

**Technology Trend Report 2021**  
Strategy & Innovation Hub

Focus on Data Privacy  
& Security

Championing  
Sustainability as the  
Only Way Forward

Supporting  
Growth in Developing  
Countries

Building Trust in an  
Open Society

The Relationship Between  
Global Crises and Technological  
Development

# *A look into technology*

**Rabobank**

## Preface

# Technology through a social lens

A year ago, we presented our Technology Trend Report 2020, in which we discussed eight technological trends that are relevant for the future of Rabobank and its customers. In this edition we will look again at these technologies, but this time through a social lens.

Because what is it that makes these emerging technologies so interesting? What challenges and opportunities do we face, as world citizens, consumers and internet users? And what role does technology play? What changes as we combine new and existing technologies? To answer these questions, we interviewed colleagues in their fields of expertise. The result? Beautiful stories, enlightening insights and inspiring examples. We are proud of the Technology Trend Report 2021 and share it with you with great pleasure.

### **Technology as a solution**

No one is looking for a specific technology to solve his problem. We just want solutions. For this report, we delved into technology as a solution for several areas, like privacy & security, the digitization of emerging markets in Africa and Asia, climate and food sustainability issues and the interplay between global crises and technological advancement. Various themes in which often the same technological developments play a role.

### ***“If you want to go fast, go alone. If you want to go far, go together.”***

In our conversations there was always one recurring topic. To really make a difference, there needs to be more and better collaboration between parties. Mutual trust is the key to success. Trust in your cooperation partner, in the machines that are connected via the internet and the algorithms being used to protect sensitive data. Without good and wide access to trusted data, AI, for example, cannot be used optimally. If there's no confidence in you handling data with great care, access will be denied. And it's a two-way street: of course you don't want to work with people and machines you don't trust either. The world we live in includes many different ecosystems, making it very complex. There's no one individual organization that's able to oversee everything, collaboration and trust need to be organized. The good news is that there are more and more technological possibilities to support this. In this report, we show you a few great examples.

To create this report, we talked to many colleagues. With a lot of enthusiasm they shared their valuable input and talked with passion about what technology can mean for their field of expertise. Special thanks to Mimoent Haddouti, Albert van de Boogaard, Marcel Kuil and Alexander van de Koevinger.

### **About Rabobank Tech Lab**

This report is offered to you by the Tech Lab team of the Rabobank Strategy & Innovation Hub. We research emerging technologies and experiment with them. We continuously search for ways to apply these technologies to Rabobank and its ecosystem, in a way that suits our mission Growing a Better World Together.

We wish you lots of fun reading this report and hope to inspire you and give you food for thought about the possibilities these technologies offer and how they can change the world we live in. We invite you to start a conversation, with each other or with us. There's no doubt the world around us is changing rapidly, but we don't know where we're heading. Just remember: we are the ones in the driver's seat.



**Roel Steenbergen**  
Technical Innovator

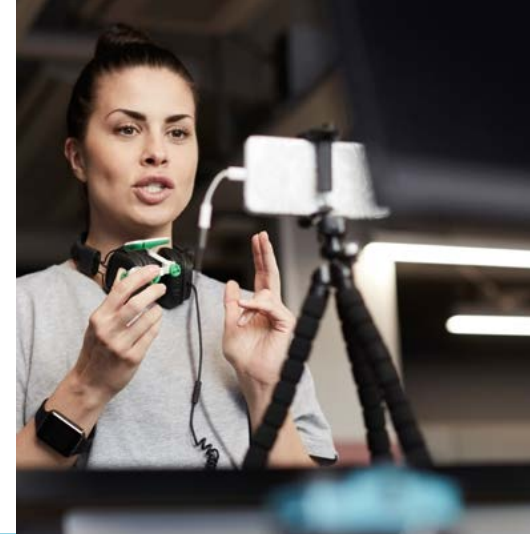


**Chris Huls**  
Lead Tech Lab

***“If you want to go fast,  
go alone. If you want go far,  
go together.”***

# Table of contents

Preface



**Introduction:**  
Looking at technology through a social lens

**Theme 1:**  
Focus on data privacy & security

**Fundamental technological development #1**  
Blockchain's most important ongoing innovation: digital currencies

**Theme 2:**  
Championing sustainability as the only way forward



**Fundamental technological development #2**  
Quantum Computing: from potential to real possibility

**Theme 3:**  
Supporting growth in developing countries

**Fundamental technological development #3**  
Empowering individuals through privacy-enhancing technologies

**Theme 4:**  
Building trust in an open society



**Fundamental technological development #4**  
The rise of tokenization



**Theme 5:**  
The relationship between global crises and technological development

Conclusion



# *Looking at technology through a social lens*

*Introduction*



## Introduction

# Looking at technology through a social lens

In the 2020 edition of the Rabobank Technology Trend Report<sup>1</sup>, we reflected on how the world found itself at a tipping point. Our focus was on the development of a new chapter in the digital era that saw most organizations having already undergone a major digital transformation or being in the process of undergoing one.

We also discussed how, across all the digital technologies available to us, we had only seen the tip of the iceberg when it comes to advancements and all the new channels, collaborations and business models that potentially await us.

We delved into eight different technological themes, namely *the Internet of Things; Next-Generation Communication Networks; Extended Reality; Blockchain; Secure Multi-Party Computation; Voice Technology; Quantum Computing and Artificial Intelligence*. We were both excited and intrigued to see how these domains would continue to unfold, to witness the impact they would continue to have on the world, and, most of all, to explore how we at Rabobank could leverage these technologies to do what we do even more effectively.

<sup>1</sup> Rabobank Technology Trend Report 2020: <https://www.rabobank.com/en/about-rabobank/innovation/tech-trends/articles/20200107-technology-trend-report-2020.html>

## The year that changed the world forever

What we couldn't have foreseen, though, is that 2020 would go down in history as the year of COVID-19: the most disruptive period of this millennium so far. This time demonstrated – possibly more clearly than ever before – the monumental importance of technology. The world has looked to the power of big data and Artificial Intelligence (AI) to help us to not just develop an effective vaccine quickly, but also prevent future disruptions in times of crisis.

Without technologies like robotics and the Internet of Things (IoT), a pandemic like COVID-19 would have brought the world to a complete standstill. Technology offers possibilities that, in this time of uncertainty, are absolutely invaluable. Like many other major crises that came before it, the global pandemic didn't slow down innovation; on the contrary, it accelerated it, pushing it forward at an unprecedented pace.

## As technology has evolved, so has people's perception of it

Over the past few years, we've witnessed another shift. Not too long ago, people were fairly accepting of technology and open to it being woven into their lives. But now, we're seeing something of a "techlash": a backlash against technological innovation. People's unconditional love for technology is, slowly but surely, starting to fray at the edges. We're becoming much more critical of technology and its impact on the planet, our society, our health and, last but definitely not least, our privacy.

Now more than ever, we're requesting – demanding, even – that technology be used responsibly and for the greater good. People don't just want more advanced technology; they want technology that is more human. We want to know that businesses are using our personal data for our own benefit, not theirs, while prioritizing security and safeguarding our privacy.

In this report, we explore five social themes and delve into how they have been influenced by digital technologies. We also examine how these themes have, in turn, impacted certain technologies too. Topics include *privacy and security; sustainability; developing countries; open society and the relationship between global crises and technological developments*. These five themes serve as the lens through which we look at the development of different digital technologies and their practical application. Because it's not enough to simply want technology to change the world, we need to ensure that it does so in a way that benefits not just businesses, but also people, society, and our planet.

## Fundamental technological development #1

# Blockchain's most important ongoing innovation: digital currencies

**Before we dive into the topic of digital currencies, here's a quick reminder of what blockchain actually is: Put simply, blockchain is an IT solution that allows multiple parties (businesses and individuals) to work on a shared set of data, whilst keeping full ownership of their own pieces of data. Blockchain technology is used to record transactions made with cryptocurrencies, like Bitcoin, but it has many other applications.**

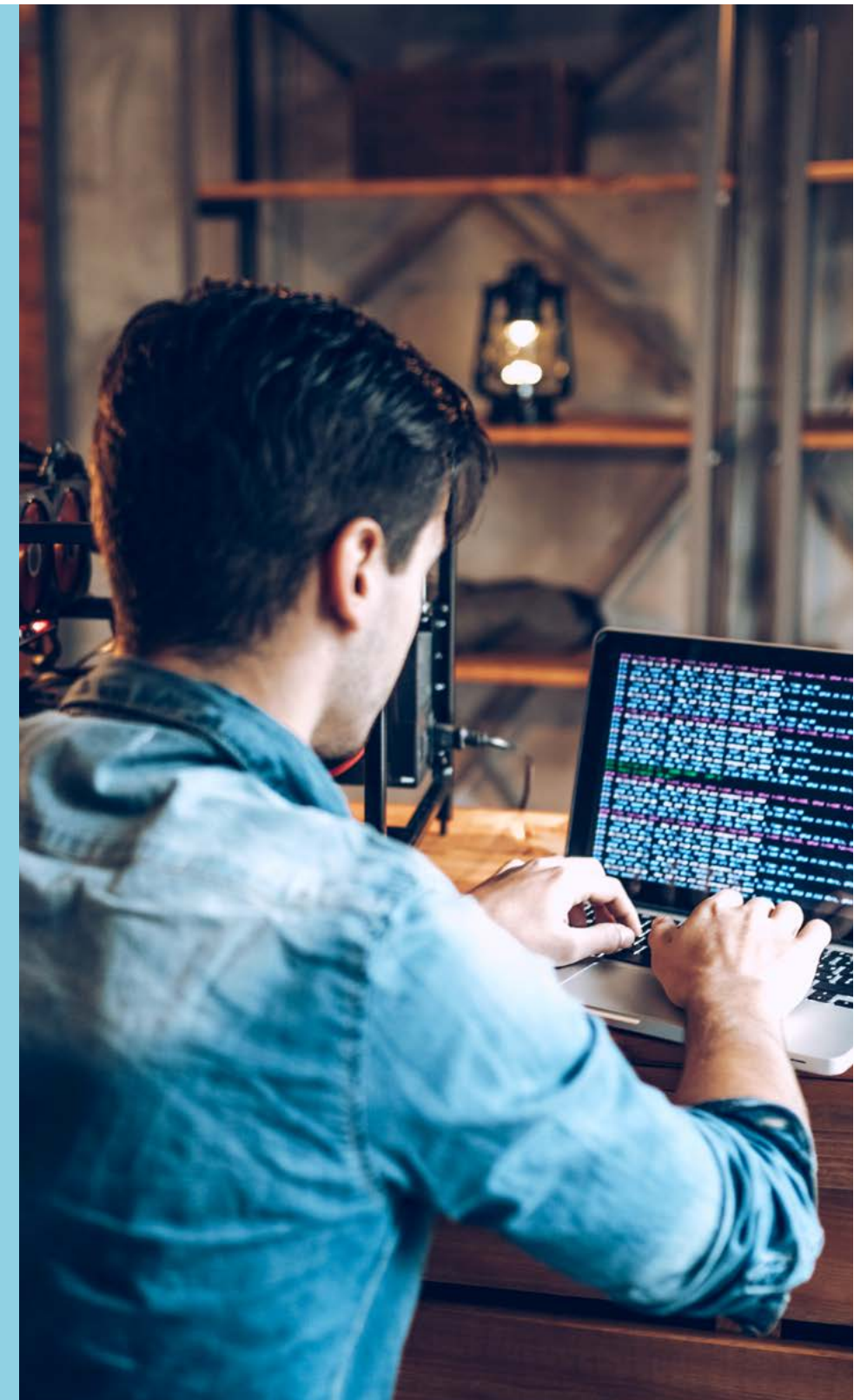
The evolution of blockchain, and the development of Bitcoin and similar blockchain-based cryptocurrencies, has ultimately paved the way for the concept of a Central Bank Digital Currency (CBDC). Essentially, a CBDC uses digital tokens, issued by a particular country's financial authority, to represent that nation's official currency (only in virtual form).

When Facebook announced the rollout of its digital currency, Libra, in June 2019, the incentive for central banks to start investigating the possibility of

their own CBDC increased. It seems that using cash money is becoming increasingly rare, but CBDCs could ensure that citizens will continue to have access to regulated central bank currency, even if traditional currency formats are abandoned at some point. That said, there are still doubts around whether the new technology is mature enough to effectively replace current systems.

While countries like China are already piloting such national digital currencies, Europe is certainly not there yet – in fact, the continent is far from ready for such a change. After all, launching a digital currency has major financial implications and economic consequences for a country. It also comes with many challenges related to privacy and security. While physical cash is still by far one of the most anonymous ways to transact, a virtual currency issued by a central bank certainly isn't. There is the risk of fraud and questions around how secure a digital currency would be and how well users' privacy would be protected.

Various different technologies could address some of these dilemmas and therefore contribute to the appeal of a CBDC. These include blockchain, IoT (a network of uniquely identifiable "things" that can communicate with each other without a need for human intervention) and AI (a collection of technologies that together enable machines to act with human-like levels of intelligence). For instance, IoT can be used to help automate payments (so that your car or other asset pays on your behalf), while AI can equip cameras to recognize your vehicle's number plate on toll roads and in parking garages.



A photograph of two IT professionals, a man and a woman, in a server room. They are standing in front of a server rack with many colorful cables. The man is pointing at a cable, and the woman is holding a tablet. The room is dimly lit with blue light from the server racks.

# *Focus on data privacy & security*

*Theme 1*



**Theme 1:**

## **Focus on data privacy & security**

A decade ago, people set up profiles on social media networks and downloaded apps on smartphones without a second thought. People must have known they were sharing personal information online, but it didn't concern them too much back then.

Those days are gone. Now, privacy issues have become a major societal debate, with concerns about how data is collected and used by third parties leading to more and more wariness and distrust. As a result, laws are getting tougher, and ideas about what's ethical and what's not are shifting.

Various major companies have done serious damage to our ability to trust. Facebook in particular made us aware that many businesses thrive on gathering as much of our personal data as possible – that some business models are entirely designed around that specific purpose. It's no surprise then that people have grown increasingly worried about data privacy. The good news is that various technologies (or a combination thereof) can serve as powerful tools that can help restore trust and enhance security. We'll delve into that later in this chapter.

### **New rules and regulations**

Data-driven businesses have enjoyed rapid growth in recent years, but it's uncertain whether this trend will continue. A heightened focus on privacy and security concerns has resulted in the development of new data protection rules and regulations, including AVG (The Netherlands) and GDPR (Europe). New laws impact the further growth of these companies, as well as the evolution of underlying technological trends such as AI. In the financial services field, a responsible use of AI now demands that businesses pay attention to soundness, accountability, fairness, ethics, skills and transparency ("SAFEST") when developing applications.

Unfortunately, innovation (and the speed at which it happens) can take a bit of a knock when there are heaps of new restrictions. Technologies now have to meet more and more requirements before they can be applied. Many need adjustments and additional work and so naturally, they take longer to develop and go to market. The stats speak for themselves: in 2019, 74% of survey respondents said that data protection

"A highly complex ecosystem is much harder to protect – the more connected the world is, the more tricky it is to keep data safe. We need to start breaking down silos, sharing knowledge more widely, establishing a long-term vision and overcoming challenges."



**Mimoent Haddouti**

Chief Information Security Officer

requirements are the main obstacle hindering the development of new technologies (only 63% of respondents felt this way in 2018, and only 45% in 2017<sup>3</sup>).

The key is to find the perfect balance between technological advancements and the drive to support privacy and security. Rules and regulations help to guarantee that our personal information is used for the right reasons, and only by people and businesses that should have access to it. So we must continue to accelerate innovation while ensuring privacy and security.

At the end of the day, the only technologies we want to see evolve are those that are 100% secure and uphold privacy standards. This is not something we should ever take lightly – in fact, we must insist on it. This chapter of the report sheds light on the tension between technology, privacy and security, and explores how trust can – and should – be restored.

### **Cybersecurity requires constant attention**

When somebody uses a device, it collects data about that user. The more devices are used, the more information is gathered. Today, millions of people use multiple connected devices several times a day. This is how the concept of IoT originated and has grown into one of the most prominent technological developments of our time.

However, more data being exchanged across networks is not always good news. In a worst-case scenario, hackers with bad intentions can gain access to this information, take control or misuse the data. We saw how easily this can happen in November 2020, when a tech journalist attempted to showcase the vulnerability of Rotterdam's Erasmus Bridge lighting system by breaking into it and temporarily changing the color of the lights. Similarly, there was the Adobe hack in 2013, which saw the email addresses, passwords and financial details of almost 150 million users being stolen. These were not isolated incidents, either: clusters of IoT devices are hacked rather frequently, and usually for criminal purposes.

One way of improving cybersecurity is by working in the cloud rather than locally within your own personal computer infrastructure. As security is a key priority for cloud service providers like Google, Amazon and Microsoft, this environment has many benefits, also with regard to security. With security updates being run automatically, cloud users can trust that they always have fully up-to-date protection. What's more, as cloud environments don't allow much influence and intervention from users, they are standardized. This means that they are far less complex, so easier to protect.

Essentially, as more devices and identities are added to the digital arena, the risk of cybercrime increases dramatically. A highly complex ecosystem is much harder to protect – the more connected the world is, the more tricky it is to keep data safe. We need to remember that advancements in technology don't only benefit us; hackers capitalize on them in highly ingenious ways too. Sometimes it's a race between good and evil to see who can adopt new technologies faster and more effectively.

### **Self-Sovereign Identity as a key focal point for Rabobank**

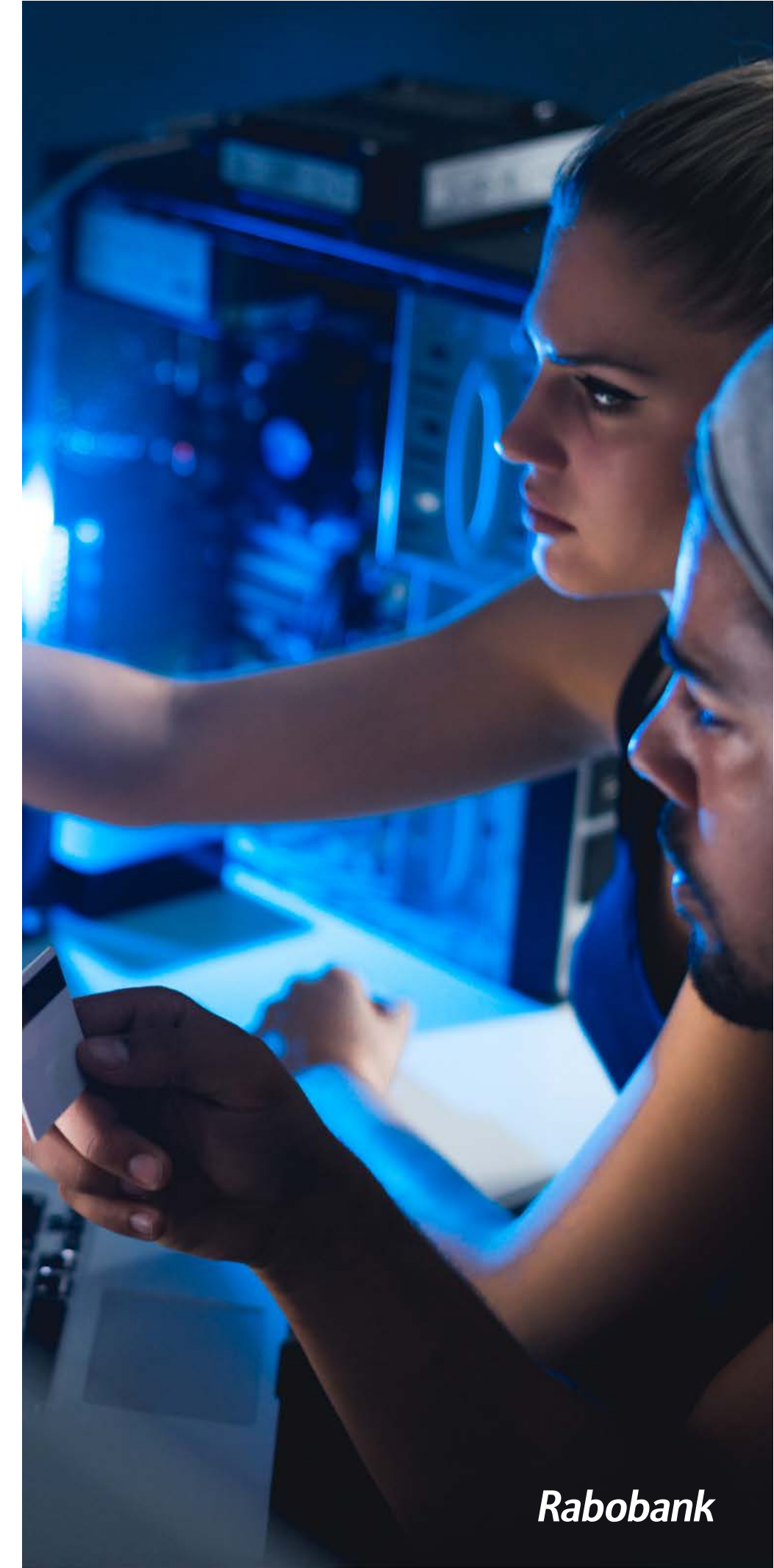
What is a potential solution? One of the answers lies in the concept of Self-Sovereign Identity (SSI), a new model of identity that puts users at the centre of the identity management process. The idea behind SSI is that consumers own and are completely in charge of their personal data, which can be stored in a decentralised manner (by decentralised, we mean not hosted on a single central platform that's owned and controlled by one party, but rather stored across multiple "nodes"). This way users are always in control of the identity-based relationship established with other parties – they hold their own information, and businesses wouldn't be able to collect and store personal information like they do currently.

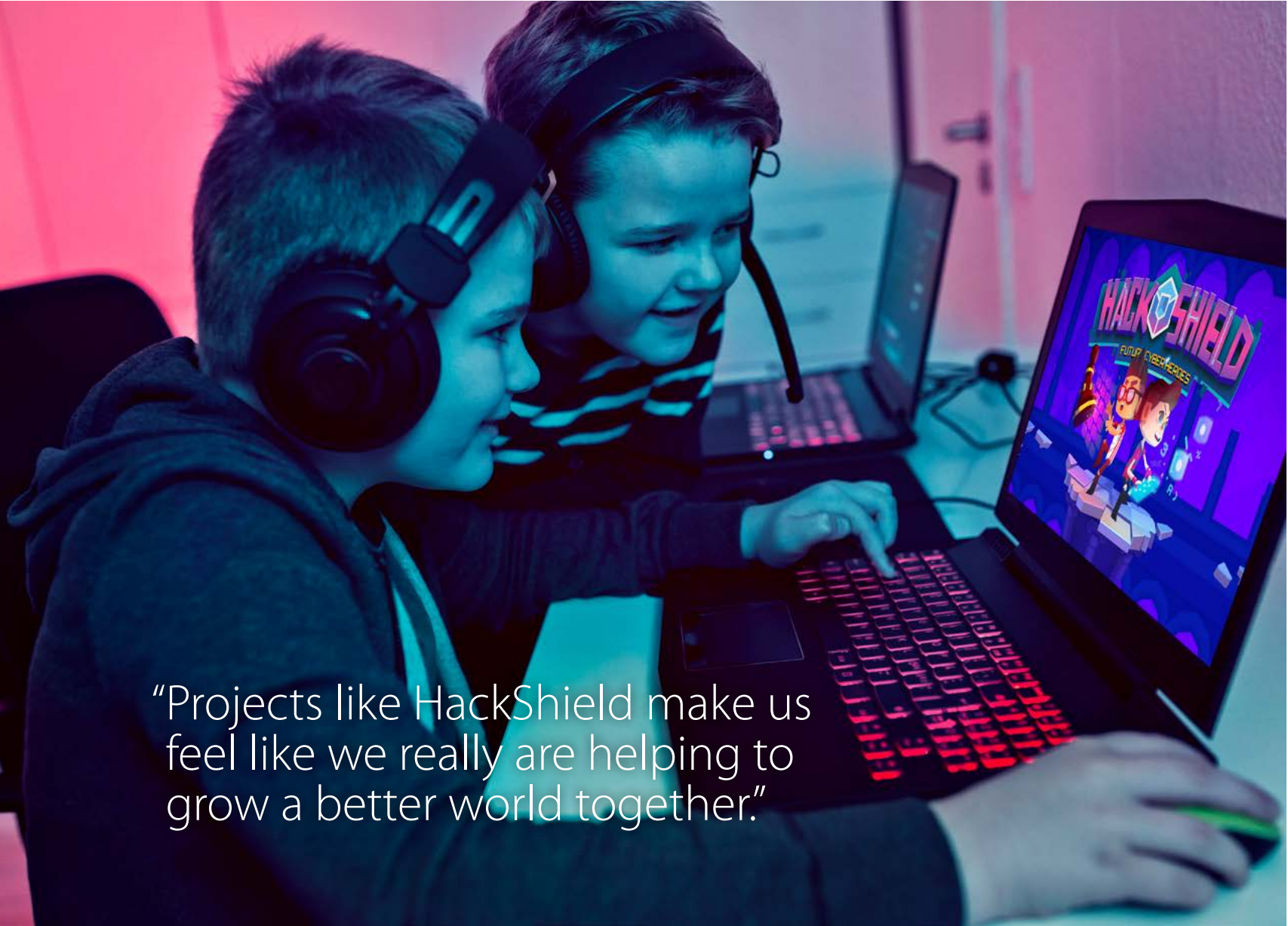
The knowledge that we are fully in control of our own identity data will help to restore trust in a world where distrust has become the norm. As we move towards an open ecosystem in which devices can act autonomously (or on behalf of others), we need to be able to verify and trust the identities of not only other people, but of machines too (that is, we need to be sure that devices really are "who" they claim to be).

### **The Identity Wallet: from a promising concept to (almost) proven success**

In last year's report, we referred to the Identity Wallet as one of the most promising use cases of blockchain technology. The Identity Wallet is essentially a digital wallet that holds verifiable credentials, like certificates and diplomas, in an app on a user's mobile device. Information is stored in a secure manner and can be shared with others very easily.

<sup>3</sup> Bitkom Trend Study 2019





“Projects like HackShield make us feel like we really are helping to grow a better world together.”

While the wallet started as a pilot for HR-related documents only, it is currently being scaled up and improved so that it can be deployed more broadly. The idea is that it'll be able to store many different types of credentials, including mortgage papers, payment slips, passport information and potentially even COVID-19 test results (also check the Fieldlab project in which Rabobank participated). Importantly, documents are not stored in a database; everything is kept in a decentralized system. The wallet owner can choose who to share credentials with through the process of consent management. If they decide they no longer want a particular party to have access to a certain credential (for example, on completion of a contract),

they can easily withdraw consent. Imagine what a difference it makes to be able to make a company forget everything about you with one swipe on your phone and avoid being bothered with irrelevant offers for years.

### **A win-win situation**

The Identity Wallet is the perfect example of an SSI application that can both add business value and greatly benefit consumers by safeguarding their privacy. The wallet doesn't only empower consumers; it's also incredibly valuable for all parties that require access to credentials. Thanks to a security check carried out by the bank on all credentials and documents,

these entities can trust that the information is legitimate. To ensure the wallet remains 100% secure going forward, institutions like banks, corporates and governments should work together.

It's critical that consumers really understand that no one – not even the bank or developers – will be able to access or view documents or data in a user's wallet. Only when people fully understand that the wallet doesn't undermine their privacy, but rather protects it, will they be open to using it.

### **Digital identities for a secure travel experience**

There have been identity-related developments in the cross-border travel space too. Traditionally, a traveller's personal data is collected and stored by a different organization every time that person goes through passport control, buys a flight ticket or books a hotel room.

This year marked the start of a pilot for the Known Traveller Digital Identity (KTDI) concept, an initiative by the World Economic Forum designed to offer a better travel experience by changing how data is shared through the international ecosystem. The blockchain-based solution encrypts traveller's key identity data (like passport information) and stores it on each person's own mobile device. With KTDI, only the traveller can decide who gets access to what, and when – the human is placed at the centre of the travel ecosystem. As data access is withdrawn when a transaction is completed, the KTDI concept improves efficiency and reduces security risks for everyone involved.

### **HackShield: cultivating cybersecurity awareness from a young age**

Aside from launching technological initiatives such as the Identity Wallet and KTDI, it's also critical to improve the public's awareness of cybersecurity matters. Over the years, people have rapidly grown more aware of possible cybersecurity threats. It's a trend we encourage, and we've committed to help deepen the community's knowledge about this field.

Last year, the Rabobank Foundation co-developed a game called "HackShield". It is distributed to primary schools around the Netherlands and teaches children the skills they need to become cybercrime-fighting agents. The objective of the game is simple: to make sure that young children understand the dangers that come with the online world. This way, they're not only equipped with knowledge from early on, but can also act as role models and teachers for their parents and grandparents. Projects like HackShield make us feel like we really are helping to grow a better world together.

### **Cooperation is key**

As mentioned previously, cooperation with other parties and entities is key to restore trust, and pave the way to a world in which privacy and security is guaranteed. Rabobank actively collaborates with several organizations, but an even more integrated approach is definitely required. More specifically, we need to start breaking down silos, sharing knowledge more widely, establishing a long-term vision and overcoming legal challenges.

Now is the moment to invest in innovation. Cybercriminals keep evolving their practice at a rapid rate. If we don't stay ahead of the game, we'll be left in the dust.

## Fundamental technological development #2

# Quantum Computing: *from potential to real possibility*

**Quantum Computing (QC) entails a fundamentally different approach to computing than that adopted by classical computers. Quantum computers don't use transistors or classical bits; they're based on qubits (quantum bits). They have the capability to perform complex computations in a fraction of the time it would take classical computers to run the same calculations.**

A complete, fully useful commercial quantum computer is yet to be developed, but the world has made great strides towards this goal. In October 2019, for example, Google stunned the world when it announced that it had realized quantum supremacy. Although competitors like IBM questioned the company's results, it appears that Google has taken a massive step forward in the world of computer science: its quantum computer, named Sycamore, successfully performed a calculation that would completely baffle standard machines. In fact, while even an extremely powerful classical supercomputer

would need around 10,000 years to solve such a complex problem, Sycamore managed to complete the computation in only 200 seconds.

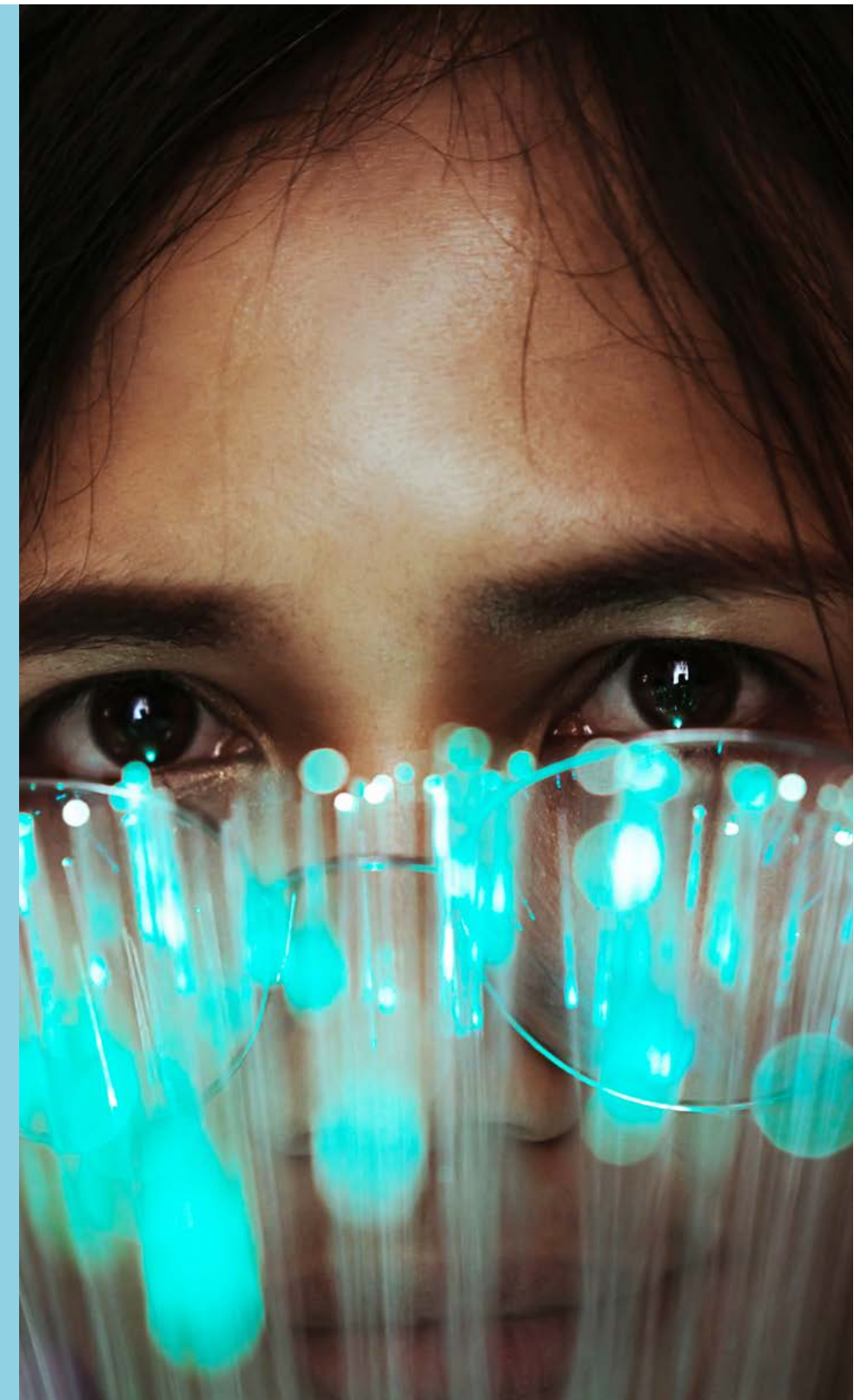
### ***A major step in the right direction***

However, while the calculation in question was highly complex, the solution unfortunately doesn't carry much social relevance. The next step would be to use quantum supremacy to solve not only very complicated, but also highly meaningful and significant dilemmas.

Of course, that reality might still be another 10, or even 15, years away. But until we get there, we expect to see many quantum-inspired innovations unfolding. An example is the Digital Annealer built by Japanese IT company Fujitsu. This invention can carry out complex calculations inspired by quantum phenomena for a limited selection of problems. Fujitsu used the Digital Annealer to optimize operations and workflows at its main manufacturing site, where they were struggling with an inefficient product assembly process. The

result was that they managed to quickly reduce the distance that employees travel when gathering product parts by 20%.

Few technologies other than QC present as big an opportunity and as enormous a threat at the same time. One day, when quantum computers are up and running, they could potentially break cryptographic algorithms and expose all the sensitive information that's currently securely encrypted. Which is why new "quantum-safe" algorithms that can withstand attacks by powerful quantum computers need to be developed rather sooner than later. In this case, though, the pros definitely appear to outweigh the cons. We believe it's vitally important to master a technology that might enable us to solve complex, pressing dilemmas like the climate change crisis or find cures for deadly viruses.





# *Championing sustainability as the only way forward*

**Theme 2**

“Through this project, and the mechanism of carbon credits, we aim to change the face of farming, feed the world and help tackle the climate change issue all at once.”



**Alexander van de Koeving**  
Global Head of Carbon Bank

## Theme 2:

# Championing sustainability as the only way forward

Sustainability is one of the world’s hottest topics today, and a critical lens through which technology should be considered. With sustainable development ranked as one of society’s biggest challenges, it is essential that every technology (and application thereof) meets sustainability requirements and contributes in some way to building a more sustainable world.

Of course, all companies, not just those developing technologies, should put sustainability at the top of their agenda. Their operations, and business as a whole, should be very critical about their ecological footprint. Ideally, they should also proactively contribute to building a cleaner and better world.

As technology evolves, new ways to assess the sustainability performance of organizations pop up too. Take for instance the Frankfurt headquarter data provider Arabesque S-Ray, offering a tool that lets anyone evaluate the sustainability of the practices of over 7,000 of the world’s largest enterprises. It works by assessing the extra-financial performance of a company to get a better idea of the value that it brings to society. While the tool is simple to use, it’s also incredibly smart: using machine learning and big data, it combines over 200 environmental, social and governance (ESG) measures with news signals from over 50,000 sources across 15 languages.

### **Consumers should be aware of their ecological footprint**

Along the same lines, Rabobank launched the Go.Green.Easy app to help make consumers aware of their own ecological footprint. The platform provides people with a clear figure that indicates their impact on the climate issue based on their spending behaviors and personal profile. The hope is that this information will encourage them to make more sustainable choices.

After all, businesses aren’t the only ones being carefully monitored and held accountable. Consumers are also starting to rethink their actions in a globally interconnected economy and seek more sustainable products and services. Technology is providing new ways for all of us to step up – it’s helping us to reduce our carbon footprint and shift away from fossil fuels, for example.



“Encouraging corporates to purchase credits isn’t a problem, but it can be difficult to determine exactly how much carbon is really stored in the soil in a cost-effective way’ – creating crop diversity – and making other changes to how soil is dealt with.”

In this chapter, we explore two technological developments that are promoting the move to a more sustainable planet. These include:

- Pay-per-use business models
- Carbon credits

### **Pay-per-use business models on the rise**

Thanks to technology that supports the pay-per-use (PPU) business model, we are rapidly moving towards a sharing economy that sees us all share access to products and services, rather than owning goods. The PPU market and business model have both evolved very quickly. As is clear from the evolution of ride-sharing platforms, it’s now become fairly mainstream to use a car, bicycle, electricity or almost any other asset on a PPU basis. The impact can only be positive. By promoting a model where we all share goods and only pay for what we use, we encourage responsible consumption and minimize waste.

These days, many cars that are available on a PPU platform have a wallet on board so that users can pay on the spot for, for instance, gas, toll fees and insurance. This wallet connects directly to a banking system, which saves transaction costs and a lot of admin. Such examples of PPU initiatives can only exist if they’re enabled by IoT applications that are trusted and supported by the financial institutions that allow the transactions involved.

Since their launch in 2011, Dutch company SnappCar has always been a true pioneer in the ride-sharing business. In 2018, the company introduced keyless car sharing, a revolutionary innovation at the time. By installing a special hardware device in cars, renters could

get into vehicles using the platform’s app. As a result, car owners no longer had to physically be present to hand over the keys. It certainly took the ride-sharing business and PPU convenience one (big) step further.

### **PPU in practice: the CISE platform**

Rabobank was involved in the launch of the decentralized Circular Service (CISE) platform in April 2019. This blockchain-enabled infrastructure aims to reduce the administrative burden for product-as-a-service businesses. Companies and entrepreneurs who are eager to transition to a circular, pay-per-use model are invited to pilot their service on the transparent, trusted platform. By taking care of the transactional and administrative part of the transition, the platform hopes to encourage many different parties to team up and promote a shift towards a circular sharing economy.

What’s currently standing in the way of this really taking off? Well, there are economical, logistical (e.g. insurance) and geographical (“Where is the closest available car at the moment?”) constraints. And then there’s also the fact that the identities of users and devices aren’t yet 100% reliable (see “Self-Sovereign Identity” under Theme 1), and that most IoT applications still tend to operate in silos, each with their own technical solution. It comes down to the same problem that hinders developments in other areas: a lack of cooperation between different parties. Every entity wants to make sure they get out as much as they put in and tends to (understandably) distrust other parties. An identity platform that safeguards privacy and security could be the perfect solution. Going forward, we hope to further mature the CISE platform and ensure it connects optimally to other technologies and devices.

### **Growing a better world by encouraging carbon farming**

Obviously, we can’t discuss sustainability without talking about global warming and the need to significantly reduce greenhouse gas emissions. This goal is ultimately what inspired the launch of the Carbon Bank by Rabobank earlier in 2020. Through this project, and the mechanism of carbon credits, we aim to change the face of farming, feed the world and help tackle the climate change issue all at once.

If we want to mitigate climate change, we need to alter the way that farming is carried out. The mission of the Carbon Bank is to give farmers a financial incentive to embrace carbon farming, and in so doing, help to absorb carbon from the atmosphere. This can be done by planting certain cover crops, rotating crops regularly – creating crop diversity – and making other changes to how soil is dealt with. Healthy soil can store significantly more carbon (up to 1 or 2 tons per hectare more per year), thereby limiting the amount released into the atmosphere. It can also support the growth of significantly more food crops. The result? A real win-win situation for farmers and the planet.

### **Changing the game through carbon credits**

Based on the carbon they’ve stored, and hence removed from the atmosphere, farmers can then sell carbon credits to other companies. By acquiring such credits, businesses can offset their carbon footprint, with the ultimate aim of reaching a net-zero emission rate. In the future, the idea is that companies will buy these credits on Rabobank’s Carbon Bank Marketplace, which will essentially link several CO2 reduction projects to the demand for carbon footprint compensation.

Encouraging corporates to purchase credits isn't a problem, but it can be difficult to determine exactly how much carbon is really stored in the soil in a cost-effective way. That's the objective of Rabobank's innovative carbon credits program. By using satellite information, IoT applications and other data, it aims to measure the CO2 storage capacity of soil in real-time. Essentially, how it works is that a satellite takes a high-resolution picture of the soil and uses AI to do a thorough analysis of the image and then classify the information. This data is what's used to estimate the CO2 storage capacity of the soil. Once that estimate is known, it can be turned into a transferable credit: a carbon credit. Credits can then be verified, quantified and made comparable and, ultimately, the supply can be scaled.

*"The mission of the Carbon Bank is to give farmers a financial incentive to embrace carbon farming, and in so doing, help to absorb carbon from the atmosphere. This can be done by planting certain cover crops, rotating crops regularly – creating crop diversity – and making other changes to how soil is dealt with."*

### ***The potential of carbon trading and carbon engineering***

On the topic of carbon credits, it's also worth mentioning the Point Carbon platform, which was launched by Refinitiv, a global provider of financial market data and infrastructure established in 2018. Point Carbon is a market intelligence platform that aims to help users make informed carbon trading decisions. It combines real-time and historical carbon price data (as traded through the European Union Emissions Trading System, for example) with the world's largest database of carbon offset projects and offers continuous updates and analysis of supply and demand. The platform also includes an analysis of key policy decisions and regulatory issues that could impact carbon markets.

There's also the example of Carbon Engineering, a clean energy firm that's commercializing technology that captures CO2 directly from the atmosphere for conversion into carbon-neutral fuels. The company was co-founded by Harvard climate scientist David Keith, with funding from the Bill & Melinda Gates Foundation.

While all these initiatives help to promote a more sustainable society, it's important to note that, here in particular, there's no one technology that can solve all our challenges alone. A lot actually hinges on how we as human beings choose to live our lives – we will essentially decide for ourselves what our future will look like.





### Fundamental technological development #3

## Empowering individuals through privacy-enhancing technologies

Consumers are becoming increasingly concerned about data privacy and the commercial tracking of their location, interests and online behaviors. Similarly, enterprises are hesitant to share data with other organizations, partly because of uncertainty about data ownership rights and partly because they lose control over how that data is used. Essentially, the risk of sharing data is significantly higher than the potential value of doing so – even when there is trust.

These challenges have spurred on the further development of Privacy-Enhancing Technologies (PETs): technological applications that allow us to make computations on joined data without actually sharing them. The value lies in the outcome of the calculation, not in the underlying, often sensitive data. Because PETs allow for collaboration without the need for trust, they can be an extremely valuable option in a world where trust is scarce.

PETs use encryption to enable the sharing of data with other parties, while limiting how or where it can be accessed, which parts of the data can be seen, or what can be inferred from the information. Several different mechanisms are used to achieve this, but they usually do one or more of the following: control the environment within which the data can be manipulated; mask the data to protect privacy and remove identifying details; or provide a means for the data to be processed while encrypted.

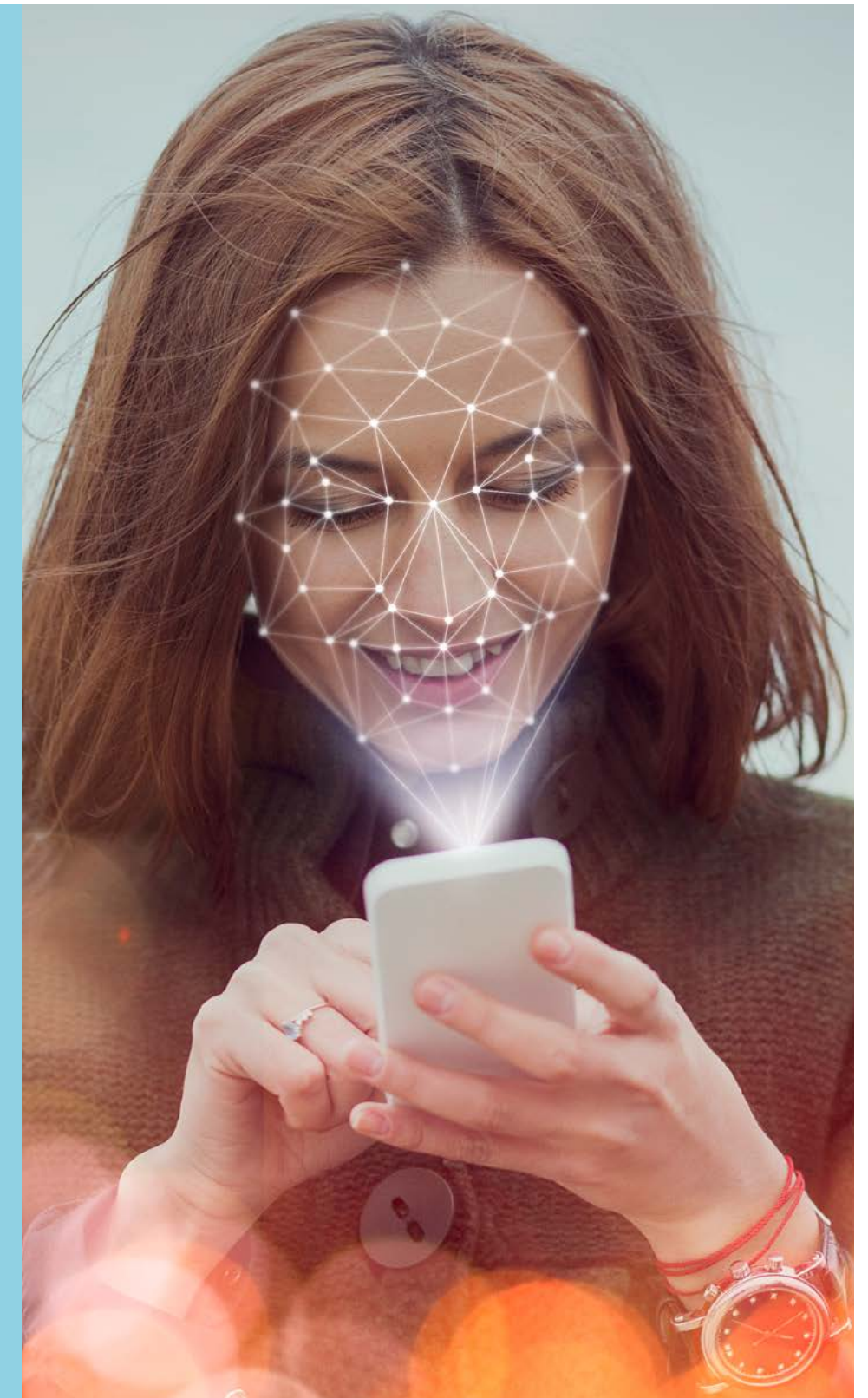
### **The power of PETs in practice**

The MELLODDY (Machine Learning Ledger Orchestration for Drug Discovery) project is another striking example of how PETs can be used in practice. The aim of this program is to get 10 international pharmaceutical companies to willingly share data and knowledge so that drug research can be accelerated. A blockchain-based distributed learning system allows partners to feed information to a drug discovery algorithm without directly sharing their data with the other companies (their competitors).

Raw data is never seen by the whole ecosystem and so remains confidential.

In a similar vein, we'd like to bring MyHealthMyData (MHMD) to your attention. MHMD is an EU-funded project that looks into how anonymized data can be shared for the purpose of medical care, research and development, while still allowing people to retain full ownership of their health information.

PETs are a great area of interest for Rabobank. Recently, we leveraged PETs to develop a data sharing proof-of-concept that can be used to identify healthcare fraud, and we're considering experimenting in the area of money laundering detection too.





# *Supporting growth in developing countries*

*Theme 3*

**Theme 3:**

## **Supporting growth in developing countries**

Developing countries have always been a focal point for Rabobank. In fact, supporting smallholder farms in developing nations, and stimulating the growth of their ventures, was the motivation behind the launch of the Rabo Foundation in 1974.

Reaching small enterprises in developing countries is hard, but technology can play a significant role in bridging gaps and changing the status quo. One of the bank's top priorities is exploring how, and specifically which, technological applications can optimize the supply chain and ultimately improve people's lives in these countries. We are convinced that developing nations will benefit greatly from the delivery of services and technology.

The shocking reality is that, today, nearly 500 million (!) small-scale farmers in developing countries lack between 80% and 90% of the finance and resources they need to grow their agricultural business. In order to enable these farmers to increase productivity and therefore boost their income, it is critically important that we improve access to finance. As long as this bottleneck remains, we are far from ending poverty or solving the world's food shortage problem. Right now, small-scale farmers around the world are only growing 20% of their potential outputs. While this is a dire situation, it also means that there's plenty of

room for growth, and just minor changes could make a world of difference.

### **Wefarm: the largest farmer-to-farmer network in the world**

One initiative that has already made a world of difference to farmers is the UK-born venture Wefarm. This platform, which is free to use, was launched in 2015 to help smallholder farmers who don't have internet access to share ideas and solve problems. Today, Wefarm is the largest farmer-to-farmer digital network in the world – over 2 million small-scale farmers, retailers and brands have joined the ecosystem and are working together to grow their businesses.

Every day, more than 40,000 questions and answers are shared via SMS, enabling farmers to learn from each other, tackle challenges and spark innovation. Using the latest machine learning technology, the Wefarm service accesses crowdsourced information to help farmers increase their yields, make pricing

“Just minor changes could make a world of difference.”



**Albert Boogaard**  
Head Innovations, Rabo Foundation International

“Rabo Foundation is constantly running pilots and exploring technological innovations aimed at improving the financial supply chain in rural areas and across the agricultural industry as a whole.”



decisions, diversify their business, seek out loans, and source the best quality seeds and fertilizer.

### **Technological leaps in developing nations**

While Wefarm is ideal for farmers who don't have online connection, the truth is that these days, more than half of the world's population – 4.5 billion people – have access to the internet. We've also seen an influx of (cheap) smartphones and improved connectivity in even remote rural areas. It's therefore becoming significantly easier for emerging countries to adopt new technologies. In fact, trends like IoT, blockchain, cloud computing and machine learning-enabled applications reached developing countries relatively quickly. Case in point: in rural parts of India, 4G is often faster than in cities like Utrecht. And it's cheaper, too.

The rapid rise of mobile banking 10 to 15 years ago in Africa is another example of how quickly digital innovations can take flight in developing regions. This particular development presents opportunities for the use of digital currencies, which could improve financial self-sufficiency in those areas. This is especially powerful for farmers who have no access to a local bank account or lack the credentials needed to set up banking profiles. In this realm, technological advances like blockchain, AI and IoT can make a huge difference, and already are in various cases.

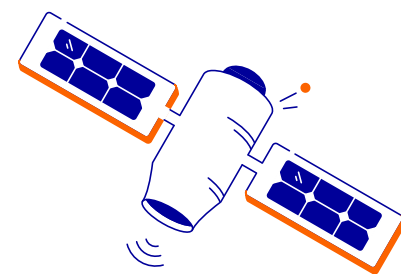
### **Rabo Foundation**

In order to uplift farmers and address the global food crisis, Rabobank and the Rabo Foundation are constantly running pilots and exploring technological innovations aimed at improving the financial supply chain in rural areas and across the agricultural industry as a whole. In order to get closer to this goal, we

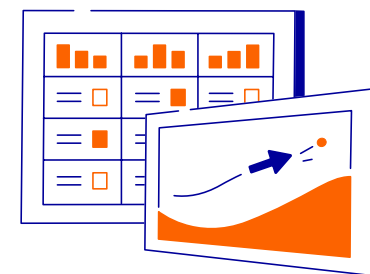
specifically focus on the following four data categories, which provide insights on a number of different parameters, including crop yields, costs, climate impact, fertilizer usage and financing needs.

### **Successful technological use cases: AgroCares, AgNext, IntelloLabs and FarmWise**

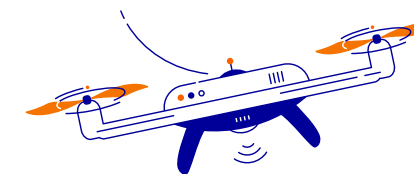
Rabobank has been involved in various initiatives aimed at delivering such data to provide invaluable insights and learnings. One of these initiatives is the AgroCares Soil Scanner, a mobile soil scanner enabled by IoT and AI that gives farmers easy, instant access to data about nutrients in the soil, in feed, and in plant leaves. This data can easily be integrated into a farmer's management information system and digital platform and support more informed decision-making to ultimately increase crop yields.



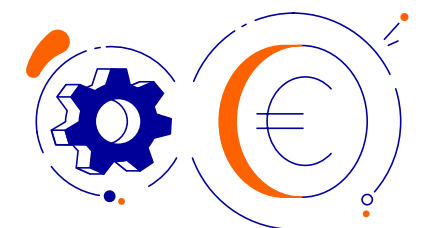
**Satellite and IoT sensor data**



**Scalable collected farmer field data**



**Agricultural supply chain data**



**FinTech solutions data**  
*(wallets, payments, credit scoring)*

Another example of IoT sensor solutions, is AgNext, a company based in India that uses mobile scanners to measure food quality and safety instantly, and guarantees end-to-end commodity traceability. By applying computer vision and IoT, AgNext aims to ensure effective procurement, trade, production, warehousing and consumption.

IntelloLabs, another Indian company, seeks to minimize food waste through its mobile app, which can assess the quality of fresh produce across the supply chain based on images analyzed by AI technology. Immediate feedback contributes to quality-based payments and incentivizes farmers to improve production and harvesting techniques.

Lastly, there's the example of FarmWise, a California-based scale-up that makes devices designed to help

vegetable growers streamline their business and boost efficiency. The company's products combine computer vision, sensors and learning algorithms to gather data that's specific to various individual plants, and then act accordingly. The business is looking to use autonomous robots to handle everything from seeding to weeding and harvesting. In 2019, the founders raised \$14 million, which should go a long way toward helping them to realize their future ambitions.

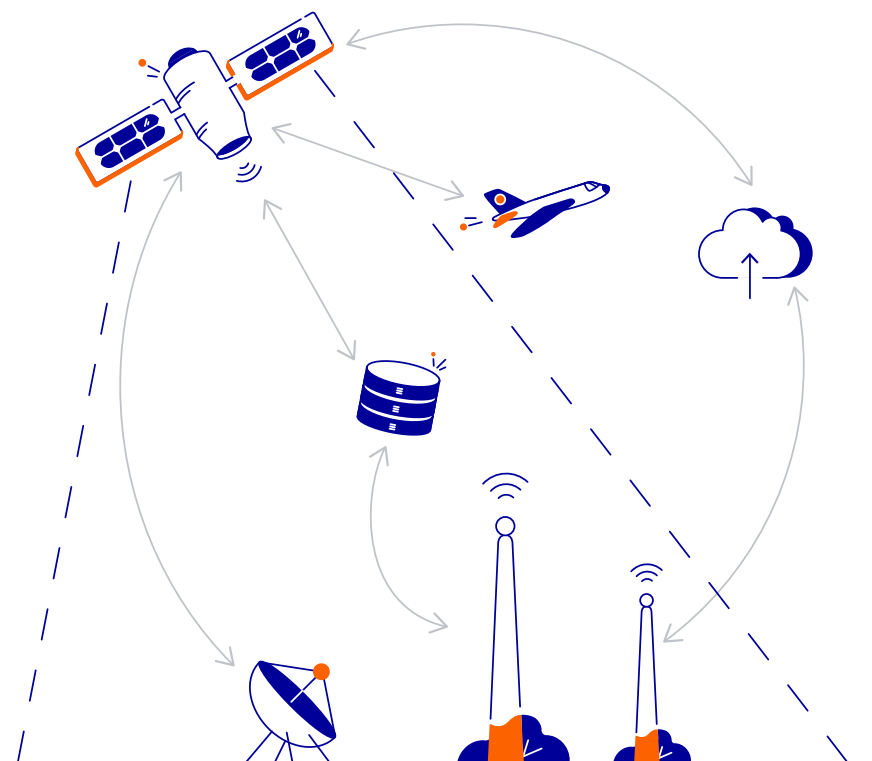
While individual validation remains crucial, digital platforms are ultimately needed to combine solutions and create a rich data environment with relevant data output for credit scoring and finance connections. For instance, information about a farmer's history must be combined with the transactional data derived from an Agri-wallet, a proper package of farm inputs and the right soil information, and then augmented by

satellite data and smart data about crops from the field in order to gain 360-degree insights that can completely transform agricultural organizations and allow access to finance. This is why Rabobank strongly focuses on the development and validation of such digital platforms and a newly formed smallholder ecosystem team.

An example of such a platform is AgriXchange, a cooperation between Rabo Partnerships and Mastercard. It aims to give more than one million farmers in emerging markets access to a digital platform that makes it easier for them to sell their produce at a fair price.

### **A mixed matrix of different technologies**

It's important to note that these different initiatives all rely on different data sources and combinations of technologies. When it comes to the AgroCares Soil Scanner, for example, it was revolutionary to discover that near-infrared analysis, driven by machine learning, allowed us to take samples of soil on the spot. However, it also demonstrated that, in many cases, a scan or sample by itself doesn't provide a blanket solution that can solve all problems. Smallholder farmers need combinations of different physical and digital solutions.



"... nearly 500 million (!) small-scale farmers in developing countries lack between 80% and 90% of the finance and resources they need to grow their agricultural business. In order to enable these farmers to increase productivity and therefore boost their income, it is critically important that we improve access to finance. As long as this bottleneck remains, we are far from ending poverty or solving the world's food shortage problem."

#### Fundamental technological development #4

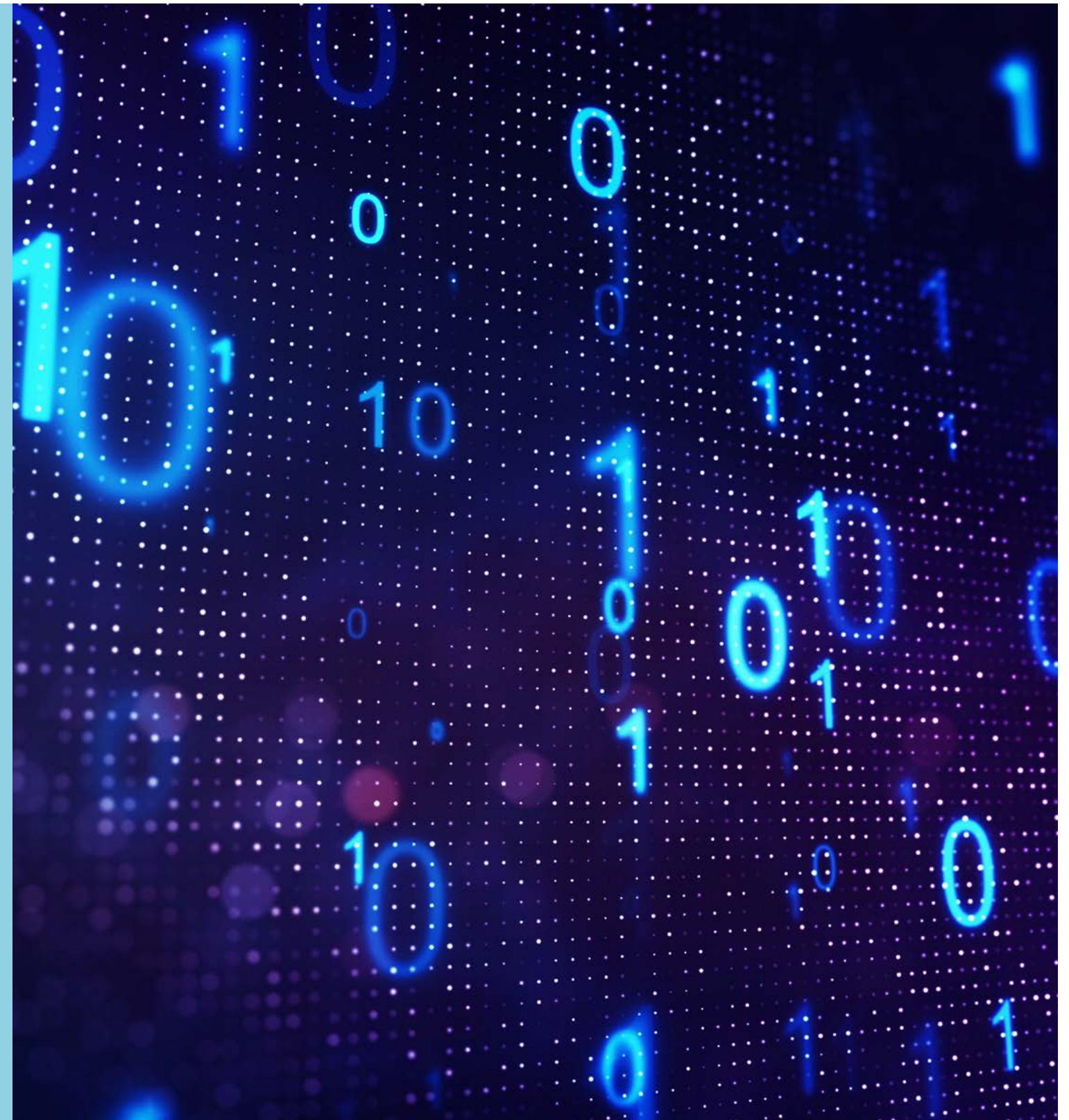
## The rise of tokenization

**Tokenization refers to the blockchain-based process of replacing an asset or piece of sensitive data, with a string of algorithmically generated characters (a token).**

The token essentially acts like a non-sensitive digital substitute – it represents the original information or asset, while ownership and access are continuously verified. The bank is a partner of the 2Tokens initiative, a collaboration of relevant industry partners that aims to deliver a clear set of rules that guide how to deal with tokenization and how to realize wider societal benefits and positive change through its application.

One way in which tokenization could bring about change is by enforcing healthy spending behaviors and financial inclusion. The key lies in the fact that tokens are programmable, which means we can incorporate rules within each token that govern its behavior. This programmability could completely change the way businesses are run and money

is spent. It could, for example, be set up so that a certain amount of money can only be spent at a certain shop or in a particular area in order to ensure local entrepreneurs are supported. Through such a “contract”, tokenization can encourage people to adopt spending habits that will lay the foundation for a sustainable future. Essentially, tokenization – especially when supported by technologies such as IoT and AI – can help us to create a society in which financial transactions aren’t just cheaper and more efficient, but also fundamentally more responsible.





# *Building trust in an open society*

*Theme 4*

“The only way we can future-proof ourselves is by restoring trust. We need to be able to have faith in the news we read, the reports scientists publish and the way our data is handled.”



**Marcel Kuil**  
Open Innovation & Partnerships Manager

**Theme 4:**

## **Building trust in an open society**

The rise of the internet opened up the world to a degree no other technological development has managed to achieve before. Within a few years, millions of people gained access to an infinite mass of information. The world was thrilled: the possibilities appeared endless.

We were hurtling towards the ultimate ideal of an open society that would include and empower everyone, everywhere, and bring us nothing but positive growth.

At least that's what we all thought. The reality has proved a little less promising. While everyone, everywhere should theoretically have access to information, in practice we've witnessed that this is not the case in certain parts of the world where restrictions apply. Sections of the World Wide Web have been geofenced in places like China, where people can't connect to Facebook or YouTube. It would seem that no matter how open the internet is, it still can't escape the threat of censorship. Ultimately, it was technology that opened up the world for us through the internet, and it's technology that has excluded some of us from that open society.

### **Open, but polarized**

Moreover, we've witnessed another shift. The internet used to be considered a source of reliable knowledge, but over time, it's become much harder to establish if online information is actually even true. Can we trust a review on TripAdvisor, or the ranking of a hotel or restaurant? Now that we know that these reviews can easily be "bought", it's near impossible to be 100% confident in what we read. What happens if we can no longer distinguish real facts from "alternative facts" – when the truth is intentionally altered, and this new "reality" is accepted by the public? If we start making major or minor life decisions based on lies, conspiracy theories and others' biased opinions? If deepfake software is used to generate images that aren't genuine, or to make people say things in videos that they never said in reality?

As we move closer to an extremely open society, trust becomes a bigger and bigger issue – one that's closely related to concerns over the loss of privacy we experience with every new app we download





“Companies are currently looking into developing general standards, but we’re not quite at that point yet. It appears that it will take a few more years before we get there.”

and every website we visit (see Theme 1). Today, we demand to know how our data is being used. We insist on preserving privacy and reclaiming ownership of our personal information – not just consumers and members of the public, but organizations and governments, too.

If people can’t come to fully trust other individuals, entities and entire industries again, society is at risk of becoming even more polarized than it already is. The only way we can future-proof ourselves is by restoring trust. We need to be able to have faith in the news we read, the reports scientists publish and the way our data is handled.

### ***The rise of ethical dilemmas***

As we embrace technological progress, new ethical dilemmas arise too. A major question is whether or not we are actually in control of the outcomes of all this innovation. Can we influence or foresee the real impact of AI? Do we know what vulnerabilities could result from the exponential rise in connections between different data sets and sources, and the increasing pressure on authenticity and identification issues? It’s because of such considerations that we demand that companies responsible for innovation meet such high standards before they earn our trust.

It’s a two-way street: in order to stay ahead of the curve, companies rely on the trust they’ve gained from consumers. Remember the mess that Facebook got itself into in 2018, when we found out about the Cambridge Analytica scandal? Or again in 2020, when the CEOs of both Twitter and Facebook were questioned by the US Senate about their incompetence when it comes to dealing with fake news and misinformation? It’s scandals like these that

make people lose confidence in such companies, with potentially disastrous consequences for these businesses. Because if we no longer trust a particular company or brand, we will never embrace their inventions, products or services. In other words, without trust, there can’t be innovation.

### ***The steering power of algorithms***

Although we all know that AI algorithms drive the success of companies like Google, YouTube and Facebook, we perhaps haven’t all considered just how much power these algorithms have over us. They track every action we take online, and based on this, they make assumptions about our preferences and future behaviors. Algorithms decide which pages we land on, and which promotions and pop-ups we see, throughout our online journey. This isn’t always a bad thing: personalized ads might be intrusive, but they’re sometimes helpful, too.

The real problem lies in the steering power of algorithms, and how they guide users down a funnel based on previous assumptions and actions, essentially cultivating “tunnel vision”. Algorithms ensure we are only shown content that aligns with past behavior, and therefore confirms existing beliefs; conflicting content is kept out of sight. As a result, people are rarely challenged by opinions that differ from their own, and therefore can quickly adopt an extremely one-dimensional worldview. We have AI to thank for this very real danger.

### ***Explainability as a confidence booster***

Going forward, the concept of explainability will become increasingly important. We need to be able to account for the decisions made by AI and

explain the reasoning behind certain outputs. If, for instance, an AI-model rejects a customer’s application for a loan, the bank needs to be able to unpack the reasoning behind this decision and justify it to the client. Essentially, we need to improve our ability to explain what happens during computation in a machine learning system and how AI arrives at certain conclusions.

It’s absolutely vital to promote explainability now and therefore ensure that people have great trust in companies that use technologies such as AI and blockchain. As time goes on, these technologies are only going to become more complex, and therefore more difficult to explain in human terms.

Which technology allows for explainability and can therefore help to restore trust? Blockchain immediately comes to mind for its transparency and capacity to store data in a decentralized manner. Blockchain allows users to track the origin of data and see if agreed conditions are met. If consumers can easily see that other parties are upholding their side of an agreement and following through on commitments, they’ll slowly but surely start to regain confidence in these entities.

### ***Establishing a joint data manifesto***

It is absolutely vital that businesses go beyond existing legislation to develop their own ethical standards and guidelines that dictate how they deal with personal data. It’s also critical that they are honest and open about those standards. When we use data at Rabobank, which we only ever do securely and in a way that protects privacy, our sole motivation is to better fulfill our clients’ wishes and cater to their needs.



The “Innovation & Trust” think tank, which was initiated by Rabobank and KPN, and involves other institutions like Achmea and Schiphol Airport, is putting all its energy into creating an innovation model that has trust at its heart. For instance, one recommendation that has emerged from the think tank is to establish a joint data manifesto, in which leading parties declare how data is gathered, clarify how it’s used and commit to ensuring that customers’ needs are met every step along the way. Going forward, all organizations must take a stand and champion reliability and transparency.

### ***On our way to establishing general standards***

Companies are currently looking into developing general standards, but we’re not quite at that point yet. It appears that it will take a few more years before we get there. Different entities – Amazon, Google and Microsoft, for example – still operate on their own platforms and aren’t working together. That said, it’s promising to see that the world of technology is determined to tackle the issue of trust on the user’s side, while simultaneously establishing an open society that truly is open for all.

Until then, the relationship between technology, innovation and trust will most likely remain as shaky as it is today. Companies need to realize that revenue growth should never be the primary objective of innovation, but rather an outcome that naturally follows if innovation is pursued for the right reasons. Moreover, businesses need to collaborate to tackle the challenge together. In order to do that, they too need to overcome trust issues between themselves and keep sight of the greater goal: to move closer towards an open society built on trust.

“The real problem lies in the steering power of algorithms, and how they guide users down a funnel based on previous assumptions and actions, essentially cultivating “tunnel vision.”



# *The relationship between global crises and technological development*

**Theme 5**

## Theme 5:

# The relationship between global crises and technological development

Humankind has been dealing with global crises of one type or another since the beginning of time. Such events wreak havoc on people's lives and the environment, but they also tend to present lots of opportunities for innovation too.

Some of the world's most prominent technological trends arose during or shortly after an international crisis. Take for instance the enormous impact that World War I had on medical science, due to the large number of wounded that needed treatment. The fields of anaesthetics and plastic surgery in particular developed at an impressive pace. Similarly, during World War II, research on nuclear weapons evolved rapidly, ultimately resulting in the world's first nuclear explosion in July 1945.

Just a few years later, the Cold War erupted. But it wasn't only tensions between the United States and the Soviet Union that spiked during that time – so did advancements in rocket technology. This progress enabled the early exploration of space, with the Soviet Union successfully launching the first artificial satellite in 1957 and putting the first human into orbit in 1961. The real peak came in 1969, when the United States succeeded in sending humans to the moon for the first time. It's fair to say that the legacy of the Cold War and the early space race yielded the birth of the modern technological age. In fact, many of the products that we take for granted today (think Velcro,

joysticks and Nike Air shoes) actually originated from space-related innovations.

### **The close link between tragedy and technology**

Other examples abound. Think back to the SARS epidemic that ravaged Asia in 2002 and 2003. In those days, e-commerce was fairly primitive in China – if anything, it was just starting to emerge. Few people had access to the internet, and e-commerce platform Alibaba focused on B2B trade, connecting buyers from the United States with Chinese suppliers. As business travel was suspended and many were avoiding physical retail outlets, SARS fueled the rapid growth and adoption of e-commerce in the region. Ultimately, it helped to make China the epicentre of innovation around digital commerce.

Remember the financial crisis that hit the world in 2008? It was shocking to see the global financial system collapse the way it did. However, it also laid the foundation for the sharing economy to rise and thrive. In the aftermath of the crisis, the notions of

sharing or renting emerged as new social ideals as people pushed back against overconsumption and the accumulation of debt that caused the crisis in the first place. Technology allowed for the creation of online portals where people could manage the sharing of assets that weren't being fully utilized (cars and homes, for instance). Highly successful platforms like Airbnb, Groupon and Uber were all launched during or very soon after this period.

Then there was the explosion and sinking of the Deepwater Horizon rig in the Gulf of Mexico in 2010, which unleashed the largest single oil spill the world had ever seen. This uncontrolled 87-day gushing of crude oil into the sea (over a mile underwater) created an unprecedented problem and a serious environmental disaster. At that time, no technology or mechanism existed to contain the spill. The "Capping Stack" that ultimately stopped the flow of oil was developed "on the fly" over a few months, and so was the means to install it at such a great depth. This technology is now used as a contingency plan for deep water drilling operations across the globe.

### **When disaster strikes, ingenuity spikes**

In that same year, a devastating earthquake hit Haiti. Within a short space of time, aid workers and locals managed to piece together makeshift solutions to various problems using mobile phones and internet connection. They successfully created an instant banking system that humanitarian agencies could use to distribute cash for food, medicine and other essentials. They used OpenStreetMap to provide up-to-date information about affected populations, damaged infrastructure and key emergency locations. With mainstream communication platforms down, people turned to social media networks to reach out to others and share crucial updates.

Finally, consider how the focus on the climate crisis and new regulations over the past few years have fueled the rise of electric cars, driven widespread adoption of solar power equipment and created space for innovation around more "earth-friendly" foods like plant-based meat substitutes. Of course, these developments have also been driven by demand from the general public, who are increasingly looking for environmentally friendly goods and services.



It's clear that there is a direct link between times of trouble and accelerated technological progress. In the midst of a crisis, people need technological solutions more than ever. When disaster strikes and we find ourselves insecure and afraid, innovation picks up at an unprecedented speed. And after the crisis has passed, the new inventions born from it quickly become part of our daily lives.

### ***And then COVID-19 hit the world***

If someone told you in 2019 that you'd spend three-quarters of 2020 in your slippers, working from home and doing video calls with colleagues, would you have believed them? Probably not. And yet this has been the reality for most of us since the worldwide outbreak of COVID-19. The pandemic kicked off a global crisis like nothing our generation has ever seen before.

This was the first international crisis of this intensity to take place in the modern digital era, at a time of great

technological advancement. How would the tech world respond in the face of such a significant threat? How would technological innovation help us deal with the crisis? Would it continue to evolve as rapidly as it had been pre-COVID-19? We didn't know.

We started to see the answers after the initial shock sunk in. Anyone who thought the pandemic would slow down innovation was wrong. The world shut down, but innovation certainly didn't. The outbreak effectively amplified ingenuity to historic levels and rapidly sped up the adoption of existing technologies.

One area that saw significant progress was robotics – the field in automation that deals with the design, construction and operation of robots. Before the pandemic, robots were already driving growth and adding business value in many industries. Now they're helping businesses achieve even more – they're running test labs, disinfecting buildings, cooking hospital food, and all the while, they're demonstrating the possibility of more and more robotics use cases to regulators, workers and the public.

Across the board, COVID-19 has inspired numerous other examples of innovation, both in the medical realm and in areas that impact our daily lives. We shed some light on a few of these instances below.

### ***A boom in COVID-19-driven creativity***

One example of a business that's invested in technological progress to help tackle the virus is Insilico Medicine, a Hong Kong-based biotech company. The firm repurposed its AI platform to help speed up the discovery and development of a COVID-19 drug using machine learning. More specifically, it used AI to simulate the impact of molecules on our cell system.

While the organization didn't find a cure or vaccine for the virus, it did discover a number of new molecules that could potentially affect the virus and its mutation. Time will tell if this is indeed the case. Other projects like the American open-source COVID-19 Open Research Dataset (CORD-19) also rely on AI – it's an effort to combine data provided by humans so that intelligent systems can look for patterns.

Not too far away from Hong Kong, in Shenzhen, a startup called Youlbot built an antivirus robot in only a couple of weeks. The robot uses its six ultraviolet bars to sanitize surfaces and an infrared camera to scan people for the signs of fever. Similarly, Massachusetts Institute of Technology (MIT) researchers designed a robotic system that uses UV-C light to disinfect large spaces and neutralize the air within a remarkably short amount of time.

The World Health Organization (WHO), Oracle, Microsoft, IBM and others are collaborating to get the most out of HACERA's MiPasa. This is a multi-party, multi-source, blockchain-based verifiable data sharing platform that aims to quickly identify COVID-19 carriers and hotspots. The platform essentially makes it much easier to gather, integrate and examine information about how the pandemic is spreading.

On an individual level, technology is also helping to tackle a very human challenge that the virus has posed: a serious lack of physical contact and affection. HEY Bracelet and Bond Touch, both wearable bracelets, attempt to solve this conundrum by virtually simulating human touch. Usually sold in pairs, the bracelets will lightly squeeze whoever is wearing them, or light up and vibrate, when the wearer of the bracelet "partner" activates theirs.

Aside from not touching each other, we also need to be careful not to touch our own faces in order to protect ourselves from potential infection. NASA's Jet Propulsion Lab (JPL) developed PULSE, a 3D-printed wearable device that vibrates when a person moves their hand towards their face. The pulse feels like a little nudge that then reminds the wearer not to touch anywhere near their eyes, nose or mouth.

### ***Impact that will last long after this crisis is over***

As is obvious from the examples above, this most recent crisis has changed the way we act, plan, create and think about the future. The global challenge presented by COVID-19 spurred on a massive innovation effort from companies, governments, universities and individuals. As we've seen in the past, crises and disasters tend to provide endless possibilities for accelerated progress.

Leaders are currently exploring and capitalizing on all the possibilities presented to us now. They are using this time to form partnerships, develop new capabilities and work with governments to unlock new opportunities, thereby shifting entire ecosystems. Whether the aim is to roll out technology to keep the world running or to prevent industry collapse, the partnerships, products and services that enterprises are building today have an impact that will likely last long after this crisis is over, redefining business and technology for years to come.

# *Conclusion*



## Conclusion

It is safe to say that 2020 turned out to be an entirely different year from the one we'd all anticipated. However, what we did (correctly) anticipate was that, just like in previous periods, digital technologies would continue to radically transform businesses and society.

This past year, probably more than any before it, has demonstrated the importance of technology. We have seen first-hand the value it adds, not only in our attempt to tackle a global pandemic, but also in our efforts to safeguard people's privacy, build a sustainable future, uplift developing nations, and re-establish trust.

### ***The magic lies in the mix***

In particular, this year has revealed what's possible when different technologies and applications are combined to unleash the full impact of innovation. The blending of different technologies, so that they enhance and reinforce one another, has proven to be an incredibly powerful tool for addressing some of the world's most pressing challenges. Naturally, technology – whether applied alone or in combination – causes its own problems, too. We believe that these issues should be fought with the same weapon: a mix of technological innovations.

It's not only different technologies that are stronger together; businesses and governments are, too. As we've pointed out in this report, companies tend to still operate in silos, fragmenting the landscape and

thereby limiting the possibilities. The more businesses break away from their separate islands, team up and share knowledge, the greater their impact can be and the faster they can catapult innovation forward. Perhaps even more importantly, through true collaboration supported by official legal frameworks, we can hopefully restore people's trust in others, in organizations, in science and in governments – something the world desperately needs right now.

### ***All the puzzle pieces falling into place***

It's like a puzzle, with all the pieces slowly but surely falling into place. We still don't know how many pieces there are in this puzzle; in fact, the puzzle might never be complete. However, as long as we continue to explore technology from all angles and investigate its ultimate mix, we will no doubt get closer to solving the complex puzzle that is many of the world's gravest dilemmas.

We will remain at the forefront of technological developments and navigate our way through the mass of opportunities that they present us – the opportunities to improve our services, and empower our clients and partners. Most importantly though,

we need to remember to put a commitment to contributing to the well-being of people, society and the planet at the heart of all innovation initiatives. This has been the driving motivation behind everything we do at Rabobank for many, many years. It will continue to be our guiding star long into the future.

# **Technology Trend Report 2021**

*Strategy & Innovation Hub*

***This report is the result of a tremendous team effort.***

***We would like to thank:***

Claudia Terpstra, David Lamers, Rob Guikers and Paul van Zwieten from the Tech Lab team for sharing their technical insights with us.

Inge Abraham and Ivo Weterings (Accenture) for delivering a great job in turning massive amounts of information into easy-to-read text.

Sander Pronk from the Creative Hub for this beautiful design. And last but not least, José de Ruig and Rosa Braas for helping us with that intensive last mile to bring this report to you.

***techlab@rabobank.nl***

***Rabobank***