LARS THINGGAARD &
JIM HAGEMANN SNABE

TECH
FOR
LIFE

PUTTING TRUST BACK
IN TECHNOLOGY

"*Tech for Life provides us with the
mental warehouse to regain trust in
our future using technology as the
catalyst for positive change.*"

KLAUS SCHWAB
FOUNDER & EXECUTIVE CHAIRMAN,
WORLD ECONOMIC FORUM

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Foreword

By Thomas Madsen-Mygdal

Throughout history, technology has been a powerful engine for advancing society, greater prosperity, empowerment of individuals, and health. From the wheel to the printing press, the steam engine to the antibiotic, the historical timeline of technological development is inseparable from advances that have benefited humankind and changed our world for the better.

Today, gene sequencing allows us to identify and address genetic abnormalities, supporting efforts to make congenital diseases things of the past. Advanced modelling of the environment made possible through computing power unknown only five years ago gives us deeper insight into the climate changes that are transforming our planet. The devices in our pockets connect us to others around the world in ways unimaginable but a couple of generations ago.

It is for these, and countless other reasons, that technology has always had the potential to be an even greater force for good. It is only through technology that we may answer pressing questions about our planet and address the pressures placed on our environment, societies, economies, and systems of governance.

Yet we now find ourselves not so much at a crossroads, but already going down a path that isn't as well-lit or clearly marked as we, the creators and users of technology, would like.

It has become increasingly apparent in recent years that the same technology with the potential to improve our lives dramatically, is open to abuse, misuse, and malicious intent. The same social media that connects us to others allows bad actors to share fake news. The freedom of speech that the internet was founded upon provides space for extreme opinion and hate speech. And, if we are always-on, how, where, and when do we escape the pressures of constant communication?

Historical perspective also reveals how many of the noble uses to which technology has initially been put have given rise to unforeseen and unwelcome consequences. If oil was the commodity that, above all others, drove economic growth in the twentieth century, then data is its twenty-first-century equivalent. Yet we are right to be concerned about the ownership of our personal data, which we have handed over in return for access to technology that saves time and adds convenience in our busy lives. However, when we allow big tech to mine our data for profit and track our every move through the apps that we use, is it really in our best interests?

All the while, technological development continues to progress at an unprecedented rate. Artificial Intelligence plays an increasingly important role in our lives, governing everything from loan applications, to the flow of the traffic in our streets, or the type of stories that appear in our news feeds. Ethical considerations around any inherent bias in AI, for example, or our ability to oversee the decisions that machines are now making, have typically emerged after the event, if at all.

Yet these debates are essential if we are to ensure that technology is to progress in a way that serves humankind, and not the other way around. Sustainability, purpose, and trust must be at the very heart

of technological development if it is to transform our lives for the better.

It is for this reason that The Copenhagen Letter emerged at the inaugural Techfestival in 2017 (copenhagenletter.org). It was the agreed outcome of a meeting of 150 technology professionals from a wide range of disciplines and more than 40 countries who came together for 48 hours to reflect and set a new narrative and direction in the technology world. It determined that a range of voices from across the technology industry, and not simply the usual tech giants, should be heard.

The Copenhagen Letter is raw. There was no established language. Its message was bold and challenging: "It is time to take responsibility for the world we are creating. Time to put humans before business. Time to replace the empty rhetoric of 'building a better world' with a commitment to real action. It is time to organize and to hold each other accountable."

Whether they create, develop, or harness technology, few would find fault with such a goal. Most would agree that it's less an ambition, and more a natural response to the unrestrained development of technology and how the monoculture of Silicon Valley shaped the world globally. But I recognize that acting on the letter's demand for "real action" is a challenge for all of us.

What we who work in technology and all of those who make decisions on technology need, therefore, is practical advice to put one foot in front of the other and start acting – precisely the type of guidance that *Tech for Life* provides. This book shows how we can create and use technology in a sustainable and responsible way. It reveals the small steps that organizations can take – right now – to

make an immediate difference. And it places these steps on a defined path that allows easy progression towards broader responsibility.

Of course, meeting the goals established in The Copenhagen Letter provides leaders with a new and profound challenge. If we are "to leave our garden patch a little greener than we found it", it will require leaders who embrace open innovation and redefine the purpose of their organizations to ensure that trust, sustainability, and profit remain in balance.

So, *Tech for Life* not only aims to provide practical guidance but seeks to inspire leaders in the world of technology. It should give them hope for a future in which technology works *for* humanity. It will provide them with the tools to capture the momentum at which technological development is progressing and channel it into developing, creating, and managing technology, now, and for generations to come.

Thomas Madsen-Mygdal
Founder of Techfestival

Introduction

In *Tech for Life* we draw on our own experiences in working in technology-led industries, the experiences of the many people we have quizzed and interviewed about technology over time, and our experience in working with Scandinavian management models.

A book, especially in this technology age, is not an end point, but a starting place; an ignition point for a continuing debate about the role of technology in our lives and how we can best put it to work for today and for all of our tomorrows.

We met for the first time in 2008. As the CEO of Milestone Systems Lars invited Jim for a meeting to discuss a role on the board. At the time Milestone was looking for people who could help the company accelerate its global expansion. "With my packed agenda at SAP I knew that I would become a bottleneck – and Milestone Systems needed a catalyst," remembers Jim.

We continued our efforts independently. We both experienced the tremendous value of technology and shared a strong optimistic belief that technology is a force for good, solving many of the problems of the world.

Little did we know that our introductory meeting in 2008, followed by a number of casual conversations when meeting at various conferences in the years to come, would inspire us to work together. Not in the context of a board role at Milestone Systems, but as co-

authors of a book pivoting around the common notion we share that technology should be used for the good of individuals, organizations and humanity.

Like many people, our careers are embedded in technology. Lars worked in finance and consultancy early on in his career – at Arthur Andersen and later Price Waterhouse. He went on to co-found his first technology startup in 1993. This experience gave Lars a fundamental understanding of the power of technology – and built on his early programming skills. For the next couple of decades, Lars was involved with a number of startups and exits until he began his assignment with Milestone Systems around the turn of the millennium. Milestone Systems was to become the global number one provider of software for the video security industry. In this capacity Lars experienced what we describe later as "unintended consequences" in the use of technology. This opened his eyes still further to the much-needed balancing act when building and using technologies. This focus became even more apparent when Milestone Systems was sold to the Japanese conglomerate Canon in 2014:

> "If there is one thing I learned from working more closely with the Japanese culture, it is the notion of long-term planning. It does not mean that the short term is not important, but to view centuries ahead gives another -- and more often sound -- perspective".

Jim has spent his entire career in technology. He was fortunate to get a job as a trainee at SAP in 1990. For more than 25 years he experienced how technology made businesses run better and created value for shareholders:

"I remember the first moment when it occurred to me that technology also had a dark side. It was back in January 2011 at the Annual meeting in Davos organized by the World Economic Forum. I was new in my role as co-CEO of SAP and I found myself in a meeting with the leaders of the biggest tech companies in the world. We were discussing the impact of technology. Someone asked the question: Are technology companies killing more jobs than we create? I remember that I was a bit surprised about the question. At SAP I had seen the company grow from a few thousand people to more than 50,000 people within 20 years, so I naturally assumed that technology companies were creating jobs and increasing the productivity of companies. Later we discussed topics like cyber security and privacy. During the meeting it became very clear to me that while technology is a strong force for good, there are significant consequences associated with the digitalization of our world and lives, consequences which we have to understand and master. When Lars asked me to join his project "Tech for Life" it was an easy decision. I was thankful for the opportunity to dig deeper into the risks associated with technology and explore possible solutions in collaboration with Lars and his team."

Writing *Tech for Life* has without doubt been a collaborative venture. We have drawn on our own experience, but also the experience and actions of others, to inform and form our thinking.

It takes a deliberate effort prioritizing ideas, being challenged about them and working alongside a group of people who believe in your project. Many thanks to all those who were kind enough to read the beta copy of *Tech for Life*. Your insights, feedback and support were

invaluable. This agile way of working allowed us to build on our ideas and we sincerely thank everyone for their time.

In particular, we would like to thank Mark S. Wilson. Mark had the wisdom and skill to understand our intentions and his confidence, support and encouragement have endured through multiple iterations. Mark is a great sparring partner, he asked questions, coached us to tell our stories, and pored through hundreds of documents.

Further in developing on our ideas the Thinkers 50 team led by Stuart Crainer and Des Dearlove has been instrumental in the process together with James Tate and Jenny Morris from the Henley Group. Denmark's Techfestival was, of course where the kernel of the idea began. Thomas Madsen-Mygdal receives our thanks for paving the way and demonstrating courage in challenging the world to be accountable for its actions and writing the foreword to this book.

Along the way we have also received impeccable review and design input from a group of people close to the World Economic Forum. First and foremost, Klaus Schwab the founder of the World Economic Forum and author of *The Fourth Industrial Revolution*. His commitment to improving the state of the world has been a guiding vision for our project. Also, Murat Sönmez, who heads the Centre for the Fourth Industrial Revolution at the World Economic Forum, has been instrumental for us in understanding the true impact of technology and the challenges associated with creating agile policy frameworks to maximize the value and reduce the risks associated with technology. Marc Benioff the founder of Salesforce has in his capacity as the founding partner of the Centre supported our vision to make technology a force for good. And finally, we owe a special thanks to Subi Rangan, Professor at Insead and founder of the

Society for Progress for his feedback and guidance and Loubna Bouarfa from Okra in directing our sometimes simple technological minds towards the healthcare side of life.

Our project would not have come to fruition without all of you taking the time to help when asked. For this we are very humble and appreciative – always!

Lastly, to future generations – we thank you for giving us the motivation to make a change, right now. No more waiting. Technology is a wonderful, exciting thing – and we want it to remain so. We hope to pay you back for your motivation by inspiring you to lead technology in a direction where it becomes a strong force for good – or as we call it: Tech for Life.

As the latest wave of technology comes of age, and society begins to experience its long-term impact, the global Tech for Life movement this book entertains asks: "What can we do to positively shape our future through the use of technology, and make tech a force for good?"

Tech for Life exists to champion the responsible use of technology, and advocates for its creation and shaping in such a way that it supports society's needs and drives positive behavior. Tech for Life is about understanding and exercising that responsibility in ways that help make the world become a better place.

Let's be clear: we are realists, experienced in the pragmatic world of business. In the future economy, we believe, for companies to sustain growth in the long term, tech leaders, users and influencers must optimize their organizations to bring back the balance between not one, but three bottom lines: **profitability, sustainability** and **trust**.

This will ensure the responsible use of technology so that it continues to transform our lives for the better.

The story behind Tech for Life goes back to the northern summer of 2017 when 150 technology professionals came together in Copenhagen for 48 hours during the first year of Techfestival. They included technologists, designers, philosophers, educators, and artists. What united them was their deep-seated concern about the future of technology and its impact on humanity.

That meeting gave rise to what became known as the Copenhagen Letter on Technology. When it was posted online more than 5,000 people signed the Copenhagen Letter. (It is included at the end of the book.) Its co-authors and prime movers included technology industry leaders not just from Denmark and Scandinavia, but from around the world. It was the start of a conversation about the values and principles that guide technology, and marked the start of the Tech for Life movement, adding what we hope is a fresh and vital voice to the technology debate. Most notably, it established that the future of technology and the expectations of the technology industries will be shaped by responsible leaders worldwide rather than simply by a few tech giants.

The message was blunt. It is time for individuals and organizations to take responsibility for the world we are creating. Time to put humans before technology. Time to replace empty rhetoric with a commitment to real action. It is time to organize, to lead, and to hold each other accountable.

We believe passionately that the development and commercialization of technology must have a purpose which goes beyond simply money making. Now, to be clear, we are commercial beings. We work in organizations which need to make profits. But profit-

making in itself is not enough. There is, always was, and always will be, more to organizations than that.

With that in mind, Tech for Life's core principles are:

- Technology must make a positive contribution to society
- Technology must enhance the lives of its users
- Technology must create opportunities for all
- Technology must respect and enhance human rights
- Technology must be human-centered at all times.

We believe every organization needs to aspire to do more; to solve problems which are relevant to people in their daily lives; to change the world; to make a positive and sustainable difference.

As we finalized this book, the world was in the grip of corona virus. Cities and entire countries were in lockdown. One of the clearest messages from this dark time was the enormous community and life sustaining power of technology. As never before, technology brought people together and kept people alive. Its centrality to modern life was abundantly and thankfully clear.

We know that change, when it comes, often comes in small incremental steps rather than through grand gestures. "The world is fundamentally transforming technologically, economically, socially and politically," says Klaus Schwab, founder and executive chairman of the World Economic Forum (WEF), as well as one of the most persuasive voices on the leadership required for Tech for Life, and what he labels the Fourth Industrial Revolution:

> "The ongoing transformation needs to be shaped by appropriate policies and institutions. There are no simple, ready-made solutions. What we urgently need are pragmatic and

future-oriented actions, even in the form of small steps, to provide positive narratives."

In this spirit, this is not a book of answers, but of questions and the beginning of discussions which we hope, in time, will provide compelling and practical answers. And, of course, there are many others asking questions in a similar vein. In particular, we salute the work of Subramanian Rangan and the Society for Progress and Murat Sönmez of the World Economic Forum's Centre for the Fourth Industrial Revolution.

The questions of our time are three:

- How do we use data without losing privacy?
- How do we use platforms without creating monopolies?
- How do we use AI without losing trust and control?

In this spirit, we invite you to respond to the issues and questions we raise in *Tech for Life*.

You can do this in a number of ways. Our website – techforlife.net – has a comments section, and we will hold regular Tech for Life events to carry on the conversation. Join our community to participate in the dialogue and receive regular updates.

Full details of the Tech for Life movement can be found at the end of this book.

For now, join us as we explore where technology has come from, where it is at, why it must change, how it must change, and what needs to be done. And, most importantly, what you can do.

For all the doubts we have, the major issues, which need to be resolved, and the changes needed among policy makers, business

leaders and entrepreneurs, we look forward to creating technology, which will positively shape all of our futures. It can and must be done.

Lars Thinggaard & Jim Hagemann Snabe
Copenhagen May 2020

PART 1 – TECH REVOLUTIONS

The ultimate Tech Age

Two hundred years ago in the throes of the first Industrial Revolution, the north of England was home to a vociferous and often violent group of discontented textile workers. They were called the Luddites.

The Luddites attacked the machinery which was endangering their livelihoods. Without the power of universal suffrage, it was the sole form of protest, which they thought would attract the attention of the powerful in business and government. They were right. At one point, the British army had more soldiers dedicated to dealing with the Luddites than it had actively engaged in the Iberian Peninsula fighting in the Napoleonic Wars. Protestors were punished harshly. Some were shot, some executed, others imprisoned and deported. The movement flickered and quickly died.

The Luddites did not blindly oppose technological advancement – though that is what the term is now largely understood to mean – but simply felt powerless in the face of progress. Destroying machinery was, they believed, their only viable course of action. They simply wanted some power at the negotiating table. This was described as "collective bargaining by riot" by the historian Eric Hobsbawm.[1]

The Luddites of northern England were not unique. Soon after, French tailors launched violent protests against Barthélemy Thimonnier, the inventor of the sewing machine.

Similar protests are footnotes throughout technological advancement. More recently, there is Neo-Luddism, which describes itself as "a leaderless movement of passive resistance to consumerism and the increasingly bizarre and frightening technologies of the Computer Age."[2]

Such movements are founded on fear. For those involved, the fear is genuine and grounded in their experience of reality. But, fearful footnotes should not divert us from the universal narrative: technology is the animating spirit of progress in all forms of human life and endeavor. Genies cannot be put back into bottles. What has been discovered cannot be undiscovered.

We live in an era distinguished by wide-ranging and rapid technological progress. Software is the technology at the core of this. Software code now lies behind virtually every business. It is the lubricant of the tech growth engine. And what an engine! Every single day 2.5 quintillion bytes of data is generated globally. Ninety percent of the data in the world has been created in the last two years.[3] There is more and it is coming quicker than ever before. The time it takes a medium or technology to reach 50 million people is speeding up: radio, 38 years; television, 13 years; the internet, four years; Facebook, 3.5 years; Instagram, six months; Angry Birds, 35 days.[4]

Look around.

Artificial intelligence (AI) is changing the world. The creation of intelligent machines, allowing for speech recognition, facial recognition, problem-solving, machine learning, autonomous robots and

much more is rapidly expanding what we can achieve. Machine learning in particular, where massive amounts of data can be processed by ever increasing computational power to find patterns not discernible to humans, is pushing the boundaries.

Originally coined in 1955 in a research proposal by John McCarthy at Dartmouth College, the term "artificial intelligence" was to encapsulate the "study and design of intelligent machine." Machines which could learn from their environments, build up their own knowledge, and solve problems in their own way. The official start of the field is generally agreed to be 1956, when the project in the research proposal was set in motion.

Since artificial intelligence emerged in the 1950s, innovators and researchers have filed applications for nearly 340,000 AI-related inventions and published over 1.6 million scientific publications. AI-related patenting is growing rapidly: over half of the identified inventions have been published since 2013.[5]

Stanford University's AI Index charts some of the developments in AI.[6] They are astonishingly many and varied. In recent years we have seen these milestones:

- In 2016, the error rate of automatic labelling of ImageNet declined from 28 percent in 2010 to less than three percent. Human performance is about five percent.
- In March 2016, the AlphaGo system developed by the Google DeepMind team beat Lee Sedol, one of the world's greatest Go players, 4–1. DeepMind then released AlphaGo Master, which defeated the top ranked player, Ke Jie. And then AlphaGo Zero used self-generated data and with three days of data beat the original engine (AlphaGo Lee) 100-0.

- A 2017 *Nature* article described an AI system trained on a data set of 129,450 clinical images of 2,032 different diseases and compared its diagnostic performance against 21 board-certified dermatologists. Researchers found the AI system capable of classifying skin cancer at a level of competence comparable to the dermatologists.
- In 2017, Microsoft and IBM both achieved performance within close range of "human-parity" speech recognition in the limited Switchboard domain.
- A Microsoft machine translation system achieved human-level quality and accuracy when translating news stories from Chinese to English. The test was performed on newstest2017, a data set commonly used in machine translation competitions.
- In 2018, Google developed a deep learning system that can achieve an overall accuracy of 70 percent when grading prostate cancer in prostatectomy specimens. The average accuracy of achieved by US board-certified general pathologists in study was 61 percent. Additionally, of ten high-performing individual general pathologists who graded every sample in the validation set, the deep learning system was more accurate than eight.

The AI story is constantly unfolding. As we were writing, Microsoft invested $1 billion in OpenAI, the Elon Musk founded initiative looking into the transparency of algorithms. The share of jobs requiring AI skills has grown 4.5 times since 2013 and machine learning, deep learning and natural language processing skills are now the three most in-demand on the job site Monster.com.[7]

Perhaps one of the most significant developments in AI in recent years has been the increased investment announced by both govern-

ments and industry. The UK government has committed to spend £1 billion; France 1.5 billion euros and Germany three billion euros. In the corporate world, Alibaba announced plans to invest $15 billion and SoftBank's Vision Fund is focusing much of its $100 billion on AI. (The disparities in the size of governmental and corporate AI investments appears to make it clear where the tech power now lies.)

In June 2018, the European Commission announced a Digital Europe program with a budget of 9.2 billion euros for 2021-2027. The program focuses on advancing AI technology and ensuring the use of AI across the economy and society. The EC also proposes to develop common "European libraries" of algorithms that are accessible to all.

Elsewhere, China aims to triple its annual production of industrial robots to 100,000 by 2020, compared with fewer than 33,000 in 2015.[8] The country also intends to sell more than 30 billion yuan ($4.6 billion) worth of service robots by 2020 amid surging demand in the health care, scientific research and domestic service sectors.

The next stage for AI is, according to the management consulting firm Accenture, likely to be "explainable AI". "Some AI-based services and tasks today are relatively trivial – such as a song recommendation on a streaming music platform," says Accenture:

> "However, AI is playing an expanding role in other areas with far greater human impact. Imagine you're a doctor using AI-enabled sensors to examine a patient, and the system comes up with a diagnosis demanding urgent invasive treatment. In situations such as this, an AI-driven decision on its own is not enough. We also need to know the reasons and rationale behind it. In other words, the AI has to 'explain' itself, by opening up its reasoning to human scrutiny. Explainable AI

won't replace people, but will complement and support them so they can make better, faster, more accurate and more consistent decisions."[9]

People plus AI is the new agenda. Freddy Lecue, Explainable AI Research Lead at Accenture Labs, says: "The future of AI lies in enabling people to collaborate with machines to solve complex problems. Like any efficient collaboration, this requires good communication, trust and understanding."

Manufacturing is being revolutionized. We are now in the early stages of an era of business transformation that could rival the impact of the Industrial Revolution, but will rise this time from innovations in 3D printing, the biggest leap in manufacturing innovation since the assembly line. The strategy professor Richard D'Aveni (who coined the phrase "hypercompetition" in the 1980s) anticipates that technology will reinvent business competition and give rise to a new kind of giant company, the *pan-industrial* (Jabil, Siemens and United Technologies are among the top contenders), which will dominate the global economy and drive far-reaching social, political, and economic change.

On the factory floor, "cobots" are being called on to work alongside – collaborate with – their human colleagues. Small, flexible and easier to program than many traditional manufacturing robots, they bring automation into new areas.

Additive manufacturing is on the march. Lockheed Martin has a patent for the additive manufacturing of jet airplanes so that one day a country will be able to print an air force on the spot for just-in-time defense. Arizona-based startup Local Motors has developed a 3D printed minibus called the Ollie. Ocean Learning Center,

founded by Fabien Cousteau, grandson of underwater explorer Jacques Cousteau, is testing 3D printing of artificial coral reefs. HTC is already producing 15 million 3D printed cell phone antennas a year. Adidas is using 3D printing and robotics to make tens of thousands of advanced running shoes. Chinese construction company Huashang Tengda unveiled a 3D printed earthquake-proof "luxury villa". Jabil Inc., a Florida-based manufacturing services company, has built a digital platform, connecting scores of factories around the world into an optimized manufacturing powerhouse.[10]

Astonishingly, we are not far away from 3D printing to create DNA which no longer exists or has never existed. This is referred to as "synthetic biology". Drew Endy at Stanford is leading this field and one of his former students, Jason Kelly, is co-founder of Ginko Bioworks which functions as a foundry for new organisms. This field is as miraculous as it is potentially world-changing.

And the world of finance is being reinvented. Fintech covers an array of tech-led developments in the financial world covering everything from the use of blockchain technologies to crowdfunding and mobile banking.

Crypto currencies, like Libra, are shaking the foundations of financial services. This has led to the World Economic Forum creating a global consortium for the governance of digital currencies.

The classic mobile banking inspirational story is that of M-Pesa. It was launched in 2007 as a mobile phone-based money transfer, financing and microfinancing service. It began life in Kenya and Tanzania (backed by Vodafone, Safaricom and Vodacom) and has since expanded to Afghanistan, South Africa, India and elsewhere. Within three years, M-Pesa was the most successful mobile-phone-based financial service in the developing world. By 2012, around 17 million

M-Pesa accounts had been registered in Kenya and, by June 2016, seven million M-Pesa accounts had been opened in Tanzania by Vodacom. This technology revolutionized the movement of money in these economies and brought many people into the banking systems for the first time.

Investment in fintech ventures is growing fast. Global VC investment in fintech rose from $1.8 billion in 2011 to more than $30.8 billion in 2018.[11] Research by McKinsey & Company identifies four different categories of organizations leading the fintech charge: infrastructure providers seeking to help financial institutions digitize and modernize their technology stacks; new entrants, startups and attackers seeking to enter financial services using new technologies; large technology ecosystems using financial services to strengthen relationships with users; and incumbent financial institutions making significant investments in technology to lift their game.

Growth in fintech is rapidly occurring across Asia. Alipay, a spin-off from Alibaba, and now known as Ant Financial, or simply Ant, started in 2011 and is one of the largest players in the market, valued in 2018 at $150 billion. Another is WeChat Pay, hosted within the messaging app WeChat, the dominant chat app in China. Both are enabling disruption in the financial sector, supporting payments in a new way that finds the customer where they are – on their phones – rather than making the customer come to them. By doing so, they remove a number of barriers for people operating in cash-based societies but wanting to go digital. According to a 2019 special report on banking in the *Economist*, "Together with its main rival WeChat Pay, Alipay has transformed Chinese commerce – and everyday life. They have enabled China to leapfrog straight to mobile payments using QR codes, bypassing credit and debit cards".[12] WeChat Pay started slowly in the market in 2013, but then

stormed to attention by offering a service in 2014 that enabled users to share 'red envelopes', traditional gifts of money in small red pockets given between family and friends during lunar new year, through a few clicks in the WeChat app. The *Economist* notes that in WeChat Pay's debut year 40 million transactions were made in China throughout the holiday period; just one year later, 500 million transactions were made on the single busiest day.

These financial services are taking advantage of a gap in the market where a significant portion of the world population still lacks access to formal banking mechanisms. "We see our role as serving the unbanked and the underbanked," says Lieming Chen, Ant's general counsel.[13]

This concept is echoed by Indonesian player Go-Pay, part of Gojek. Gojek started as a ride-hailing app and has since moved into small scale financing. Founded in 2010, Gojek is a deca-unicorn valued at over $10 billion. Go-Pay notes that in its market, banks have only 30 percent of the market, leaving 70 percent up for grabs. They also see themselves as a potential partner for banks, rather than as rivals per se, as their services can act as a conduit toward more formal banking for those currently sitting outside.

With neo-banks having two big cost advantages – up-to-date cloud-based software and no branches – they can offer services to a broader market who expect a different kind of service. In South Korea, this has seen the entry of Toss, which started as a payments app and has now moved on to being a money-management app. The advantage of Toss is that it allows the user to view their financial status across multiple different providers in one location. It has attracted huge attention from the multi-account holding local population, with 11 million registered users, a quarter of the South Korean

population. At this stage, Toss also positions itself as a fun and useful front end for the more formal back-end of conventional banking. Where these players move next remains to be seen.

And education. In 2011, Stanford University instructors Sebastian Thrun and Peter Norvig decided to offer their course 'Introduction to Artificial Intelligence' online for free. Over 160,000 students in 190 countries enrolled, and the ensuing developments gave birth to the edtech unicorn, Udacity. The idea of sharing university level teaching with a mass audience at a low cost was novel in the hugely expensive US tertiary education sector. It attracted enormous attention. Signups were high, but completion rates were low – as low as three percent. By developing a model of short-courses with more formalized signups and peer review, it created a learning community and increased engagement. By 2015, it was claiming a completion rate of 90 percent.[14]

Following close on the heels of Udacity was Coursera, again founded by Stanford academics in 2012. It also launched its offering with courses in computer sciences but now offers courses directly to consumers, hosts online degrees for partners and runs enterprise offerings. In 2018, *Forbes* reported that Coursera had 150 international university partners, 36 million registered learners, $210 million in investment capital, and a $800 million valuation.[15] Through creating learning communities, these platforms are connecting technology and education across mass audiences.

The global edtech business is also growing fast. In 2018, global edtech investments totaled $16.34 billion – and of these 44 percent were Chinese. Twelve companies raised over $200 million in funding, with particular growth among game-based learning companies.[16]

In Kenya, technology is being used in classrooms in a way which is not immediately obvious – evaluating children's progress as a way of monitoring teacher performance and tracking teacher absenteeism, a huge roadblock to improving educational outcomes. One initiative seeks to work around this, by removing the teacher and focusing only on tech. The global learning XPRIZE, supported by Elon Musk among others, is one avenue driving such innovation. The $15 million competition challenges teams from around the world to "develop open-source, scalable software that will enable children in developing countries to teach themselves basic reading, writing and arithmetic within 15 months".[17] The prize states that its aim is to address the issue that 250 million children worldwide cannot read, write or demonstrate basic arithmetic skills. Launched in September 2014, the challenge ran over five years, with the joint winners named in May 2019 as the Kitkit School and the educational app onebillion.

And healthcare. From blockchain-enabled hospitals to bioprinting, intelligent drug design and skin-as-a-platform, and much more, the global digital health market will be worth $536.6 billion by the end of 2025 according to *Transparency Market Research*.[18] Gene editing technology is being considered it the global fight against malaria, where modifying characteristics in the carrier mosquito population could limit the spread of the disease. Virtual reality has made it from the world of car-racing and flight simulation to the labor ward, where high-tech goggles are being used to transport mothers to soothing environments in an effort to reduce pain without medication.

And much, much more.

Tech-utopia or tech-dystopia?

For all the marvels and the possibilities it creates, technology polarizes people. There are tech-utopians who envisage a world and a universe in which technology enables human exploration into entirely new frontiers.

Elon Musk, co-founder, CEO and lead designer of Space Exploration Technologies (SpaceX), is a hyperactive utopian. Musk is seeking to make life 'multi-planetary', revolutionizing space technology and enabling people to live on other planets. To this end, SpaceX has aspirational plans for a cargo mission to Mars in 2022, and a combined cargo and crew mission in 2024. From there, the plan is to gradually build up a colony that could receive further inhabitants over time. Moreover, the technology used in these endeavors could, according to Musk, be used to dramatically reduce "Earth to Earth" transport times, with Los Angeles to London to be covered in a mere 32 minutes.[19] These kinds of aspirations are pushing the edge of what could be achieved through the application of technology to some of the world's greatest challenges, namely, no planet B.

Meanwhile back on earth there are tech-dystopians, with more than a thing or two in common with the Luddites. They imagine technology as a constant threat to how things currently are. They see AI as a destroyer of jobs rather than a creator of incredible possibilities. They would rather return to an imagined simpler age. They believe, as Karl Marx put it that "the instrument of labor, when it takes the

form of a machine, immediately becomes a competitor of the workman himself".[20]

In his marvelously far-sighted book, *The Tale of the Big Computer: A Vision*, published in 1966 and written under the pen name of Olof Johannesson, Hannes Alfvén, (winner of the 1970 Nobel Prize in Physics), casts a future vision of the evolution of computers and mankind. His prediction takes form around a stark dichotomy: technology saves humanity, or technology kills humanity.

Lars has always loved *The Tale of the Great Computer* and bought an original copy a few years ago. It was a bargain. Within a very short time, supply and demand raised the price tag for the book to $1,200. This tells us a lot about the growing interest in the dilemmas at the intersection between humans and technology.

The book offers a dystopian future for mankind in which the abdication of responsibility for technology has led to the "great disaster," a catastrophic breakdown in civilization. Today, especially after our experience of a global pandemic, Alfvén's vision seems chillingly

prescient. He tells of a time in the future when humanity put its trust in the global organization and surrenders its will to a super-being of its own creation – the Big Computer. The Big Computer controls every aspect of life, from food production to healthcare, so when it stops working for reasons unknown civilization is plunged into crisis. "They [mankind] must have had some inkling of what was to come, and it seems to have been rumored that the global organization was wrestling with grave problems," writes Johannesson.

In the aftermath of the breakdown, shortages of food and medicines lead to most of the world's population dying out. "It was utter disaster. Within less than a year the greater part of the population had perished from hunger and privation."

But despite the mass extinction of humanity, it isn't all bad. "Though disastrous to mankind, the universal breakdown was liberation for the Earth, for nature. It brought a pause in unlimited exploitation. Vegetable and animal life was no longer poisoned by chemicals; for man had been more devastating than locusts, more poisonous than bacilli."

The two extreme positions paint colorful pictures, but what will the reality be? How can we best navigate in this new technological era toward a future which embraces the positive developments of technology and minimizes its negative effects?

Lars Thinggaard

Lars Thinggaard was President and CEO of Milestone Systems A/S until 2020. A Thinkers50 Radar Class of 2019 "thinker to watch", Lars is an investor and intuitive entrepreneur.

His previous roles include co-founder and CFO at Mondosoft, COO and CFO at Beologic (acquired by Baan), CFO at In2itive (acquired by SPSS), and an auditor at Arthur Anderson and Price Waterhouse, now Price Waterhouse Coopers. Lars led Milestone from 2003, steering the company to be a global industry leader in open platform Internet Protocol (IP) video management software. During his 16 years as CEO, the company's revenue increased more than fifteenfold. It is now part of the Canon Group.

Lars has a bachelor's degree in corporate finance and accounting from Copenhagen Business School, and is based in Copenhagen. He is the author of *Business Magnetism* (2015) and co-author (with Jim Hagemann Snabe) of *Tech for Life* (2020).

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An active member of the Board of Trustees at the World Economic Forum, he is particularly focused on the digital transformation of business and society. Jim is an advocate for progressive thinking, sharing insight and taking action.

Jim's career in the IT industry spans more than 25 years, and he has held a number of leadership and consultative roles at SAP and IBM, leading global consulting, sales and product development operations. In 2008 Jim was appointed to the executive board of SAP, responsible for innovation and product development. In 2010, he was appointed joint CEO with Bill McDermott, heralding a new era for the software giant.

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