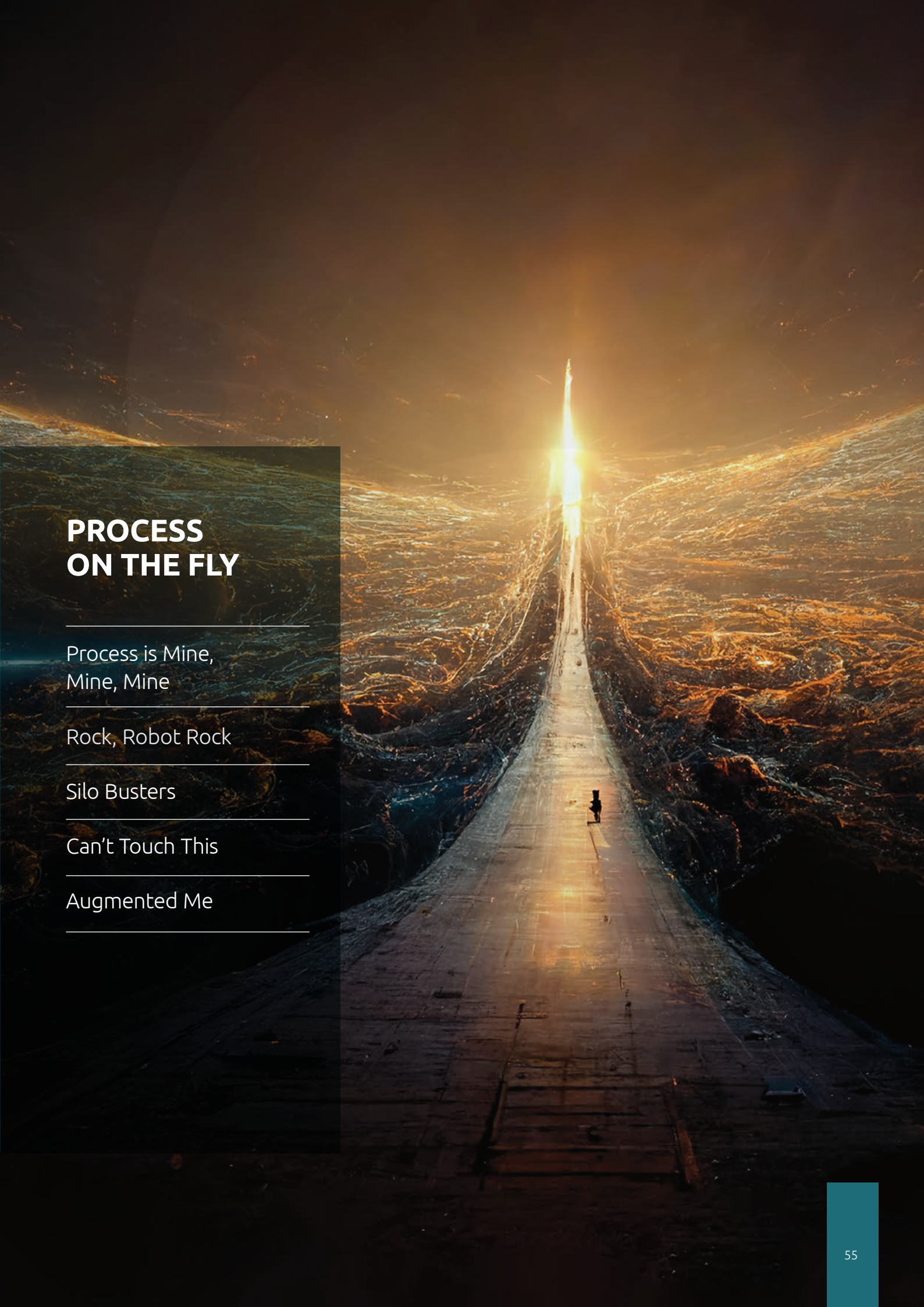
In many ways, a process is just another 'thing'. When equipped with 'sensors', this thing provides a continuous flow of data points about its status and whereabouts, not unlike the concept of a Digital Twin in the Intelligent Industry domain. With the emergence of "Internet of Twins", a full spectrum of possibilities opens up 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. Automation also helps to relieve the pressure on organizations that always need to deliver more, but with fewer human resources and fixed assets, and a lighter carbon footprint.

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 next-generation application microservices to the mix and any process is just an API call away. And while we are on the topic of 'minimization': redesigning legacy processes into micro-processes – each of them well described with input data, transaction data and output data – brings simplicity, and thus less complexity, less rules, and less mistakes.

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

Pretty fly, no?



PROCESS ON THE FLY

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 might 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

- Modeling 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 that are 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 boost process improvement to explore, measure, qualify, and manage ideas effectively, enabling the organization to focus on its value-adding and high-priority initiatives.

USE

- **BMW** created a facility digitization plan – supporting supply chain, engineering, and operations with remote, reliable, detailed visualizations – by integrating NavVis' Digital Factory Solution, which will reduce costs, planning errors by 10% to 30%, travel time by 20% to 40%, and lead to 10% to 20% efficiency improvements.
- **Trantor**, a US-based digital transformation company, utilized Signavio's Business Process Management (BPM) platform for a proof-of-concept study to improve more than 180 processes (and 785 sub-processes) with 0% errors and to perform process mining, consulting, modeling, simulation, optimization, and enterprise architecture.
- **Aker BP** integrated Halliburton Landmark's cloud application DecisionSpace 365 application to accelerate delivery and increase efficiency through automated workflows, multi-scenario analysis, and digital twin models. It utilized the Open Subsurface Data Universe (OSDU) platform to improve processes and identify risks within field development concepts.
- **Airbus** integrated Siemens Capital software for next-generation Electrical/Electronics systems development in commercial aircraft. The platform automates design and engineering process as a part of Airbus' Lean PLM (Product Lifecycle Management) environment.
- **Cosmo Tech** used Microsoft's strategic 360° Simulation Digital Twin to enable enterprise customers to monitor systems in real time and to simulate the evolution of uncertain environments. This application improves planning, decision-making processes, and activities in financial functions.

IMPACT

- Accelerated process design with enhanced virtual collaboration and change transparency using digital process-modeling tools to model target processes.
- Higher business case and change impact accuracy by using simulation from digital twins to assess process improvement opportunities, without a strain on physical and human resources.
- 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, LiveJourney, UpFlux, Soroco
- **Simulation/digital twin tools:** Celonis, BusinessOptix, Improbable, Google Cloud, Landmark Solutions
- **BPMN software:** BusinessOptix, Signavio, AxonIVY
- **Agile management tools:** Jira, Trello, Monday.com, BusinessOptix

ROCK, ROBOT ROCK

MAREK SOWA
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. Simple, fluid, and frictionless Intelligent Process Automation. So, while Robotic Process Automation might 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) uses 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

- **Sumitomo Mitsui Trust Bank** deployed UiPath's end-to-end automation to automate more than 250 critical business operations and 500 workflows, resulting in savings of more than 400,000 total hours in labor-intensive tasks.
- Technology specialist NewGen automated customer onboarding and lending processes for one of Vietnam's largest commercial banks. The firm used New Gen's technology to eradicate manual operations, reduce turnaround times, and enable end-to-end customer journeys.
- **Michelin** automated its operations to reduce CO_2 emissions by 50 tons. The company deployed centralized electric autonomous guided vehicles (AVGs) that were controlled by Rockwell's Automation Level 2 supervision system. The deployment led to an increase in production efficiency and safety, and lower costs.
- **Pepper Money**, an Australia-based Finance company, used Appian's Low-Code Platform to support SOLANA, an Asset Finance Loan Origination solution. The application increased the credit and settlements team's productivity and improved business volumes by 70%.
- Climatec deployed **Kanverse.ai's** automated invoice solution and eliminated the low-extraction accuracy associated to its existing OCR-based tool. Kanverse AP Invoice Automation reduced the invoice processing cycle from 20 minutes to two minutes, and delivered 99.5% extraction accuracy.

IMPACT

- A faster – and potentially more reliable – execution of routine human tasks carried out across a multitude of different applications, saving money, time, and precious human and natural 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.
- RPA does not need physical IT assets such as a keyboard or a mouse, it can run on a lightweight operating system (such as Ubuntu), and needs less CPU power (such as ARM) – all leading to less consumption of resources and energy.

TECH

- **Robotic Process Automation (RPA):** Automation Anywhere, Blueprism, UiPath, Nice, Pega, Appian, Laire, Nintex, Infinitus, Leapwork, Arago
- **AI solutions moving to the RPA world:** Kryon, Workfusion, Abbyy, Automize, Ansible
- **RPA platforms:** RPA Labs, Ushur, Appian Robotic Process Automation, Automation Anywhere, kofax

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, and 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.
- Robotic Process Automation (RPA) 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, can provide an alternative, unified view on disparate core application services.
- While busting them, monolithic process silos can be gradually transformed into 'microprocesses': each simple, consistent and well-defined in terms of input, transaction and output data.

USE

- **Groupe Roullier** automates its processes using Nintex K2 Cloud. The technology streamlines complex business application designs, involving data from more than 130 subsidiaries, and automates regulatory, financial, and contractual compliance processes.
- **Blue Yonder**, an intelligent supply chain company, used GreyOrange's autonomous robots to automate its warehouse processes. Blue Yonder's micro-fulfilment centers place inventory closer to its customers, speeding up order delivery while reducing costs and carbon footprint.
- **Newcastle-upon-Tyne Hospitals NHS Foundation Trust** implemented Automation Anywhere's Automation 360 software to help automate its human resources, occupational health, Cancer Information Center, and Appointment Booking Centre operations. The use of bots saved 7,000 hours annually and RPA is being used to automatically manage 10,000 patient discharges per month.
- **The Loan Store** worked with MOZAIQ & Automation Anywhere to compresses mortgage loan-turn times by more than 25%. The mortgage company used automation and AI to increase productivity by 100%, achieve cost savings of 60%, and allow employees to focus on higher-value work.
- **Walmart Canada** is investing $118 million to build a new fulfilment center in Calgary that will use robotic technology from GreyOrange. The system will help employees store, pick and sort items by using smart and flexible storage abilities.

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 instead – saves precious 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.
- Gradually transforming process silos into 'microprocesses' brings simplicity – and through that less complexity, less rules, less mistakes.

TECH

- **Analytics and BI tools:** SAP Analytics Cloud, Celonis, Minit, PowerBI, Qlik, Sisense, Datapine, Yellowfin BI, TechSee
- **API and web services management:** Salesforce MuleSoft, Google Apigee, WSO2, Akana, Sensedia
- **Robotic Process Automation (RPA):** Automation Anywhere, Blue Prism, UiPath, Pega Robotic automation and workforce intelligence suite, NICE RPA, Kryon Systems, Laire, Nintex, Infinitus, Leapwork, Arago, Ansible
- **Business process management:** BusinessOptix, Dell Boomi, Oracle BPM, IBM Intelligent BPM, Pega BPM & Case Management, Appian, Blue Yonder, Anvyl, Aurea, BluJay Solutions

CAN'T TOUCH THIS

GEETIKA MEDIRATTA
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 adjust fluidly to whatever situation occurs, anticipating next-best actions and resources needed on the fly. And while learning from what works, these systems 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 human resources.
- 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 business operations.

USE

- **BforBank**, the fully digital bank of the Crédit Agricole Group, selected Temenos open platform for composable banking to support future expansion. Moving to a fully cloud-native, API-first stack on Google Cloud will give the bank hyperscale agility, flexibility, and scalability to launch new services faster and at a lower cost.
- **Claim Genius**, a photo-AI platform generating auto repair estimates, partnered with Duck Creek to offer claims estimates for insurers. Workflows were digitized using Claim Genius's AI-based inspection platform. The system provided automated predictions on vehicle repairability, with line-by-line calculation of labor times and costs, making touchless claims a reality.
- **Liberty General** Insurance deployed AI algorithms to process and settle claims, including correct and standardized claim assessment with settlement amount accuracy. The insurer uses Liv Mobile App for 24/7 customer queries and reports claims.
- **American Financial Resources** is using Tavant's Touchless Lending AI-powered lending-as-a-service technology. By automating the existing document management system, the system processed over 500 loans and over 90,000 loan documents at a 92% success rate in the first month after implementation.
- **Deutsche Telekom** implemented Anodot's AI-autonomous business-monitoring solution for data monitoring, traffic behavior, and fault monitoring. The system reduced costs and effort by allowing only anomaly alerts to be received for real-time and service-impacting incident detection.

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 Experience^2) 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 reducing energy consumption and CO_2 emissions.

TECH

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

AUGMENTED ME

LEE BEARDMORE
EXPERT IN RESIDENCE

Adding AI to business operations to accelerate decision-making processes, 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. It's apparent from AI's mastery of natural language, and its understanding of audio, video, and images, that 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 produce narratives creatively that we typically use to tell stories about the increasingly complex environment we operate in.
- Cognitive algorithms are changing 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. These systems 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

- **Baker Hughes'** workforce and unplanned downtime was reduced by 50% through Augmentir's connected worker software that supports remote expert functionality and digital assistance.
- **Citi** Ventures' data scientists' focus was shifted from setting up models to interpretation by integrating DataRobot's AI Cloud, AutoML, and Automated Time series, which automated 80% of models and led to a 10 times improvement in productivity.
- **Mazda Motor** selected Secondmind.ai to design and develop its powertrains and expects 50% reduction in engine calibration time with intelligent automated experimentation powered by the Secondmind Active Learning platform.
- **Thread** integrated 7Bridges's AI-powered logistics platform and reduced total logistics costs by 50% to 60% through automated shipment career selection, custom paperwork, tracking and notifications, and performance audit.
- **Biotronik's** BIOMONITOR, an Injectable Cardiac Monitor, was integrated with AliveCor's AI-enabled KardiaMobile 6L and KardiaMobile Card ECG technology to enable remote monitoring of at-risk patients by analyzing heart rhythms.

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, an 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, Alteryx, 4Paradigm, H2O.ai, Boost.ai
- **Artificial solutions:** Teneo, WorkFusion, Amelia.ai, Ambit.ai
- **Loop AI:** Loop Q, Machinify, IBM Watson, Pega, Anaconda, Abacus.ai
- **Adaptive learning:** FortessIQ, Celonis, Abbyy Timeline, CognitiveScale, Beyond.ai

APPLICATIONS UNLEASHED

THILO HERMANN
EXPERT IN RESIDENCE

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 composable 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 an 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 composable portfolio is far from easy, and several aspects need to be considered.

Simplifying, rationalizing, choosing the right solutions, and ultimately decommissioning inflexible, aging applications is a daunting task that no IT expert learns in school. Yet, it is key to leveling 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.

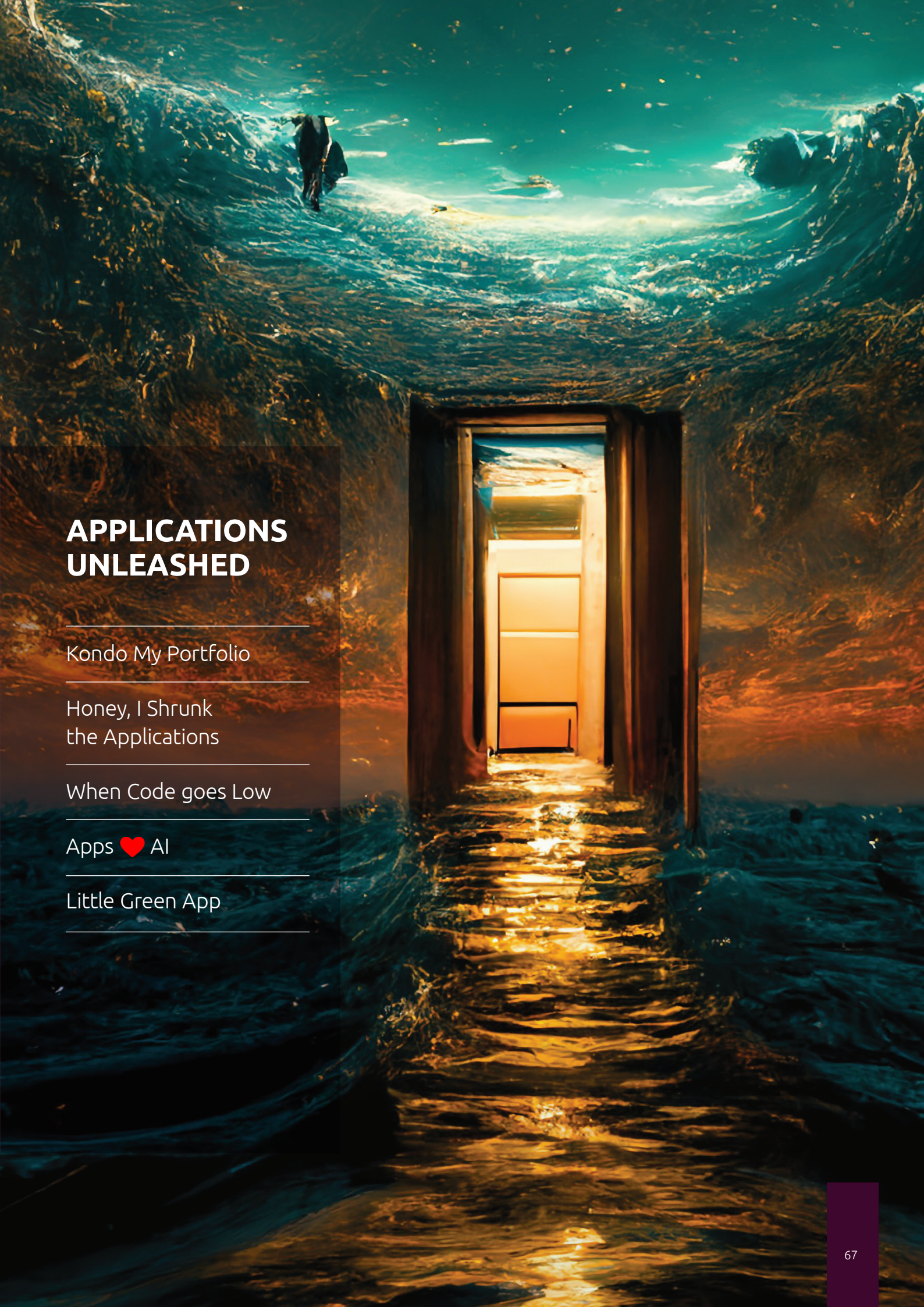
When new applications are built, they must be done in an agile, continuously deliverable way – where business and IT people are in integrated teams, perfectly in sync with the actual operations. Exactly what we'd expect from a Technology Business. And, to add even more decisiveness and transparency to 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 custom applications is a challenging, complex, and unsustainable undertaking – and the scarcity of skilled experts doesn't help. Low code/no code tools provide high productivity and enable more people to develop the apps, increasingly on the business side of the wonder wall. 'Fusion programming' combines the best of both worlds. Reuse of existing apps and services is preferable to custom-built, especially in the cloud: it saves time, money, resources, and – yes – even energy.

Furthermore, 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.

Still, have more ambitions? Make your apps 'green', engineering them for less use of energy and resources. The beauty is in simple, efficient applications services that can be easily composed to address a Technology Business challenge.

Your applications are eagerly waiting to be uncaged. Unleash them!



APPLICATIONS UNLEASHED

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, but 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 needs.
- 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

- **Vodafone Germany** partnered with Amdocs to create and run a new digital stack to unify and consolidate technology across their various lines of business. A completely automated continuous integration/continuous deployment (CI/CD) pipeline will be implemented, adopting a DevOps philosophy, allowing daily deployments in accordance with a fully Scaled Agile Framework (SAFe) operational model.
- **Schneider Electric** deployed EcoStruxure IT. It modernizes the monitoring, management, planning, and modeling of IT physical infrastructure, with flexible deployment options that include on-prem and cloud-based solutions to support hybrid, distributed IT environments, from a few sites to thousands of sites globally.
- **RWE**, a German energy firm, used Generac Grid Services' Concerto software to build a virtual power plant on Amazon Web Services (AWS) capable of managing hundreds of thousands of mixed distributed energy resources (DERs) across multiple electricity markets.
- A **US-based investment company** modernized its systems by migrating data and refactoring business functionality to the AWS Cloud. Using the CAP360 solution, the migration process was accelerated and the firm was able to retire its PCF-based services and standardize everything on Amazon ECS for its APIs.
- **StoreHippo**, an eCommerce company, migrated to the fully managed MongoDB Atlas platform, which helped to reduce storage consumption by 50%, reduce latency by 30%, and lower DevOps overheads by 10%. StoreHippo's eCommerce platform now follows the MACH architectural pattern (Microservices, API-first, Cloud-native, Headless).

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

- **Re-platforming:** Bluage, LzLabs Software Defined Mainframe, Capgemini eAPM, Capgemini Cloud Migration Factory, AWS Mainframe Modernization, Confluent
- **Agility:** SAFe, LESS (Large Scale Scrum), Scrum@Scale, Disciplined Agile
- **DevOps:** Production Line, CP Innovate (e.g., DevOps-PaaS, API management), Jenkins, Ansible

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 frontend, 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, and 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 finished. 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 result.
- 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 responsibilities.
- 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

Chatbots

- The City of Markham is working with **IBM Canada** to launch the Elections Markham Virtual Assistant, powered by IBM Watson Assistant. The AI virtual assistant is designed to simplify the voting process, making it easier for voters to get information about the upcoming municipal election.
- The **Reserve Bank of India** along with National Payment Corporation India launched the DigiSaathi, an AI-powered chatbot to help customers with automated responses on information related to digital payment products.

Infrastructure

- **HDBank**, a Vietnam-based bank, chose AWS to deploy Amazon Elastic Kubernetes Service (Amazon EKS Anywhere), allowing HDBank to self-manage and control technology on the cloud-computing platform. HDBank will migrate its IT infrastructure and applications from the bank's data center to the AWS platform, building an integrated data platform that optimizes data analysis.
- **Storyblocks**, a US-based media company, deployed Confluent Cloud, a fully managed cloud service for Kafka. The technology allowed the company to replay events on demand with powerful in-built schema validation. It also helped reduce technical debt and TCO from REST APIs, and modernized monolithic applications.
- **eBay deployed** Confluent-designed microservices to help migrate from a monolithic to a microservices architecture that enables more independence, greater flexibility, improved scalability, and electronic design-based applications that have allowed the company to cut its go-to-market time in half.

IMPACT

- Faster, scalable, and intent-driven application services that are modular, sustainable, and 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, and 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, Claudia.js, VMware Tanzu, communicating event streams such as AWS Kinesis, Google Cloud Dataflow, Confluent, Apache Spark, Kafka, AWS Lambda, KEDA
- **Voice assistant platforms:** Microsoft Cortana, Apple Siri, Amazon Alexa, Google Duplex and Assistant, Alibaba's AliGenie, Bixby, Hound, Databot
- **Text assistant platforms:** WeChat Open Platform, Microsoft Bot Framework, Facebook Messenger Platform, UiPath Druid, Fyle

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.
- 'Fusion development', the combination of 'pro'-code and low/no-code to build composable applications, combines the best of both worlds.
- 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 – as evidenced by 'creative machines' such as chatGPT.

USE

- **Sodexo Engage** has deployed the OutSystems platform to provide its public sector customers with a robust and secure fully managed service. The platform enables customers to offer eVouchers and Bulk Voucher Cheques to their employees via desktop and mobile devices, as well as the ability to process large volumes of vouchers. The platform also eliminates the need for previously needed time-consuming manual workarounds.
- **Capgemini** expanded its partnership with Mendix to jointly build and deliver low-code insurance solutions. The companies released two solutions, Direct to Consumer (D2C), a framework that allows insurance agencies to quickly deliver customer-oriented solutions, and the Property & Casualty Underwriting Workbench solution, which helps frontend staff connect directly to backend systems.
- **Horizon Power**, an Australian energy provider, deployed the Appian Low-Code Platform to power its digital transformation program. The company used the platform to automate processes, helping to reduce duplication and make workflows more efficient.
- **DKB Service**, a German-based subsidiary of Deutsche Kreditbank, deployed Pega Platform and its intelligent automation capabilities to standardize and automate back-office service processes, such as digital mail distribution, name changes, and account deletion.
- **T Mobile** started using Microsoft Power Platform's low-code development tools, including Power Apps, Power BI, and Power Automate. Employees use the Platform to build solutions to business challenges. T-Mobile has a thriving internal Microsoft Power Platform community and is creating a T-Mobile Center of Excellence to promote further low-code development.

IMPACT

- Increased application development productivity, on both sides of the business and IT spectrum, by choosing the best approach for the challenge at hand.
- Enhanced organizational 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 that demonstrate enterprise robustness combined with agile solutions.
- Dealing with a scarcity of specialized software developers by enabling more people in the organization – who are 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, UiPath Apps, ServiceNow App Engine, SS&C Blue Prism, Zoho Creator's low-code platform, Retool, AgilePoint, AuraQuantic, Decisions, Lansa hybrid low-code

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 web services – 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 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 accessed easily through web services and APIs, including image and voice recognition, intelligent automation, natural language processing and generation, 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 help to create this 'Apps AI' shortlist.

USE

- **Jio Haptik**, a conversational AI company, selected Microsoft Azure Cognitive Services to improve its existing Hindi conversational AI models and accuracy. This AI translation model enables end-to-end conversations in Hindi, English, and even Hinglish, increasing local language queries by 2.5 times and reducing human interventions by 80%.
- **Vodafone** deployed **Google** tools BQML and Vertex AI to completely automate ML lifecycle compliance activities, such as drift and skew detection, explainability, and auditability with the use of reusable pipelines, containers, and managed services.
- UK-based **Northumbria Healthcare NHS Foundation** started using Azure Machine Learning and the Responsible AI dashboard, which enabled the organization to understand, refine, and explain its outcomes with the help of insights drawn from the data, so specialists at the center can serve patients better.
- **Siemens MindSphere** selected **TIM** InstantML technology from Tangent Works to develop an AI application for industrial IoT called AI for Everyone. The hyper-automated, machine-learning engine allows users to perform and scale forecasts with anomaly detections.
- **Capgemini** developed The Federated Learning platform for three Spanish hospitals to share trained AI models and to create a global model that is significantly better than any of the local versions, while assuring the protection of sensitive patient information.

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, Vertex AI, H2O.ai, Caffe, Apache MXNet, AutoML, Symphony Sensa AI, Neural Designer, Oracle AI, Apache PredictionIO, Tangent Information Modeler, OpenAI

LITTLE GREEN APP

SJOUKJE ZAAL
EXPERT IN RESIDENCE

Engineer applications to be less demanding in terms of resources and energy with superior performance: get more sustainable, but also better software

There is a mixed bag of 'green' software engineering approaches and tools, all concerned with creating long-lasting software that uses less energy and resources, while executing faster and more efficiently. Software does not consume energy or emit harmful discharges on its own. The issue is with how software is developed for use – and then how it is used. Companies are integrating software into their sustainability efforts by judging its performance on energy efficiency with a focus on parameters such as security, scalability, and accessibility. Some organizations are now including green practices and targets as a key criterion for CIO performance reviews. Sustainable Software Engineering principles have been developed to assess eco-friendliness and spread best practices. Because the ICT sector is expected to account for 14% of the world's carbon footprint by 2040, green software engineering clearly matters.

WHAT

- Building a 'green' app is always a trade-off, and only experienced architects and developers can both fulfil the requirements of the business and reduce the impact on the environment to a minimum.
- Choose the best-fitting architecture for sustainability requirements. A focus on cloud-based solutions is often sensible and helps organizations to measure and reach the sustainability targets they set.
- Microservices are not a silver bullet, so check for the benefits (scaling, best-fitting technology) versus the challenges (network traffic, data replication) – and decide accordingly.
- Invest in algorithms and choose the most efficient ones for the given business challenge, but be aware that premature optimization is the 'root of all evil'. Only optimize what you really need to optimize.
- Frameworks and products will add a lot of abstraction and complexity, so chose the simplest ones that satisfy business requirements.
- The most efficient software is the application that doesn't exist. The 'KISS' principle – "Keep it simple, stupid!" – holds true for green apps, and you should reduce in the following dimensions: CPU, RAM, Disk, and Network.
- Don't forget about the lifecycle, as things will change over time and efficiency might also change. Keep an eye on your efficiency by establishing a mechanism for measurement (e.g., with a dashboard).

USE

- **Capgemini** was selected by Mercedes-Benz to support the vehicle manufacturer in its aim of becoming a CO_2-neutral enterprise, modernizing a widely used backend service for vehicle master data and buildability services. Several deployments were consolidated into a central shared service to minimize the CO_2 footprint. The initiative proved that IT can also significantly contribute to corporate sustainability targets. A CO_2 reduction of approximately 50% was achieved, based on reduced energy consumption, hardware, and operational efforts. Deployment on the public cloud enables even more energy savings.
- **SL Green**, a US-based real estate company, deployed software as a service (SaaS) from Envizi, an IBM Company, to better understand and report on its environmental initiatives, identify opportunities for greater efficiency, and further drive sustainability across its extensive real estate operations.
- **Google** introduced the Carbon Sense suite, which is a collection of features that aims to help companies quantify and report their emissions, as well as reduce them. Active Assist is a part of Google Cloud's AIOps solution that uses data, intelligence, and machine learning to reduce cloud complexity and administrative toil. Under the Active Assist portfolio, the company has products and tools like Policy Intelligence, Network Intelligence Center, Predictive Autoscaler, and a series of Recommendations for various Google Cloud services – all focused on helping users to achieve their operational goals.
- **Eka Software Solutions**, an enterprise cloud solutions provider, collaborated with Microsoft to offer cloud-driven sustainability solutions for enterprises, enabling businesses to reduce their impact on climate change and gain meaningful insights across their carbon usage, supplier relationships, governance, workforce management, and the circular economy.
- **GE Digital** announced that All Nippon Airways (ANA) implemented Fuel Insight, a software solution that works by understanding real data from the aircraft to meet 2050 net-zero emissions goals. Fuel Insight from GE Digital Aviation Software is a digital suite that leverages proprietary analytics algorithms to monitor fuel efficiency and deliver data-driven insights for identifying and implementing sustainable fuel efficiency initiatives.

IMPACT

- Contributing to the corporate sustainability agenda by engineering applications for less energy consumption, fewer CO_2 emissions and less environmental impact.
- Being attractive to scarce, skilled development resources as more people prefer to work on solutions in a sustainable, responsible way.
- Through the focus on efficiency, applications will not only be greener but also better-performing – leading to higher satisfaction with users.
- Green applications are optimized on efficiency and use of resources. Therefore, run costs are lowered across the entire lifecycle.
- A thorough assessment, which focuses on simplifying and cleaning up application services, is beneficial for maintainability.

TECH

- **Development Tools:** Greensight, Capgemini's sustainability and efficiency plugin for SonarQube
- **Eco-friendly apps:** Ecosia, Carbon CI Pipeline Tooling, Cloud Carbon Footprint, Microsoft Emissions Impact Dashboard, Google Apps, CodeCarbon, JoularJX, INRIA PowerAPI, Cirrus Nexus TrueCarbon
- **Frameworks:** Principles of Green Software Engineering

INVISIBLE INFOSTRUCTURE

DAPO ADEKOLA
EXPERT IN RESIDENCE

O' Infrastructure, Where Art Thou? The odyssey towards a truly invisible IT infrastructure is ongoing. The cloud, a signpost of increasing 'invisibility' is the default choice with a diverse range of deployment options. Plain acceleration has given way to a focus on value extraction, sustainability, industry contextualization, technology debt removal, and security, all while maintaining operational resilience. A software- and AI-driven, nearly autonomous supply chain is key to that, providing an approach to deal with both the scarcity of skilled experts and excess energy consumption and CO_2 emissions. But IT infrastructure also expands its reach, integrating Operational Technology and 'things' at the edges of central IT, showing that "Infostructure" never was a spelling mistake.

The cloud is increasingly the only IT infrastructure platform that provides the required quality levels, availability, elasticity, and evergreen sustainability. 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. This shift to on-demand IT comes with a diversifying range of deployment options – involving multiple providers and locations, including regional sovereign clouds. The latter – according to Capgemini's recent research – will be adopted to ensure compliance with government regulations and standards, reducing exposure to extra-territorial laws and providing a trusted, safe environment for data.

An infrastructure platform must be high-performing yet agile, resilient yet evergreen, robust yet cost-effective, secure yet user-friendly. Satisfying these demands requires an evolution of infrastructure platforms with cloud and automation at its nucleus, supported by 'All Ops' principles (such as DevOps, DevSecOps, DataOps, MLOps, ChatOps, NoOps). 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 an autonomous, self-healing equation that relies less on scarce, skilled resources.

These features all come in industry clouds, where pre-packaged – yet fully configurable – data and solutions are being developed for a specific sector. These industry clouds deliver speed to market, industry best practices, and a fast track to lessening the weight of existing, unsustainable, and aging IT landscapes.

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 or upcycling them whenever possible – not only brings cost benefits and agility, but also raises the corporate ESG score. This perspective needs to be integrated in a 'FinOps' approach in which both technology and business stakeholders work together to find the optimal balance between the benefits and (financial/sustainability) concerns of a cloud-based IT infrastructure.

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 provides new networking, compute, data, events, application services, and devices securely. Invisible or not: that is an infrastructure platform with innovative business potential.

INVISIBLE INFOSTRUCTURE

Lord of the Clouds

My Industry,
My Cloud

Ops, AI did it Again

Simply the Edge

Silence of The Servers

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 out on a journey, 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

- Regulatory requirements, the need for unique services, and the emergence of more loosely coupled, 'mesh' business models drive 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 to build 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 significant reductions in carbon emissions, marking the way towards a more sustainable, net-zero 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

- **Walmart** worked with Azure and Google to create a multi-cloud platform that enables a consistent developer user experience and frictionless cloud-native services adoption, lowering its cloud spending by up to 18%.
- **Boeing** has entered multi-year agreements to leverage Azure, AWS, and GCP to create digital twins of its aircraft, leveraging the latest data tools at a scale that was not previously achievable while also reducing the company's carbon footprint.
- **Agrology** partnered with Google Cloud to monitor crops and receive predictions on irrigation, extreme weather, soil carbon respiration and sequestration, pest, and disease outbreaks, and more.
- **3i Infotech** launched NuRe 3i+, a Zero Trust Sovereign Cloud, in Malaysia. It will offer customers a stack of cloud services, supporting cloud-native applications, mission-critical applications, and performance-intensive (HPC, GPU) workloads.

IMPACT

- Optimized cloud usage – especially when achieved in conjunction with Artificial Intelligence – will deliver significant savings in energy consumption, reducing carbon emissions.
- Significant cost reductions can be achieved through cloud financial management ('FinOps') and better visibility of cloud usage. Wildlife Studios managed to cut its cloud costs by 45%.
- A hybrid mix of cloud options provides sovereignty, trust, and data ownership. This mix enables an agile, unified ecosystem of cloud and data services, where applicable, that is 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 the business dictates.
- Open access to sustainability data allows machine-learning models to be tuned to include the whole cloud value chain, including power efficiency, cooling efficiency, and performance predictions.

TECH

- **Application platforms:** Fly.io, platform.sh, Accelario, Vercel
- **Data platforms:** Starburst.io, Snowflake, Atlan
- **Observability:** Snowsoftware, Chornosphere.io, Coralogix
- **Sustainability tools:** Microsoft Sustainability calculator, Carbon footprint, Google Carbon Sense suite
- **Hybrid, multi-cloud tools:** Google Anthos, Azure Arc, Sentry, Backstage, Crossplane, Isovalent, Kubevela
- **Sovereign Cloud:** Microsoft Cloud for Sovereignty, GAIA-X
- **Cost management ("FinOps"):** Azure Cost Management, AWS Cost Explorer, Kubecost, Apptio, Spot.io

MY INDUSTRY, MY CLOUD

JOSE KUZHIVELIL
EXPERT IN RESIDENCE

Industry-specific clouds – focusing on data and solutions for a particular industry, domain or even region – deliver speed, focus, and compliance, while trimming legacy

You don't want to get off this cloud! Industry clouds bring together all an organization needs for its sector-specific activities, neatly packaged as ready-to-use, yet adaptive data, solutions, and infrastructure services. They capture industry best practices and assure appropriate regulatory compliance. When leveraged in a stepwise way, industry clouds bring benefits in terms of speed-to-market, cost and resource reduction, accelerated growth, and regulatory compliance, while also driving collaboration between industry partners. They can also bring a powerful, high-quality fix to lessen the weight of legacy, aging, custom-built IT landscapes – reducing their environmental impact while doing so. Whilst we are not quite at the desired "industry cloud" destination, the journey has definitely begun!

WHAT

- An industry cloud contains the composition of multiple cloud services, business applications, data, and tools, contextualized to provide vertical, sector-specific capabilities.
- Some of these services, applications, and tools can be generic; others might be purpose-built for the sector. In all cases, these services can be configured and composed for more adaptivity.
- Industry clouds make industry best practices available 'off-the-shelf', without the need for extensive customization.
- Elements of an industry cloud can be the result of a joint initiative between technology providers, separate – possibly otherwise competing – businesses, and sector-specific consortia; they can provide industry reference models as well.
- Industry clouds provide built-in support for local or sector-specific regulatory and sovereignty requirements.

USE

- **Goldman Sachs** partnered with AWS to launch Goldman Sachs Financial Cloud for Data, a new suite of cloud-based data and analytics solutions for financial institutions. The cloud-native financial data management and analytics solution targeted hedge funds, asset managers, and other institutional clients.
- **Mortgage365** partnered with Microsoft to bring its mortgage-lending platform to the Microsoft Cloud for Financial Services. This cloud-based solution for financial services uses Microsoft's data privacy and security controls.
- **LifePoint Health** implemented Google Cloud's healthcare data engine in its hospitals to improve community-based healthcare delivery across the 29 US states where the company operates.
- **Cropin** launched Cropin Cloud, an industry cloud for agriculture, which provides: an integrated platform of applications for digitization; clean and contextual data pipelines that enhance decision-making processes via data analytics; and crop-specific and geography-agnostic machine-learning models.
- **Volkswagen Group** partnered with AWS and built the Volkswagen Industrial Cloud, which uses AWS Internet of Things (IoT) services to connect data from all machines, plants, and systems across more than 120 factory sites. The group is also expanding beyond manufacturing into ride-sharing services, connected vehicles, and immersive, virtual car-shopping experiences with AWS.

IMPACT

- Rapid availability of industry best practices and innovative solutions from the cloud, increasing speed to market.
- New ways for organizations to monetize their solutions, possibly through partnering with technology and cloud providers.
- An accelerated route to modernize and migrate the existing, legacy IT landscape to the cloud, benefiting from the scale and sustainability advantages cloud providers deliver.
- Rapid compliance with sector- and region-specific rules and regulations.
- More standardization within the sector (also through industry reference models), which makes it easier to exchange data, collaborate on joint purposes, and optimize for efficiency.

TECH

- **Microsoft:** Microsoft Cloud for Finance, Microsoft Cloud for Healthcare, Microsoft Cloud for Retail
- **Google:** Google Cloud for Retail, Google Cloud for Manufacturing, Google Cloud for financial services
- **AWS:** AWS for Automotive, Telecommunications on AWS, AWS Energy, AWS for Health
- **Sovereign Cloud:** Oracle Sovereign Cloud, Microsoft Cloud for Sovereignty, Azure Germany, GAIA-X, IBM Satellite
- **Other Industry Clouds:** Salesforce Manufacturing Cloud, Lumen platform, ONAP

OPS, AI DID IT AGAIN

INDU MALHOTRA
EXPERT IN RESIDENCE

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

So many platforms, applications, services, industrial assets, and edge devices to take care of securely. 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.
- Infrastructure as Code (IaC) drives best practices for consistent and reliable setup of cloud infrastructure and immutable services, all integrated into modern application delivery via continuous integration and continuous deployment (CICD) processes.
- AIOps for real time checks and guardrails for secure operations, as algorithms can detect malicious attacks on a real-time basis and prevent intrusions with zero-trust architectures by default.
- Organizational change management is essential. Cross-functional teams must be set up to integrate AIOps with DevSecOps, quality assurance, and Site Reliability Engineering (SRE). This approach will not only help reduce complexity, but will also drive high-frequency, high-quality, and cost-effective platform delivery across applications and infrastructure.
- Automated incident intervention and sentiment analysis – using analytics and Natural Language Processing (NLP) to expand from customer scenarios to frictionless IT service desk engagements with (remote-working) business users.

USE

- **BT Digital** is planning to consolidate all of BT Group's application-monitoring processes on the Dynatrace Software Intelligence Platform as part of a new service management stack. The aim is to simplify and ultimately automate service operations within BT via a new AIOps model.
- **TSB Bank** implemented Dynatrace technology and its AIOps enables the bank's frontend and backend digital teams to deliver integrated customer experiences faster and more efficiently. The technology allows digital teams to resolve problems before customers are ever impacted and creates valuable time for innovation.
- **The US Department of Veterans Affairs (VA) is leveraging data and** AIOps to address unanticipated abnormalities in the agency's IT network. AIOps improves and automates monitoring and enables VA to see the events that happen and to think about how it will fix them moving forward.
- **Moogsoft** is helping Alesia to enhance its observability portfolio with AIOps capabilities, such as noise reduction, anomaly detection, and insight enrichment.
- **Datacom** implemented conversational AI software, Amelia, in government and enterprise client environments to create a human-like service desk support assistant named Sam. Employees can converse with Sam via the company's Microsoft Teams environment to resolve service desk requests without waiting for the helpdesk team.
- **LATAM Airlines** selected Iguazio as its MLOps platform provider to prevent fraud on the company's frequent flyer program, improve pilot training through better analysis of landing issues, and provide intelligent route planning to reduce carbon emissions.

IMPACT

- Routine, repeatable IT operational tasks can be automated to provide a frictionless service while reducing costs and enabling a focus on 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, ensuring higher customer and employee satisfaction and retention.
- Dealing with the scarcity of skilled SRE and DevSecOps resources, AIOps reduces the number of experts required to run critical services, which means SRE and DevSecOps engineers can focus on 'Infrastructure as Code' and self-service cases.
- 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 IT, AIOps can predict customer behavior and proactively deal with cyber threats, contributing to business resilience and growth.

TECH

- **Observability:** AppDynamics, Splunk Enterprise, Datadog APM, Sumo Logic, Dynatrace, 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
- **AWS:** AWS for Automotive, Telecommunications on AWS, AWS Energy, AWS for Health
- **Chaos:** ChaosIQ.io, Steadybit, VMWare Mangle
- **SRE & Application Operations:** PagerDuty, ServiceNow, FireHydrant, Honeycomb.io, Splunk On-Call, Buoyant.io

SIMPLY THE EDGE

BERND WACHTER
EXPERT IN RESIDENCE

Intelligent devices, at the 'edge' of central IT and close to operations and OT, 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. It's where cloud meets its edge cousins of 'mist' and 'fog'. Simply put, with IT infrastructure now turning into a genuine "infostructure," it's so much better than all the rest.

WHAT

- The emerging paradigm demands a new kind of talent – the IT-OT specialism in all facets of technology, with skills as well as the ability to credibly bridge capabilities across IT and OT domains.
- The infostructure, oiled by data, needs to be fluid, enabling data at the devices and sensors ('mist') to flow seamlessly to its periphery, at the edge ('fog'), all the way to the central cloud. This mix will enable a new generation of application services, solutions, and business models.
- The interfaces between Operational Technology (OT) and Information Technology (IT) keeps improving, easily connecting physical assets and devices to IT systems. It often happens in real time and is secured with zero-trust capabilities at the edge.
- The improved availability of high-quality, hyper-scale Industry Clouds – and edge services and 5G networks – enables new applications and solutions that were previously technically unfathomable at reasonable costs.
- Technologies such as TinyML and lightweight containers enable new business models in areas as diverse as household and wearables to industrial devices and onto installations, connected cars, and even professional healthcare.
- 'EdgeOps' will evolve to guarantee a secure, continuous delivery of up-to-date solutions and services up to – and beyond – the edges of the existing IT infrastructure to support AI, sensor-based applications, or control data.

USE

- **Bell** and **AWS** brought 5G Edge Compute to Canada, launching the country's first public Multi-access Edge Computing (MEC) with AWS Wavelength and Bell's 5G network. MEC provides the foundation for low-latency innovations, including real-time visual data processing, augmented/virtual reality, artificial intelligence and machine learning, and advanced robotics.
- **Siemens** and **NVIDIA** partnered to enable the Industrial Metaverse and increase the use of AI-driven digital twin technology. The partnership allows companies to develop innovative industrial IoT technologies, leverage actionable insights from analytics at the edge or in the cloud, and tackle the engineering challenges of tomorrow by making visually rich, immersive simulations.
- **Spacewerx**, the innovation arm of the US Space Force (USSF), collaborated with Wallaroo Labs to solve edge-computing challenges in space. Using Wallaroo's platform, USSF will be able to simulate AI and ML algorithms on edge computers in space and address key challenges, such as the comparative lack of compute capacity onboard a spacecraft when compared to terrestrial capacity.
- **P&G** and **Microsoft** worked together to digitize and integrate data from more than 100 manufacturing sites around the globe, enhance AI, machine learning, and edge-computing services for real-time visibility. P&G will use the partnership to create data-led improvements in the production of its baby care and paper products. Pilot projects are already happening in Egypt, India, Japan, and the US.
- **Nokia** partnered with OIV, a Croatia-based strategic communications company, to deploy a 5G private wireless network at AD Plastik's automotive component manufacturing facility. The network includes local edge computing, video services, and applications that will support digitalization and factory automation initiatives.

IMPACT

- The edge is where IT and OT continue to merge, helping to enable the intelligent enterprise and develop the Industrial Metaverse.
- Hyper-scalers are investing heavily in Industry Cloud solutions for manufacturing, utilities, and consumer products, which bring together sensory data, analytics, AI models, and cloud platforms to drive intelligence at the edge.
- There remains huge potential to use data to add even more value to physical products. Think, for example, of developments surrounding the use of customer-focused analytics, the creation of autonomous driving cars, and the evolution of next-generation artificial intelligence hardware.
- Intelligent IoT and edge services, such as sensors, smart devices, and meters, continue to shape the development of energy-efficient manufacturing plants, smart cities that optimize traffic movements, and so much more.

TECH

- **Building the edge:** AWS edge services, Azure private multi-access edge compute (MEC), Azure IoT Edge, VMware SD-WAN Edge, Verizon 5G Edge; GE Predix, Siemens MindSphere, Cisco Edge Intelligence, IBM Edge Application Manager, Eclipse ioFog
- **Scale with Distributed Cloud:** Google Distributed Cloud Edge, F5 Distributed Cloud Services, OCI's distributed cloud services
- **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:** KubeEdge, EdgeX Foundry, Akraino, Project EVE; Fraunhofer AIfES; Eclipse Foundation

SILENCE OF THE SERVERS

CORNELIA GÖRS
EXPERT IN RESIDENCE

Building highly automated, self-optimizing IT infrastructure platforms that are so entwined with business operations, they are 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 that operational business continuity fully entwines with IT operations, there is a reliance on intelligently automated, software-driven, 'zero-touch', evergreen 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 evolution, the vision of a truly invisible – and invincible - infostructure is near real. Worthwhile celebrating with a nice bottle of Chianti, isn't it?

WHAT

- As enterprises evolve to a product-oriented model leveraging agile and DevOps practices, multi-speed IT providing adaptive infrastructure platforms are required. These platforms must be composed of a variety of building blocks, including Infrastructure as a Service, Platform-as-a-Service, serverless computing, event-driven architecture, and container platforms – all driven via hyper-automation and code.
- To handle multiple product-team maturity levels across the enterprise, a just-in-time infrastructure platform capability is required. Rapid provisioning channels – including service request, a self-service portal, and infrastructure-as-code pipeline integration channels across multi-cloud and private cloud – are adopted. These channels are used to meet business demand for ever-increasing responsiveness, enabling location-independent operations.
- Site Reliability Engineering (SRE) reduces toil, avoids technical debt, balances reliability, and enables velocity, successfully driving IT operations for an agile, high-frequent, and resilient enterprise.
- An API-first 'Infrastructure as Code' approach that integrates AIOps and intelligently automated workflows. This effort leads to resilient, autonomous, hands-free IT infrastructure services that move as one with Technology Business operations – the Infrastructure Developer era has come of age!
- Adaptive governance as code is the paradigm, which enables organizations to use code to manage and automate various aspects of (cloud) governance, including cost, operations, security, and compliance. The adoption of this paradigm allows organizations to support the product-oriented enterprise.

USE

- The **University of Delhi** is using AWS to enable the adoption of Samarth eGov – an open-source, secure, scalable, and robust process automation e-governance platform that runs across India's universities and higher education institutions. AWS Lambda, a serverless, event-driven compute service, allows Samarth eGov to run code for virtually any type of application without provisioning or managing servers. And Amazon's Relational Database Service makes it simple for Samarth eGov to set up, operate, and scale its databases in the Cloud.
- **L'Oréal** invested heavily in Google Cloud's serverless and data-tooling solutions to support the Beauty Tech Data Platform, which underpins the French cosmetics giant's business operations.
- **Deutsche Telekom** selected Netcracker Service Orchestration to automate its B2B services across multivendor software-defined WAN, LAN, and Wi-Fi (SD-X) environments. With Netcracker Service Orchestration, Deutsche Telekom benefits from simplified and autonomous B2B operations, mirroring a similar approach in its core and transport domains. Provisioned services use zero-touch provisioning and automated lifecycle management and assurance.
- **US Air Force's Kessel Run** selected Rancher Government Solutions (RGS) to provide Kubernetes Support Services that will accelerate digital transformation at the Air Force's IT Life Cycle Management Center's Digital Directorate. RGS will provide support for platform development and operations, applications development, SRE, cybersecurity, and IT support and operations.
- **Deutsche Bahn's** DevOps operating model leverages GitOps to transform rail IT and software delivery across more than 50 software development teams.
- Retailer **Schwarz Group** is using Red Hat's Ansible Automation Platform to introduce controlled, efficient self-service capabilities in an attempt to deploy innovative digital services quickly and to stay competitive.

IMPACT

- Customer-centric culture is a core focus across organizations, as is employee centricity. Successful front-end experiences are intrinsically integrated with back-end business and IT operations.
- Career advancement in operations has moved away from single domains, driven by workloads and technical skills, and toward a path that emphasizes multiple competencies, the ability to train and collaborate with AI bots, and continuous learning agility. This path challenges traditional hiring practices in IT operations and requires strong collaboration with HR to determine skills requirements, job scope, development, and recruitment plans for new hires.
- Service management, which is delivered in real time and is adaptive, runs on top of automated and orchestrated IT operations, covering areas such as event aggregation and correlation and major incident management. Service management is also delivered across multi-cloud platforms.
- The optimization of IT platform operations means scarce physical resources can be optimally managed, reducing energy consumption, and transport and housing requirements – and contributing to a zero-carbon mission.

TECH

- **SRE:** Google, State of DevOps, blameless
- **Zero-Touch:** Android zero-touch enrollment, ETSI ZSM, BetterCloud, ZTP Tool
- **AIOps:** AIOps Service Management
- **SASE architecture:** CISCO, SASE Architecture Reference Guide
- **Governance as Code:** Open Policy Agent, Stacklet Platform
- **3D internet:** NVIDIA Omniverse Platform
- **GitOps:** Argo CD, Flux, Faros, Guide to GitOps

BALANCE BY DESIGN

PATRICE DUBOE
EXPERT IN RESIDENCE

"Righting the technology" is all about finding and preserving the right balance: balance between the interests of various stakeholders, between short and long term, centralized and decentralized, friendly and authoritative, purposeful and spontaneous, value-rich and frugal, expanding and sustainable. Besides the WHAT of technology trends, TechnoVision also provides a view of HOW to shape this balance within the organization – by purposeful, right design. The Balance by Design principles 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 to apply the principle on a continuous basis, and **the openings** propose the potential first steps for any organization, like the opening moves of a chess game.

As always in TechnoVision, the first design principle reflects the overall theme of this year's edition. **Do Good, Do Less, Do Well** is highly relevant because sustainability is at the top of corporate agendas and scarcity of everything is a dominating economic factor. The theme suggests doing the "right" things in terms of activities that contribute to societal good, but also to "right" the technology that enables it. So, say "Yes" to initiatives that create a positive, purposeful impact, and say "No" to activities that are energy-wasting or non-essential. Striking the right balance will make the organization thrive as never before.

Then the ever-crucial **Technology∈∋Business** (pronounced as "Every Business is a Technology Business") principle makes a 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 the "water-like" capabilities described in earlier TechnoVision editions to seamlessly adapt to whatever changing circumstances might occur inside and outside the organization. Hence, Adapt First is still 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** can transform your platform into a true business magnet.

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.

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

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.

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

BALANCE BY DESIGN

Do Good,
Do Less, Do Well

Technology ∈∋ Business

Adapt First

With Open Arms

IQ CQ EQ Up

Trust Thrust

No Hands On Deck

DO GOOD, DO LESS, DO WELL

MICHIEL BOREEL
EXPERT IN RESIDENCE

THE PRINCIPLE

Make the organization thrive by saying "Yes" to initiatives that create a positive, purposeful impact, and saying "No" to activities that are energy-wasting, non-essential or non-ethical.

You can't have it all. Not everything that is technologically possible is socially desirable. As tempting as Technology Business initiatives might 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 purposes. 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 technological demands 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 CO_2 emissions. Indeed, current estimates state that 3.7% of global CO_2 emissions come from IT. If the IT industry was 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 but to also be purposeful and offer a positive societal benefit that serves the wellbeing of all stakeholders. Time to contribute: refrain from hoarding 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 sustainability footprint. Check your as-is, include 'built-in' CO_2 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 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 these factors 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 Good, Do less, Do Well to your top three current developments.

TECHNOLOGY ЄƎBUSINESS

ROBERT KINGSTON
EXPERT IN RESIDENCE

THE PRINCIPLE

Move from alignment to unity of business and IT, creating a seamless Technology Business of 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 responsiveness, speed, and adaptability needed to thrive in today's Technology Business context does 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, connected as one, 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 that think of creating experience and outcomes – with a potentially unlimited lifecycle, guided by shared budgets and tangible business value streams. Technology becomes more democratized – then internalized – as all involved 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 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 innovative technology enables them.

ADAPT FIRST

THILO HERMANN
EXPERT IN RESIDENCE

THE PRINCIPLE

Move adaptability from afterthought to prime time.

Being like water: still 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, ensuring 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 happen. Opportunities will arise. Change will come, often in unexpected, unplannable ways. Adaptability is essential to deal with these challenges. In a Technology business, a business's agility largely depends on its technology agility, but it is way too late to only change systems once the need arises. Systems must be built by design to deal with disturbance and change. A variety of technologies enables this adaptability, from 'mesh' API services and self-improving IT operations to open data sharing and autonomous systems. Adaptability is also about the mindset: the Technology Business context will always, routinely, shift, break and change. Only come to action when it occurs, and you get 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 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's 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 from 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, and 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.
- Become irresistible to the scarce human resources out there – not just by providing security and comfort, but by offering a great balance between work and life.

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- and AI-powered enterprise, every initiative should increase the corporate IQ, noticeably through new knowledge, insights, and algorithms. Also, AI now increasingly generates new, unique content from organization data, bolstering 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. Data is shared – both inside and outside the organization – for specific purposes, and to foster better, fact-based decisions and actions. 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 creative thinking 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

1. **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.
2. **Activate data** through insights, algorithms, and AI – focusing on putting data at the very core of business strategy, objectives, and daily operations.
3. **Take advantage of data**, applying a systematic framework to identify external (and possibly internal) monetization opportunities for corporate data assets.
4. **Unleash human creative energy** by scanning data for creative potential, building new content, or augmented innovative products and services through generative AI.
5. **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.
- Consider technology solutions that help monitor, analyze, and improve the commitment and motivation of humans involved in all transformation initiatives.

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 imperative. It must permeate business and technology operations alike. And trust us on this one: when applied well and proactively, it also becomes an innovative business accelerator.

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. Trust 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 narratives.

5. Use the organization's built-up trust as a differentiating quality towards the wider business ecosystem, clients, consumers, and potential employees.

THE OPENINGS

- Expand the solutions development teams to include experts in 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.

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 the 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

1. **Transform** your IT automation platform into a fully connected **business operations platform**, bringing together all underlying business events.
2. **Mine your processes:** Insights enable action; by capturing and analyzing process data, you find the best opportunities for breakthrough automation.
3. **Challenge the heritage:** Even the most established business rules and best practices should be reconsidered for relevance in the era of autonomous systems.
4. **Think autonomy levels:** Like the five levels of autonomy for self-driving cars, you can apply different ambition levels in the move towards a hands-free enterprise.
5. **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 might 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

"The future will soon be a thing of the past." No, not a quote by Benjamin Franklin this time (it is from stand-up comedian George Carlin, actually). But how soon is soon, exactly? We live in a world that can literally change overnight – in society and economy; most definitely also in technology. TechnoVision is designed to be forward-looking, and actionable: we focus on innovative technology trends and drivers that are already applicable and can deliver value now. Then again, we would not like the future to turn into the past without being noticed. So – as a final note – here are a few innovative areas that we believe will profoundly shape the technological and societal horizons. Maybe not this year, but soon, very soon.

SYNTHETIC BIOLOGY

Advancements in synthetic biology change (our relationship with) nature, the living world, and even ourselves. Scientific progress enables reading, writing, editing, and evolving the fabric of life with ease and precision. In fact, "we can now program biological systems like we program computers" (Amy Webb and Andrew Hessel, co-authors of *The Genesis Machine*).

The societal importance of synthetic biology is eminent by more than one Nobel prize. Unlike ever before, we can redesign organisms for scientific or commercial interest and open doors to fight climate change, biodiversity decline, and challenges to public health. Indeed, synthetic biology might change how we grow food, what we eat, and where we source materials and medicine.

But when do we go too far? And when should life be kept untampered? Synthetic biology is no longer exclusive to academics and is rapidly becoming a business opportunity. It is an area – just like AI – where yet unchallenged ethical considerations will need to be addressed intensively. As we learn to engineer the living world, let us decide the kind of world we want to live in.

QUANTUM COMPUTING

As we state in one of our recent 'Conversations for Tomorrow' editions, quantum technologies promise exponential speed-up vis-à-vis the best available supercomputers, tamper-proof communications, and ultra-precise and fast measurements – a phenomenon commonly known as the 'quantum advantage' – over classical systems that are in use today.

Such technologies can bring a significant shift in the way in which businesses solve problems around optimization, mechanical simulation, and machine learning. Quantum can bring greater efficiencies than current technologies in areas as diverse as risk management, cybersecurity, logistics, operations scheduling, the discovery of lightweight materials or new drugs, and addressing climate change.

Quantum technology promises to revolutionize industries eventually, but are expectations realistic in the near term? In the past two years, we have seen a spur of start-ups with hundreds of millions of dollars in pre-revenue valuations.

Now that the economy seems to be slowing down, venture capital investment in technology is decelerating. Do we have to reset our expectations? Although a quantum advantage is on the horizon, its commercial value is yet uncertain. Undoubtedly, the full benefit of quantum computers will need large-scale, error-corrected systems, which still require considerable investments.

Nonetheless, quantum computing is no longer a distant fantasy. The next few years will show us who has the power to reach the next step of scaling. Are you ready for the quantum decade, the moment it begins?

CLIMATE TECH

We made it abundantly clear in our TechnoVision 2023 edition that technology is key in battling the negative impacts of climate change. In Capgemini's Climate AI research, we analyzed over 70 AI-enabled use cases for climate action, many offering significant benefits for organizations in terms of reduced greenhouse gas (GHG) emissions, improved energy efficiency, reduced waste, use less water. Examples include tracking GHG emissions and tracing GHG leakages at industrial sites, improving the energy efficiency of facilities and industrial processes, designing new products with less waste and less emissions, improving demand planning and reducing wastage of food products and raw materials, and route optimization and fleet management for retail, automotive, and consumer products firms.

But there is so much more potential. The world is ready for Climate Tech (or as some prefer to call it, 'cleantech 2.0'): the next wave of technologies that will help to decarbonize the global economy in the coming decades.

Soaring energy prices, a planet on fire, and geopolitical instability make breakthroughs in technologies ever-more desirable. In the first decade of this century (arguably driven by the release of Al Gore's *An Inconvenient Truth*), investors put billions into 'cleantech', unfortunately, with dismal results as expectations were inflated, technology wasn't at a sufficient stage of maturity, and R&D activities took longer than expected or desired.

It is only in recent years, fueled by the Paris Agreement, that a wave of resilient and realistic climate technology has entered the market. Climate Tech has now begun to make economic sense. Solar and wind are cost-competitive or even outperform the fossil fuel industry. Smart-grid networks are starting to replace aging, carbon-intensive energy networks. Industries are looking at radically new ways to become cleaner. Battery and energy storage may finally reach the performance levels that are needed, for example, to make decarbonized transport the norm. Intelligent buildings will make much smarter use of energy and reduce their CO_2 emissions considerably.

Climate Tech is evolving rapidly, projected to reach its full leverage in the next decades. A greener world might be ahead as a result. But will it be delivered fast enough?

CREATIVE AI

In our previous edition, we flagged generative, creative AI as a rapidly evolving technology area. And we have seen some fascinating breakthroughs in recent times: from well-articulated, informed panel discussions between several AI language transformer models, to Microsoft releasing the formerly privately accessible Dall-E image generator to the public, followed by the emergence of MidJourney, Stable Diffusion, and the much-debated chatGPT.

Creative AI is potentially an inclusive technology because it will enable more people to express themselves, even if they did not have the means or the specialized skills to do so in the past. It will also provide additional augmentation to even the most intellectually demanding work, yet another way to deal with the scarcity of experienced and talented professionals. Although training creative and generative AI models requires a lot of energy and additional resources, the good news is that – once trained – these models only show a minor appetite for more.

With all of this, a new capability area is rapidly emerging: being able to articulate exactly the right intentions (often referred to as 'prompt engineering') can make or break what a generative AI system delivers. It stipulates the need in the future to dive deeper into how humans can most effectively communicate and collaborate with their AI companions.

As you may have noticed by now, all beautiful visualizations in this edition have entirely been generated by AI, prompted and overseen – of course – by our human designers. We are confident that the actual trends content of future TechnoVision editions will also be co-authored by AI systems, with 'creative machines' such as chatGPT being only at the beginning of their potential. How soon exactly will that be? Stay tuned. The future can become *a thing of the past* much, much sooner than you think!

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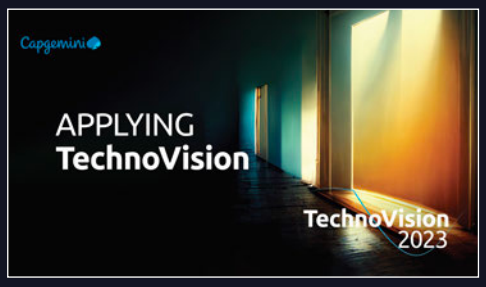
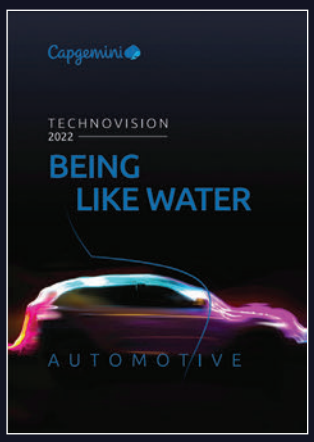
ADDITIONAL TECHNOVISION DOCUMENTS



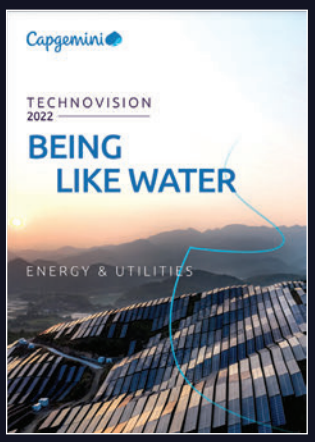
Applying TechnoVision

Overview For Business Decision Makers

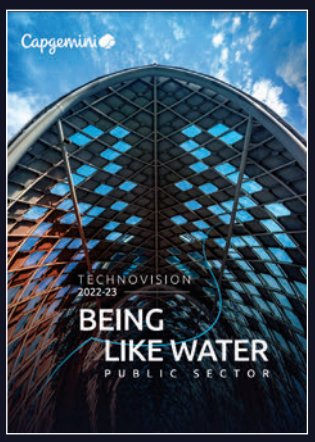
Financial Services Playbook



Automotive Playbook



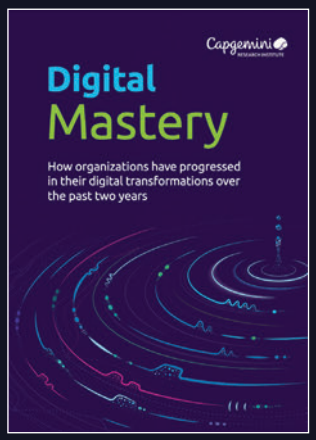
Energy And Utilities Playbook



Public Sector Playbook

FURTHER RESEARCH

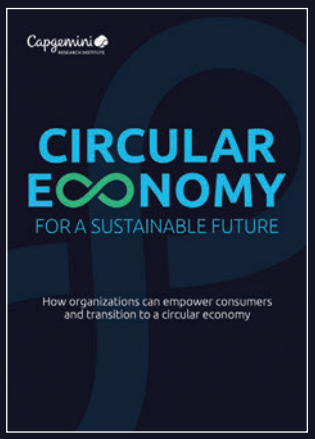
Conversations for tomorrow



Digital Mastery

Next destination: Software

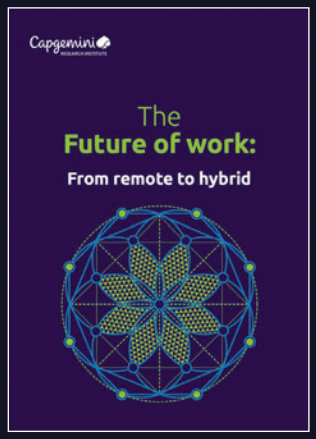
Data-powered Innovation Review



Circular Economy for a sustainable future

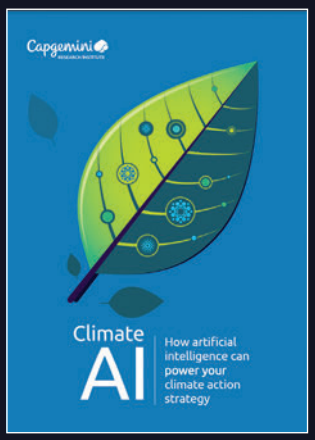
The Data-powered Enterprise

Data Mastery

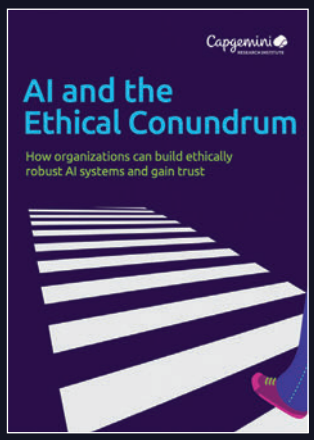


The future of work

Sustainable IT

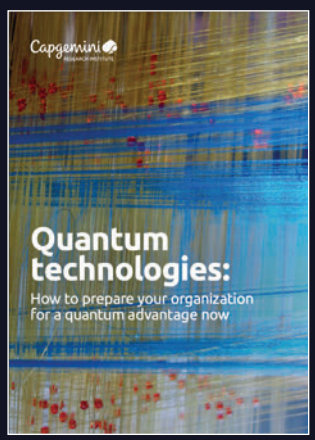


Climate AI



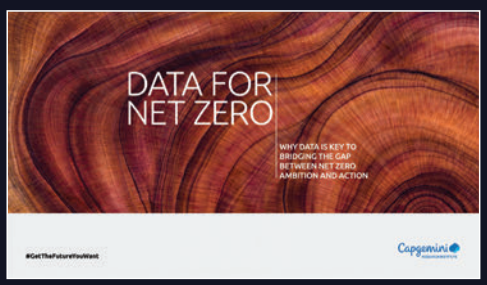
AI and the Ethical conundrum

Sustainable Operations



Quantum technologies

A world in balance



Data for Net Zero

About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 350,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2021 global revenues of €18 billion.

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