BLOCK CHAIN

Netherlands
Innovation
Network

"You must ensure you create a solution to a genuine problem, not try to invent a problem to fit your 'solution'"

Jeroen van Megchelen,
Dutch Blockchain Coalition

Connecting Innovation Worldwide

FOREWORD

Blockchain has now proven itself, but there is still much work to be done.

After the first years in which society was promised applications with significant disruptive economic impact, blockchain technology has now entered the phase when it has to deliver. Its possibilities are now becoming more concrete and realistic, such as the international exchange of official diplomas and the process of financial decision-making for mortgage loans. Over the next few years, blockchain will gradually acquire a place in our daily personal and professional lives. And I believe this will make our economy stronger and more dependable.

I would ask the developers of this technology always to keep a close eye on the social implications of block-chain. Much is possible, but there is also much work to be done. Open global standards are needed in order to be able to scale up. Pilots show that, with each new application, developers need to look closely at compliance with privacy and data legislation. To a greater extent than previously seemed necessary, developers must clearly define the governance aspects of each block-chain application. Because obviously we want to avoid the possibility of abuse, and the risk of security leaks apparently don't automatically disappear just because you're using block chain.

"Open global standards are needed in order to be able to scale up."

It gives me great pleasure to introduce this blockchain special from the Netherlands Innovation Network. It includes an overview from the innovation attachés of the technical developments, knowledge institutions and government ambitions in the countries where they are based. Our aim being to help Dutch companies investigate the added value to be found in international collaboration and inspire foreign companies to seek out collaborations with Dutch partners.

Mona Keijzer MA, LL.M.
State Secretary for Economic Affairs and Climate Policy

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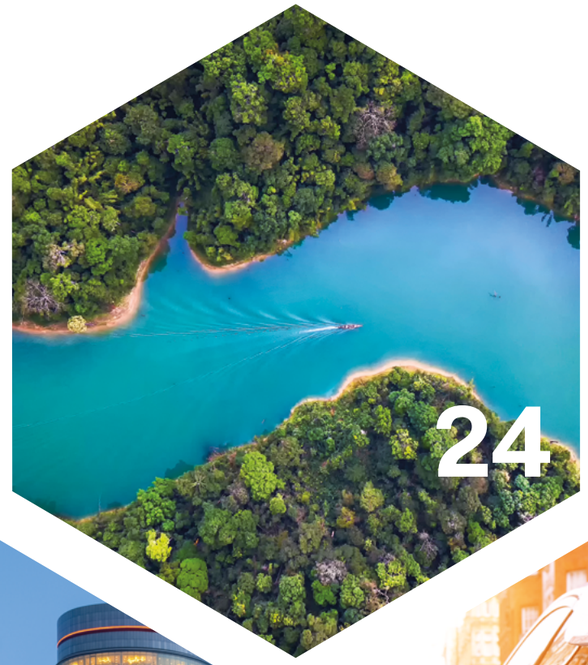
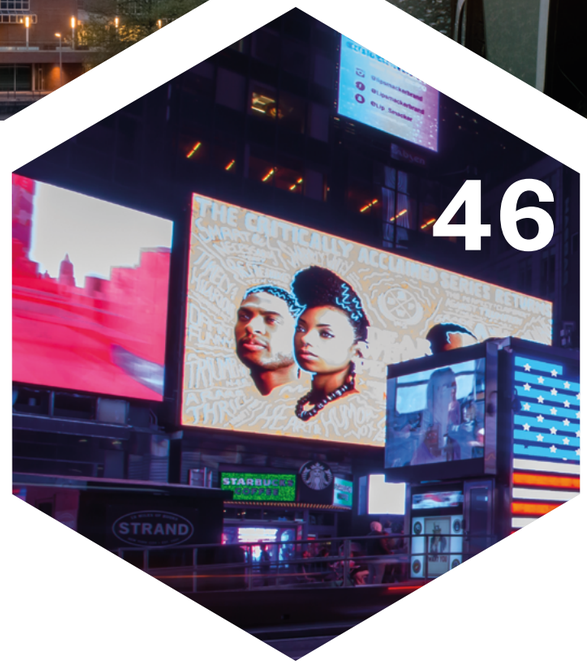




DUTCH POSITION

"The willingness of the Netherlands to collaborate – such as the Dutch Blockchain Coalition – really is unique."

Gerard Goudsmits
Sr. policy officer Digital Economy
Ministry of Economic Affairs & Climate Policy

Jan-Willem Hiddink
Sr. Advisor Blockchain and AI
Netherlands Enterprise Agency (RVO)

Netherlands Enterprise Agency: facilitating blockchain entrepreneurship

With responsibility for the block-chain portfolio at the Ministry of Economic Affairs & Climate Policy, Gerard Goudsmits and at RVO Jan-Willem Hiddink have seen how support for Dutch entrepreneurs and companies to exploit block-chain technology has developed and crystalized in recent years.

As part of the Dutch government's wide package of support to help companies innovate and do business abroad, the Netherlands Enterprise Agency (RVO) helps businesses with everything from financing, subsidies and tax concessions to advice and contracts.

Right support at the right time
Sometimes, new technology fits neatly with existing mechanisms. So, in 2012 the first blockchain projects, which mainly focused on developing smart software for mining and trading cryptocurrencies, made use of the WBSO scheme (R&D Promotion), a generic scheme for every sector and size of company that gives payroll tax concessions on time spent developing new technical operating principles or software.

At other times, it's handy to create a specific new instrument for a new technology, which is why the Ministry of Economic Affairs and Climate Policy and the Province of Groningen together developed a so-called SBIR (Small Business Innovation Research programme) for blockchain. "Such instruments make a difference because the success of a company lies not only in the underlying technology, but in a combination of factors such as entrepreneurship, speed, team competences and finding a market fit."

SBIR enables a government to carry out pre-commercial procurement. Companies submit tenders for, say, a feasibility study or prototype. The resulting product or service must also be available for purchase by a government agency. Tenders are then evaluated against specific criteria and often broken down into phases. So that results from a first phase will affect funding for the next. After two selection rounds, it was decided to finance the entire development process for two companies, Stichting Forus and Summitto (see box).

Help starting up and stepping out
RVO finances enterprises at various stages of their development. For example, for startups with significant growth potential who have found an investor who is willing to finance further development and commer-cialization but first wants to see a number of validation steps. RVO can bridge the gap between the startup's current situation and the point when the investor steps in through a loan of up to €350,000, allowing the startup to implement its early-phase plan.

"Such loans are only granted where there's ambitious growth; but that's the case with many tech startups, including those in blockchain subsectors like Fintech and Supply Chain. For an application to be successful, it needs to demonstrate a clear vision of the how, why and added value of blockchain within the product."

> "A company's success lies not only in the technology, but factors such as entrepreneur-ship, speed, team competencies and finding a market fit."

In a later phase, RVO can provide co-financing through innovation credit, with RVO often financing 45% of project costs for projects up to €10 million. While for companies with international ambitions, RVO also gives companies pitch training and constructive feedback on their project proposals for grants under Horizon 2020, a European research initiative.

Learn more about:
WBSO: www.wbso.nl
SBIR: www.SBIR.nl
First-phase startup funding: www.RVO.nl/subsidies-regelingenvroegefasefinanciering-vff
Innovation credit: www.innovatiekrediet.nl
Horizon 2020: www.h2020.nl

Or feel free to contact Jan Willem Hiddink (see box) at RVO on any aspect of this article by mailing Janwillem.hiddink@rvo.nl or calling +31 (0)6 5548 3246.

Ask Jan Willem!
With a Masters in AI, Jan-Willem Hiddink is RVO's AI and Blockchain expert. He is involved in various schemes, including SBIR and early-phase financing, and draws on his technical back-ground to analyse projects and develop criteria for new applications.

Stichting Forus
Stichting Forus (Forus Foundation), together with the municipality of Zuidhorn & Berenschot, has developed an online platform to process municipal services. As a feasibility study, they are initially using it for receiving, granting and processing applications to a council anti-poverty scheme. This is the first operational application of blockchain by a municipality.
www.forus.io

Summitto
Summitto has used blockchain to develop a triple-entry accounting system to prevent VAT fraud. By automating VAT returns, the system could save governments billions in fraud. Since receiving SBIR support, Summitto has grown substantially and is making promising progress, partly due to a European Horizon 2020.
www.summitto.com

Peter Verkoulen
Coalition Manager
Dutch Blockchain Coalition

The Dutch Blockchain Coalition: connecting, collaborating, educating

After four years as CEO of the Brightlands Smart Services Campus in Heerlen, in September 2019 Peter Verkoulen became Coalition Manager of the Dutch Blockchain Coalition. Here he discusses the Coalition's role in the country's blockchain journey and the position of the Netherlands within the global blockchain landscape.

Coming from a key partner in the Dutch Blockchain Coalition (DBC), Peter already had some clear ideas about DBC's role going forward. For him, one key priority is to create a single integrated blockchain ecosystem in the Netherlands.

"Currently, DBC consists of a number of knowledge institutes, large commercial companies and government and other non-profit organisations. But there's much more going on in blockchain in the Netherlands. Lots of startups and scaleups, obviously; but also, for example, the huge Odyssey Hackathon in Groningen and Blockchain Netherlands in Amsterdam. The ecosystem must ensure startups and scaleups can access bigger organisations. To access funding, of course; but primarily to create connections between the startup and corporate worlds to their mutual benefit. Once connected, people can start developing collaborations."

Trust, awareness and inspiration
Blockchain is built on decentralised trust, so Peter has no intention of trying to run things centrally. "Our role is to get out there, reach out to any relevant organisation and encourage collaborations. For example, at the next Odyssey Hackathon, DBC and the Ministry of the Interior and Kingdom Relations will host the Digital Identity challenge."

> "Being active goes beyond funding. We wouldn't be so far now if government simply gave us money and waited for a progress report."

Beyond the blockchain community, Peter feels DBC can help educate people about blockchain and inspire them to consider how they can use it in their companies and organisations. "We can do that in two ways, I think. First, through use cases. For a while now, the Coalition has been developing use cases. Bringing together actors in the field to work jointly on practical applications, so we can learn more about the technical, governance-related, legal and other barriers to be overcome.

"Secondly, by educating and training people in block-chain and its potential. Since the outset, DBC has been working on the Human Capital Agenda. Right now, for example, we're finalising an online entry-level training programme that covers use cases, legal issues,

developments in research, etc. It requires no technical knowledge and will be accessible to a very broad audience."

A unique model that's getting noticed
Peter sees the role of government as vital. "The Coalition is an example of the unique Dutch triple-helix cooperation between companies and public organisations, knowledge institutes and an active government.
And being active goes beyond funding. The Secretary-Generals of the Ministries of the Interior and Kingdom Relations and Ministry of Economic Affairs and Climate Policy participate actively in setting the Coalition's agenda and support us wherever they can; their staff are involved hands-on. We wouldn't be so far now if government simply gave us money and waited for a progress report. Obviously, you can always do more: the government's recent launch of an AI coalition shows they're playing catch-up a bit at the strategic and public commitment level. But bottom-up, there's already a lot happening and I'm very pleased with the role our government plays. It's helping the Netherlands remain a frontrunner in blockchain globally."

A good indicator of that frontrunner status is the interest other countries show in what DBC is doing. Off the top of his head, Peter mentions approaches from neighbours like Sweden, Germany and France as well as countries further afield like Singapore, Australia and South Korea.

Which brings us to the role of the Netherlands Innovation Network, whom Peter feels can really help strengthen the Netherlands' position as a blockchain nation.
"Without collaboration, blockchain is meaningless.
And in a small country like ours, collaboration soon means international collaboration. It'll be really helpful if Innovation Attaches are able to connect us to relevant initiatives in their countries; make us aware of local companies and knowledge institutes who are hot on a specific area of blockchain; and, where they see a specific local demand or initiative, steer the relevant players towards DBC as a possible partner. It all helps to build the ideal blockchain ecosystem that everybody's striving for."

Learn more about the Dutch Blockchain Coalition: dutchblockchaincoalition.org

Case #1

Blockchain and the changing role of corporate banks

As Head of TCF Services at ABN AMRO, Fleur Boos is closely involved in three trade blockchain-related initiatives: VAKT, Komgo and DELIVER. Making her ideally positioned to discuss blockchain's business benefits, its impact on the bank-client relationship, blockchain in the Netherlands and the value of the Innovation Network.

Fleur sits on the board of VAKT, a fully digital post trade settlement platform based on blockchain technology co created by energy majors, energy traders and banks. VAKT was a response to the operational inefficiencies errors and fraud — in the post trade settlement. A Boston Consultancy Group study found that 98% of trade flow data is repetitive. Blockchain lets you capture that relevant 2% and know that it's authentic.

Komgo is a VAKT spin-off developed by the three banks in the VAKT consortium and other international Trade banks. We wanted a solution that could service other commodities than just Energy. Komgo focuses on financial services and KYC (Know Your Customers), something obviously critical to a bank. As a single source of truth and authentic identifier of information, Blockchain provides that surety, which is why so many use cases involve trade and supply chains. Including the third blockchain project ABN AMRO is involved with DELIVER a joint initiative of ABN AMRO, Samsung and the Port of Rotterdam, which offers a single window solution through an independent notary function within a trade flow, focusing on containerised trade.

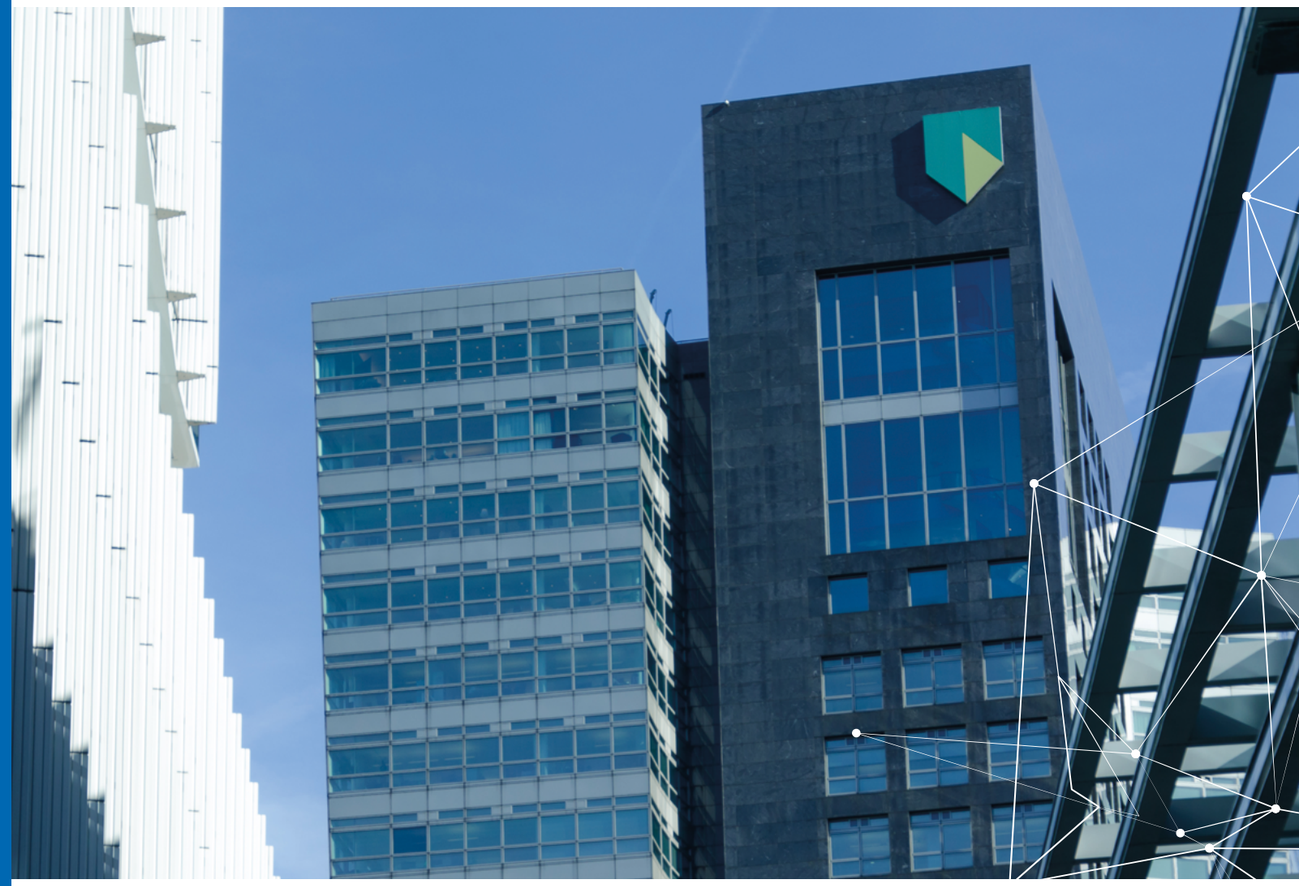
Bank's changing role

Fleur is seeing the world corporate banks serve moving towards ecosystems and platforms. "To be part of those ecosystems, the bank s role must change. These three initiatives reflect how corporates want to be served digitally. So banks will have to interact with clients on platforms alongside their client's other business partners.

It's absurd that at home a company treasurer orders pizza online, tracks & traces delivery then pays digitally; but at work Excel sheets still dominate. Companies won t accept that much longer when products like VAKT, which links a company s supply chain flow and financial flow, can offer an infinitely smoother client journey.

Netherlands strongly positioned

Fleur sees the Netherlands as ideally equipped to embrace this future. "Trade is in the Dutch DNA. Strategically, we re an international import/export hub with two major ports and we have a world-class digital infrastructure. But crucially, blockchain ecosystems are developed through cocreation to solve trust issues and only work if everyone son board (literally), a collaborative spirit epitomised in the Dutch polder model culture.



More of the same, please!

Asked how the Innovation network can best facilitate future block chain initiatives, Fleur is quite clear. "Continue what they're doing. That the Network is a global network is obviously ideal; the newsletter is excellent; the informative content conferences generate fruitful discussion between industry and other stake-holders; and the field trips are really useful. I personally attended a three-day trip to Silicon Valley. It wasn't only inspiring. It also helped build ne tworks. Amongst Dutch companies on the trip; but also, Edwin van Bommel, ABN AMRO's Head of Innovation, and I met several companies in California with whom we're now in discussions around potential collaborations. In short, keep up the good work!"

"Companies are moving towards ecosystems and platforms. And to be part of those eco-systems, banks must change."

Case #2

How blockchain is proving an opportunity, not a threat

Djuri Baars is leading the Blockchain team within Rabobank. As such, he and his team are closely involved with we.trade, Rabobank's flagship blockchain solution. As well as explaining how and why we.trade came about, Djuri discusses why the Netherlands is emerging as a global blockchain frontrunner and why organisations need to embrace, not fear, the changes blockchain is bringing.

Officially launched in 2018 by Rabobank and its partners, we.trade was the world's first commercial blockchain-based trade finance platform. Today we.trade is a joint venture composed of 13 shareholder banks, creating a strong trade network across Europe and with the aim of expanding to global reach.

"In general, the trade finance sector involves many different international stakeholders. Trades are still largely conducted using paper-based contracts, which are prone to user error, loss and fraud. It's also notoriously slow: often the paper chain takes longer to get from A to B than the goods themselves! So there's lots of gains to be made with blockchain. In cost and time savings; but also eliminating conflict, as you move from a world where disputes can arise over which is the relevant version of a contract to blockchain's single source of truth, regarding both the trade itself and the trade's contractual conditions."

Back in 2014, Rabobank conducted their first experiments with blockchain for cross-border payments, followed by a proof-of-concept in blockchain for KYC. This showed that blockchain had a lot more to offer than just faster and lower payments.

Rabobank then collaborated on a prototype with two partner banks in which blockchain was used for open-account trade. Clients responded very enthusiastically and the decision was made to develop the concept further, resulting in what is now known as we.trade.

Right motivation

Djuri feels it's important blockchain is adopted for the right reasons. First, the reason why you're offering it to your clients: "Blockchain does seriously affect your internal processes, but the client is of course not so interested in that or the technology. So while blockchain technology is the reason why we can offer functionality that was hard or impossible to provide previously, when explaining the benefits we talk about the transparency, speed and security it offers. More important than the underlying technology is the user-interface for end-users, which doesn't mention blockchain at all."

But Djuri thinks that as an organisation you also need to be clear and honest about your own motivations for adopting blockchain: "Especially in the early days of blockchain and Bitcoin, there was an expectation that it would make organisations such as banks redundant, and it was therefore seen as a threat. At Rabobank, ever since our first hands-on experiments in 2014, we've seen that blockchain is far more of an opportunity than a threat. And this realisation helped us to become early adopters.

"It's like the early days of the internet: we're only now starting to work out where and how blockchain can add value. But you mustn't be paralysed by the idea that this new technology could make parts of your organisation or processes redundant. Moreover, blockchain is often misunderstood, as many people only think it's used in cryptocurrencies. Only by coming to understand blockchain by experimenting with it, you know whether it will affect your ways of working and whether you should take action to prevent your organisation becoming redundant."

Unique mentality

Fortunately, the rabbit-in-the-headlights mentality seems to be less prevalent in the Netherlands than some other countries. So why are Dutch organisations pioneering blockchain with such enthusiasm?

"I think it's partly because we're a small country with a good digital infrastructure and well-educated workforce. But I also think our willingness to collaborate, as reflected in things like the Dutch Blockchain Coalition, really is unique. I've been to quite a few international conferences in recent years. A lot of organisations in other countries, especially in the financial sector, seem a lot more reluctant to collaborate, and sometimes don't even seem to understand why you should want to collaborate with each other. But I and the blockchain leads at competing financial institutions know that we need each other. It's not about our own clients anymore, it's about bringing our clients together; which is why we're better off joining forces."

"Only by coming to understand blockchain by experimenting with it you know whether it will affect your ways of working."

Company: Ledger Leopard

Blockchain solutions that solve real problems

In 2017, Ledger Leopard won the Computable Awards ICT Healthcare Project of the Year for *Mijn Zorg Log*, the first healthcare blockchain application to be legally certified as safe to use. The company's CTO and founder, Jeroen van Megchelen, feels blockchain can be invaluable to the healthcare sector, but stresses blockchain is not the silver bullet some claim.

Mijn Zorg Log, a blockchain application for maternity services, was Ledger Leopard's first product. It lets clients, caregivers and families keep a shared digital log. Since then, the company has used the same method to roll its Ledger Leopard blockchain healthcare solution out across the full healthcare field.

"Cooperation between stakeholders in the healthcare supply chain is generally pretty inefficient: the data islands, different languages and diverse standards are all hard to connect, plus there's a huge administrative burden." Having done their homework, Jeroen and his colleagues saw that the core benefits of blockchain would help alleviate these problems.

Lowering costs, increasing efficiencies

"First, irrefutable data is invaluable in a world where the detail and quality of patient information is critical. Secondly, it gives control back to the patient, who can decide who sees their data and when; and who has done what with that data in the past. Thirdly, blockchain is a decentralized platform that connects the data islands: once information is in the system, it's available thereafter for all and only those who need to access it."

Finally, there are the administrative benefits, clearly demonstrated in *Mijn Zorg Log*: after a visit, the midwife sends the patient a note stating the time she spent there. The patient confirms this by hitting 'agree' and the data is uploaded for all to see: patient, midwife, hospital, GP, health insurer, etc. As well as significant cost savings, efficiency gains compared with the old system are estimated at around 60%.

Dirty hands

In a sector where most ideas fall at the sandbox phase, Ledger Leopard is a proven blockchain success story. What's the secret? "Ledger Leopard started out in blockchain construction, where we learnt the do's and don'ts, a great basis. After that, you must ensure you create a solution to a genuine problem, not try to invent a problem to fit your 'solution'. Then closely study your proposed market. Get your hands dirty, walk the entire supply chain: how would your product work at each stage? Where will it add value?"

Jeroen warns against going for quick-wins. "Don't try to surf the blockchain hype by selling people a nice story. They want proof-of-product. Invest in good customers, so you can develop a product that's robust and that customers will vouch for. Stay dynamic, so you can respond to clients' needs: we can develop a new solution in three months, which is fast. And finally, take care of your company hygiene. For some, blockchain still has a somewhat shady image. We're ISO27001-certified and that's very reassuring for potential clients."

Technology with a human face

Ledger Leopard makes a good first impression, with a fresh-looking website and eye-catching logo. How important are branding and image to a technology-based business?

"We've got a good name in the blockchain world, and that's based on the quality of our offering. But we also want to come over as dynamic, innovative and cool (which we are, of course!). But seriously, image is important to any business, so we have a branding company that helps us. We also employ a growth hacker, though like many businesses, we still need to fine-tune how we get the most out of their insights. We're also always on the lookout for good people, so we need to be attractive as an employer brand, too."

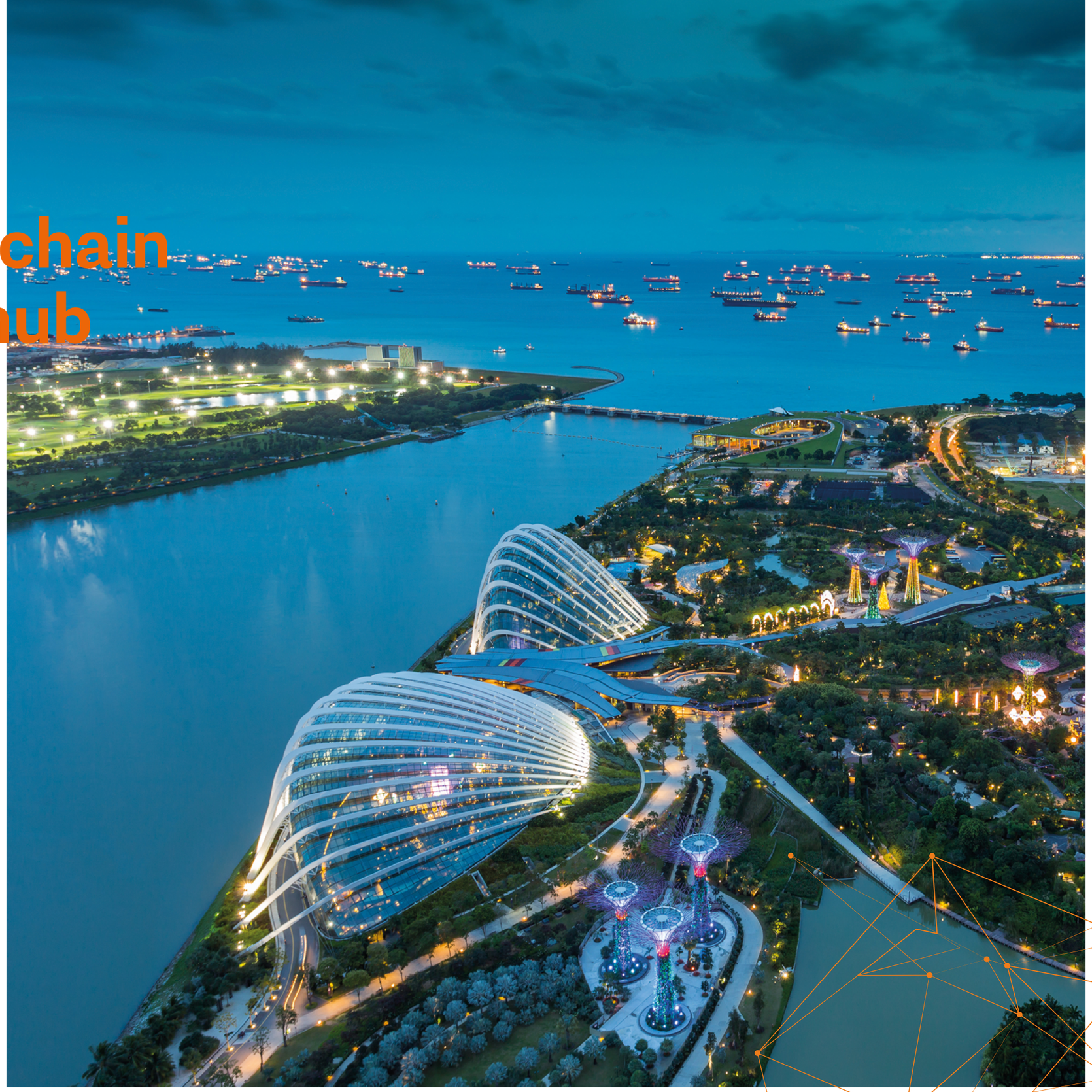
> "Don't try to surf the blockchain hype by selling people a nice story. They want proof-of-product."

Jeroen stresses the importance of having a human face and being accessible. "People can find our number on the website (https://ledgerleopard.com) and just call us. Almost as damaging as the dodgy image around crypto are the big consultancies. You see them at conferences and elsewhere, overpromising on blockchain as a silver bullet, when most of these companies don't really know anything about blockchain. They just smell an earnings model. In that context, it's important we let clients see that we not only understand the technology (and its limitations), but realise that it needs to work in the real world and deliver bottom-line benefits."

BLOCK CHAIN

Developments in Blockchain mainly occur in the financial sector, but governments are also proving major drivers. The Netherlands Innovation Network connects all these different worlds.

Singapore, Asia's block chain innovation hub



Singapore, fast becoming one of the world's most digitized and technological nations, is a blockchain hub within the Asia Pacific region, which in turn is reportedly the world's fastest-growing blockchain market. According to a review by *PwC*, 82% of Singapore executives say their companies currently run blockchain initiatives, with 13% of these already brought to market.

Widespread adoption

There are several factors behind Singapore's leading blockchain position: the country is famously business-friendly with an attractive tax framework; the government is forward-looking about new technologies and actively stimulates blockchain development; and the Monetary Authority of Singapore (MAS) has encouraged blockchain experimentation by introducing a regulatory sandbox.

MAS has also launched Project Ubin. This collaborative project set up in 2016 involves a consortium of local banks, including DBS, UOB and OCBC. It is designed to show how banks can pay one another using a block-chain-based digital version of the Singapore Dollar. Project Ubin has put Singapore on the world map for blockchain. As MAS Managing Director, Ravi Menon, put it during the 2017 Global Blockchain Business Conference, "Trust underpins all economic transactions… The key breakthrough of blockchain technology is its ability to establish trust in a decentralized system."

Blockchain is now being adopted across industries in Singapore: The SP Group has launched a block chain-powered marketplace in renewable energy certificates (RECs) that makes it easier for smaller Singaporean solar energy producers to sell these RECs. Singapore Airlines has introduced a block chain-based loyalty programme. While Averspace, a local real estate startup, offers blockchain-based digital tenancy agreements and tenant-landlord chat features via its mobile app.

Driving innovation
Government institutions are real drivers of block chain innovation. As Steven Koh, Director at Govtech, which is responsible for the digitalization of government services, says, “The application of block chain should be viewed as a public good, as its most compelling use cases are when it’s open-source and runs on a public network.”

The Infocomm and Media Development Authority (IMDA), an agency charged with driving industry’s digital transformation by promoting awareness and adoption beyond Fintech, has organised several blockchain challenges and awareness-raising events, as well as initiating OpenNodes, a platform designed to bring key stakeholders in the blockchain ecosystem closer together that will be launched publicly at the end of 2019.

Enterprise Singapore, the equivalent of the Dutch Enterprise Agency, supports Tribe Accelerator, a programme that aims to help startups spearhead new market-driven blockchain innovations. Tribe Accelerator, Singapore’s first government-supported blockchain accelerator, recently added 10 startups to its product development-focused programme, half of them locally founded.

SGInnovate builds and scales deep tech companies from the earliest stages. Along with other technologies such as AI, robotics and MedTech, blockchain is one of its focus areas. SGInnovate organises events, support entrepreneurial scientists and invest in startups. For example, MediLOT Technologies, who have built an interoperable decentralized platform that can be used by all healthcare providers to extract greater value from healthcare records. It gives patients full access to their secured health records, while the collective data can be used for predictive analysis.

Govtech partnered with the Ministry of Education and developed OpenCerts. Graduates from 18 institutions receive digital certificates that are tamper-proof and easily verifiable on a public blockchain. The solution’s potential applications ranges from legal documents and doctor’s licenses to food certificates. Local companies like NextID, Edufied, Accredify and even Lithuania-based Bitdegree are all building products around OpenCerts.

Research and collaboration
Singapore has a thriving academic blockchain environment. All universities run courses and conduct research in blockchain technology, and Singapore-based internationally-renowned academics in blockchain include Ooi Beng Chin, Prateek Saxena and Georgios Piliouras. This and the many informal student networks all contribute to a vibrant academic blockchain community, which helps Singapore in attracting talent and creating critical mass needed to grow research and entrepreneurship.
The National University of Singapore (NUS) has produced two succesful spin-offs: Zilliqa, set up by Prof. Prateek Saxena, has developed a scalable blockchain platform known for its early implementation of sharding, this increases the rate of transactions and promises to be much faster, more scalable and use less power.
The Kyber Network is a decentralized exchange model that allows instant exchange and conversion of high liquidity cryptocurrencies and other digital assets.
More recently, NUS set up the CRYSTAL (CRYptocurrency Strategy, Techniques and ALgorithms) Centre research lab and thinktank to facilitate more scientifically-grounded and industry-focused work and discussion.

Trust underpins all economic transactions... The key breakthrough of block chain technology is its ability to establish trust in a decentralized system.

The Singapore University of Technology & Design (SUTD) runs iTrust, a centre for research into cyber security and has a blockchain security lab. Nanyang Technological University research areas range from private,-permissioned blockchain systems tracking-and-tracing of dangerous goods. While the Singapore Management University’s School of Information Systems has recently started a collaboration with Chinese insurance company, OneConnect, to develop a POC for the potential of quantum computing to boost blockchain technology.

Challenges ahead
Singapore’s blockchain scene is dynamic and growing, with successful blockchain companies setting up in Singapore, corporates embracing blockchain technology, and the government focusing on ‘home-grown’ block-chain projects. Nevertheless, POCs are mainly small-scale, and large-scale use cases and mainstream adoption have yet to take off. Across sectors, people remain insufficiently clear about the possibilities blockchain offers.

One way to scale up blockchain initiatives is to work with other countries to develop cross-border use cases. For example, following a Dutch innovation mission on blockchain to Singapore in November 2018, a Dutch public-private consortium has been set up to connect Singaporean and Dutch blockchain ecosystems, and explore opportunities to collaborate on worldwide blockchain applications and services.

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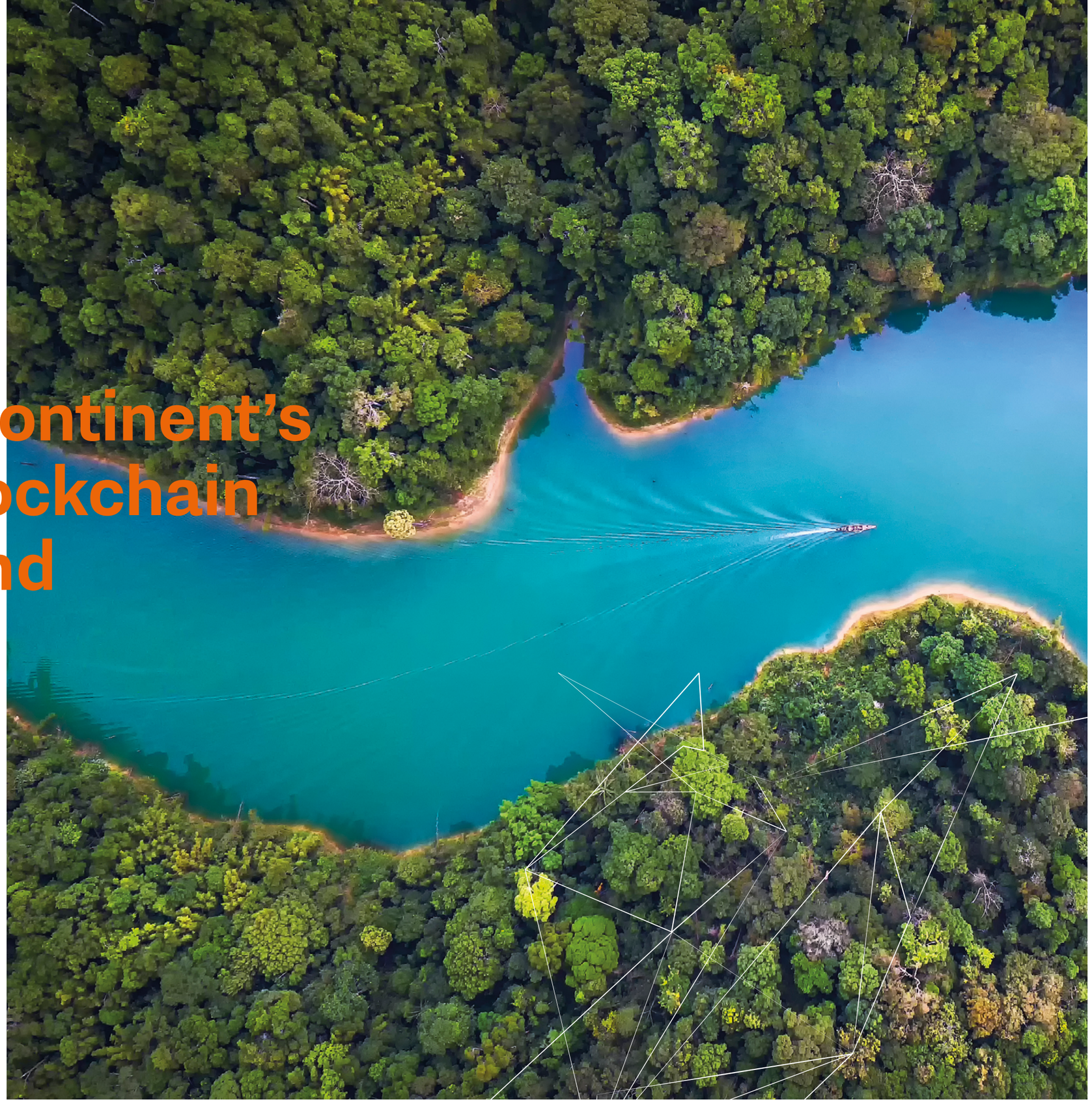
Brazil, the continent's leader in blockchain adoption and innovation

While Brazil has quickly been establishing itself as Latin America's largest cryptocurrency trader, the Brazilian government has been debating appropriate regulation for this new area. At the same time, there has been growing interest in the block-chain technology behind cryptocurrencies. Several companies are busy developing blockchain-based applications. To date, most initiatives have been focused on the financial sector, but other sectors are also beginning to see opportunities.

Financial sector leading the way
Led by its current president, a keen advocate of block-chain technologies, the Central Bank of Brazil has developed Pier, a blockchain-based platform for information exchange between financial regulators. The bank is also considering using blockchain for instant payments and for open banking. This is an important innovation in Brazil's banking system that will allow clients to 'open' their bank accounts to third parties, such as payment apps.



BRAZIL

BRAZIL

Blockchain in Brazil is quickly gaining attention. Private and public sector are experimenting with new solutions enabled by blockchain, focused on (digital) governance, finance sector and agri & food.

Banco do Brasil, Brazil's largest bank by assets, has developed a blockchain-based system for its client Petrobras to speed up the process offinancial tr ansactions authorization. And several of Brazil's major private banks, including Itaú and Bradesco, have recently joined R3. R3 is a consortium that includes some of the world's largestfinancial institutions, to jointly develop and test blockchain-based solutions. An example of such a solution is a digital wallet developed by Bradesco with the Brazilian startup eWally. The wallet, a mobile app, is targeting the more than 50 million people in Brazil, including millions of micro-entrepreneurs, who currently don't have a bank account.

Social impact
The Brazilian startup OriginalMy.com developed a customized engine for the Mudamos+ platform that won the 2016 Google Social Impact Challeng e. The app allows Brazilians to sign, with verified authenticity, so-called popular initiative bills (petitions) that are then submitted to the government. Here blockchain technology helps to overcome logistic issues of getting millions of voters to authentically sign adocument in acountr y of continental size.

Food security
Several Brazilian companies in the Agrifood sector are developing blockchain technology to track and trace products throughout the production chain. Examples include Compplied Computação Aplicada (offering off-line functionality for remote rural areas), Belagricola (to trace the origin and quality of soy and corn) and SafeTrace (to trace meat products). Brazilian food company BRF, together with retailer Carrefour, is using IBM's block-chain-based Food Trust to giveconsumer s detailed information about the origin and properties.

Brazil and the Netherlands
August 2018, Netherlands Innovation Network Brazil and the São Paulo industry federation, organised a blockchain workshop attended by the Dutch Secretary of State for Economic Affairs & Climate Policy and Dutch public and private sector blockchain experts. This successful exchange of knowledge and ideas is proving a springboard for various collaborations, such as Dutch startup Kryha's in-house blockchain training for Brazilian companies.

Netherlands Innovation Network Brazil
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France, high ambitions backed by serious strategy

Early in 2019, France passed legislation that reflected its high ambitions when it comes to blockchain. Combined with a wealth of talented engineers and a dynamic network of innovative companies, France aims to become not only the world's #1 startup nation, but also the biggest crypto nation.

Ground-breaking regulatory framework

One key measure that since its launch in June 2019 has attracted interest across the sector is the introduction of a non-mandatory 'visa' for Initial Coin Offerings (ICOs), issued by the French Financial Markets Authority (AMF). This makes it possible to give transactions a quality mark and means France is possibly unique in putting in place a regulatory framework for cryptocurrencies. In addition, parliament has given service providers (internet platforms, investment companies, etc.) the option to seek voluntary consent and be licenced as a digital assets services provider (DASP), falling under the supervision of the AMF.

The latest budget proposals also provide a clearer definition of the tax treatment of cryptocurrencies. From January 2019, the tax rate for private individuals' earnings on bitcoins and other cryptocurrencies was lowered to 30%, in parity with stocks and bonds. Moreover, as long as the proceeds are not converted into euros, transactions involving cryptocurrencies will be tax-exempt.

With pioneering legislation, the world's largest startup incubator and Europe's biggest block chain event, France is well on the way to becoming the world's #1 blockchain startup nation.

These tax rules are the penultimate stage in a comprehensive set of block chain measures that the French government has been preparing in recent months. Together with the PACTE Act (Plan d'Action pour la Croissance et la Transformation des Entreprises – Action Plan for Business Growth and Transformation), it means France has established a legal regime that removes uncertainty from the world of cryptocurrencies. Unsurprisingly, international response to the French policies has been overwhelmingly positive.

Thinking strategically
In April 2019, and having extensively surveyed blockchain stakeholders on their concerns and expectations, including key figures from over 200 blockchain projects, the French government presented its national blockchain strategy at Paris Blockchain Week. The strategy to accelerate blockchain development in France has four tracks:

Track 1: Boost excellence and enhance the structure of French industrial sectors
Major French companies are actively working on national and international blockchain pilot projects, with three sectors already collaborating on innovative blockchain-based solutions: Construction, Agrifood and New Energy Services.

Track 2: Be at the cutting-edge in applying blockchain technology
A number of French knowledge institutions, including CEA-LIST, IMT and INRIA, will be commissioned to identify the scientific and technical building blocks and barriers to achieving leadership in specific deep-tech fields. They are tasked on the one hand with describing the actions required and thresholds to be overcome if France is to achieve global leadership in the field, and on the other with drawing up an overview of the current range of relevant educational courses and programmes offered in France. The challenges in establishing this leadership include governance, sovereignty, security, energy use, interoperability, upscaling, business models and accessibility by the public.

Track 3: Foster innovative projects by funding disruptive technologies
Over the next five years, the French government will invest €4.5 billion in disruptive innovation, including blockchain technology, through its DeepTech programme. In spring 2019, there was a call for proposals for innovative projects valued between €600,000 and €5million that are close to the market and with high potential for the French economy.

Track 4: Assist block chain project initiat ors, especially on legal and regulatory issues
France helps blockchain ecosystem stakeholders in various ways. For instance, the 'France Expérimentation' office prioritises project leader s of block chain projects for support when encountering legal obstacles. While French Tech Central, a public startup booster, will be organising free workshops in the Station F incubator to facilitate exchanges between government, startups and companies from the ecosystem.

Task Force
As a follow-up to the national strategy, the Directorate-General for Enterprise of the French Ministry for the Economy & Finance has established a taskforce of national experts in order to maintain the national dialogue between blockchain stakeholders over the long term.

Paris Blockchain Week
The first annual Paris Blockchain Week in April 2019, billed as Europe's largest Block chain & Digital Assets event, saw a week packed with events organised by key players in the blockchain field. The flagship was the two-day Block chain Week Summit in Station F, the world's biggest startup incubator, attended by mor e than 3,000 participants and over 100 speakers.

PIONEERING FRENCH COMPANIES

Carrefour supermarket chain

The French Agrifood sector is a frontrunner in blockchain technology. A good example being the supermarket chain , Carrefour. Since 2018, Carrefour has been a member of the IBM Food Trust, along with Nestlé and Unilever, enabling it to acceler ate its blockchain activities. Cheese, milk, honey, oranges and a wide range of other products will become traceable through blockchain technology. In contrast to public blockchains, the IBM Food Trust doesn't allow verification of the data entered by participating entities: each participant retains ownership of its own data, thus guaranteeing its authenticit y.

KOMGO
This pioneering initiative involving three Dutch banks (ABN AMRO, Rabobank, ING) and three French banks (BNP Paribas, Crédit Agricole, Société Génér ale) is a blockchain-based secure network for seamless data communication between commodity trade institutions, corporations, inspection companies and third parties (see also p. 12, 13).

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Taiwan, reaping the rewards of an open and collaborative blockchain culture

Building on its strong global presence in the IT and Telecoms industries, its wealth of talented developers and its innovation-friendly regulatory environment, Taiwan has become an important hub for blockchain and cryptocurrency with the ambition to be the latest so-called blockchain island.

Serious playtime in the sandbox

This ambition is also reflected in 2017 legislation to create a regulatory sandbox that allows firms to experiment with innovative business models without the burden of potential legal consequences.

The innovative uses of blockchain technology include an art provenance app, whereby a certificate of ownership and other information on a piece of art are stored in a digital token that transfers to future buyers as proof of provenance. There is also an ingenious 'blockchain witness' app for use in legal proceedings: the app stores non-repudiable, tamper-proof digital data, using digital fingerprinting technology to ensure the authenticity of the evidence.

There are examples of blockchain technology across many sectors. OwlTing uses blockchain technology in everything from Social to Travel to Food Safety. In Healthcare, Shin Kong Life Insurance is working with OmniHealth to build an insurance claims platform for hospitals, insurance companies and patients. While PhrOS provides the opportunity for individuals to carry their own medical information via a personal healthcare record operating system.

There are several homegrown players in many of the key areas driving blockchain technology development. Including crypto exchanges (BitoEX/ BitoPro, Joyso and MaiCoin), wallet providers (CoolBitX and HTC Exodus), financial service providers (Formosa Financial, Green World Fintech Services, AMIS, Tixguru, Bytepay, Leadbest and Coin Masters), IoT companies (ioeX, Biilabs, Twoiot) and software providers (Unitychain, Bacon Chain and Cartesi).

> Taiwan has successfully created an environment in which an end-to-end blockchain ecosystem emerged and blockchain communities now flourish.

And Taiwan doesn't plan to leave future success stories to chance. It has successfully created an environment in which an end-to-end blockchain ecosystem has emerged and blockchain communities now flourish. A good example is the Asia Blockchain Alliance (ABA). Launched in Taiwan and now covering all Asia, ABA is an NGO dedicated to guiding and promoting adoption of blockchain technology across industries. In 2019, ABA organised the 2nd Asia Blockchain Summit, the continent's largest-ever blockchain event, in Taiwan. Confirming once again the country's openness to both innovation and international collaboration around blockchain-related technology.

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TAIWAN

THE IDEAL TIME TO EXPLORE COLLABORATION OPPORTUNITIES

Germany, an economic giant slowly waking up to blockchain's potential

In early 2017, on the back of growing German media attention for the rapidly rising value of Bitcoin, the Bavarian Centre for Digitization (ZD.B) organised the first BICC Talk, which brings together SMEs and blockchain experts. That day the conference room at the Technical University in Munich was packed with a lively mix of lawyers, researchers, startups and established high-tech companies. It felt like the start of an era for blockchain in Germany. But while that is in some ways true, until now the technology has not taken off in Germany quite how many have predicted or hoped.

Slow adopters

Given blockchain's potential to revolutionize banking systems and business models, German companies across sectors are naturally keeping a close eye on developments. However, a recent major study by BITKOM, Germany's digital association, revealed that while 82% of its members expect new business models to come out of blockchain technology for their own business, only 2% are actually using blockchain today.

One explanation for this slow adoption rate is Germany's relatively mediocre performance internationally in terms of digitization. Though this picture varies by sector with the IT, financial and high-quality services sectors having the highest digitization rates, and the automotive sector also rising quickly; mechanical engineering and logistics score below average; and the healthcare and government sectors generally score low.

Blockchain technology is still in its infancy in Germany, but with awareness rising some see this as the ideal time to explore collaboration opportunities with German partners.

Importance recognised
Nevertheless, the German government does recognize blockchain's potential. At a state level, initiatives such as *BayernDigital II* and *Blockchain Dialog Niedersachsen* are encouraging the transfer of blockchain technology knowledge to SMEs. At a federal level, the Ministries of Economic Affairs & Energy (BMWi) and Finance (BMF), are aware of the potential impact of blockchain on the financial and industrial sectors. They developed a national blockchain strategy due for publication later this year.

Across the German private sector, too, there is a lot of activity at the research, startup and proof-of-concept level, with large concentrations of blockchain startups and application centres emerging in Berlin, Munich, Frankfurt and Hamburg.

Different sectors, different issues
An overview of the state-of-play in some of Germany's key sectors:

Financial & Insurance
With trust and efficiency amongst blockchain's key benefits, the financial and insurance sector is actively looking at blockchain applications. The Technical University of Darmstadt has worked with industry partners to set up a research, training and pilot *Center for Secure Distributed Ledgers and Contracts*, focused on cryptography and cybersecurity. Startup incubator and accelerator, Techquartier, houses many blockchain companies, including Blockchain Helix. They specialise in identity verification. Another success story is Munich-based *ETHERISC* who developed a decentralized insurance protocol with insurance company AON.

Industry
The industry in southern Germany has set up various pilots to investigate blockchain's potential, such as the automotive industry's Mobility Open Blockchain Initiative (MOBI). Porsche is now using blockchain for their parking applications. BMW is looking into using it to ensure their cobalt supply chain is trustworthy. *Genesis Mining and Protocol Labs* are companies providing blockchain tools in response to the interest of many companies in using blockchain to track product sources. The nationally-funded research project, HANSEBLOC, focuses on logistics and supply chain management systems research.

Energy
The blockchain initiative on energy (BCI-E) has mapped the country's various energy-related blockchain projects, many of which are investigating the use of micro-grids. An example of a Dutch-German project is TenneT and Sonnen e.Services. Energy is temporarily stored in housing and industrial storage systems used when specific areas require more energy.

Public sector
Use of blockchain in the public sector remains almost non-existent in Germany, with most investment in fundamental R&D. However, there are some exciting initiatives at state level: North Rhine-Westphalia has enabled citizens to use blockchain technology to verify all data published by the state via the open NRW-Portal. And in Thüringen, the finance ministry is working with the national printing press (Bundesdrückerei) on an identity verification concept that will let people access their personal data.

Next steps promising
Blockchain is unlikely to change German industrial, financial or public sectors in the near future. The technology remains in its infancy here and local branches of the *Blockchain Bundesverband* association are only slowly taking shape. Also recent research by Technopolis into the opportunities for Dutch companies in the German blockchain sector found many initiatives still in their early stages.

But things can change quickly, and with awareness in the country rising, this is the ideal time to step in and explore collaboration opportunities with German partners. In which case, a good starting point would be the various blockchain hubs already emerging in Berlin, Hamburg, Frankfurt and Munich.

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India, pursuing the societal benefits of blockchain

As India invests heavily in digital services as part of its Digital India Programme, it needs to build digital trust amongst its citizens. Indian Prime Minister Modi regularly voices his enthusiasm for leveraging block-chain to build that trust and increase transparency. This has been picked up by both public and private entities, with over half of India's state governments reported to be running blockchain pilots and more than 300 blockchain startups emerging in India in recent years.

NITI Aayog, the government's policy think-tank, is leading policy development on frontier technologies. Having recently launched an AI strategy, they are now developing a blockchain roadmap, for which they are actively seeking international partnerships. Which is why NITI Aayog recently visited the Netherlands for talks with the Dutch Blockchain Coalition.

Ambition to collaborate

During his 2018 visit to India, Dutch Prime Minister Rutte issued a joint statement with Prime Minister Modi, in which they expressed *"a desire to explore closer partnership to leverage emerging digital technologies to increase transparency and trust for societal benefits."*

Key to the Indian government's strategy is an ambition to look beyond blockchain applications in 'traditional' sectors like financial services, and try to address fundamental societal challenges. Successful examples include the following blockchain applications in health and agriculture, two sectors that are also important focus areas for the Netherlands in India.

Transparency creates trust
The WHO estimates that 20% of drugs sold in India are counterfeit. In response to this problem, NITI Aayog has partnered with Oracle, Apollo Hospitals and Strides Pharma Sciences to develop a blockchain auditing and authentication platform that brings transparency and efficiency to the drug supply chain in order to eliminate the risk of fake drugs. The successful proof-of-value pilot also showed the potential to forecast demand and increase consumer confidence. The partners are now looking to scale up efforts.

Thanks to Kashmir-based Farm2U, Kashmiri apple farmers are getting a better price for their produce. Blockchain technology enables Farm2U to cut out middlemen and connect farmers directly to retailers while keeping track of apple prices. The system improves logistics, increases transparency throughout the value chain and eliminates non-value-adding costs. Such models could well be applicable in other agricultural value chains, and even hold promise for areas such as the textile industry, ports and smart cities.

The Indian government aims to look beyond 'traditional' blockchain applications in sectors like financial services and addressess fundamental societal challenges.

Blockchain and other key enabling technologies are high on the agenda of various bilateral events and forums, such as the India-Netherlands Tech Summit and a Dutch Smart Cities mission, due to visit India early 2020. Initiatives like this are expected to help increase momentum, foster closer collaboration, build digital trust and ultimately deliver important societal benefits.

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The US, a key region sees blockchain at a crossroads

The US remains one of the world's most important regions for blockchain investors and entrepreneurs. Yet the technology has yet to prove it can live up to the high expectations. After years of investment in a broad range of blockchain-related technologies, only a small number of sectors have taken the lead in experimentation, principally finance and supply chain management.

Investments have started to consolidate around the morefundamental software architecture of blockchain and Distributed Ledger Technology. With large tech players working on the underlying platforms they say will enable a new generation of busines s models to use blockchain without major costs.

Cryptocurrencies still make up a major part of innovation in the US, but there is a notable shift toward more mainstream blockchain applications, such as smart contracts, data registry and online ID. However, though many projects have moved beyond the proof-of-concept phase, few companies are actually implementing the technology in day-to-day busines s routines.

Fundamental issues
There are fundamental questions and concerns around the potential impact of block chain-based solutions on the economy and society: do we want tech firms designing an entirely new payment system, unshackled from national monetary policies, or decentralised systems determining our digital identities for shopping or mortgage applications? The risks block chain-related technology brings are significant and is further fuelled by uncertainty about national regulation, ROI and solutions' scalability.

Recent investment levels in blockchain reflect these concerns: venture capital in cryptocurrencies has dropped significantly since 2018 (see graph). Most insider s expect a return to 2017 levels in 2019 and beyond, but still most investment has a strong focus on early-stage startups and Series-A equity deals. And that's unlikely to change in the absence of some compelling user cases or greater regulatory certainty around digital assets.

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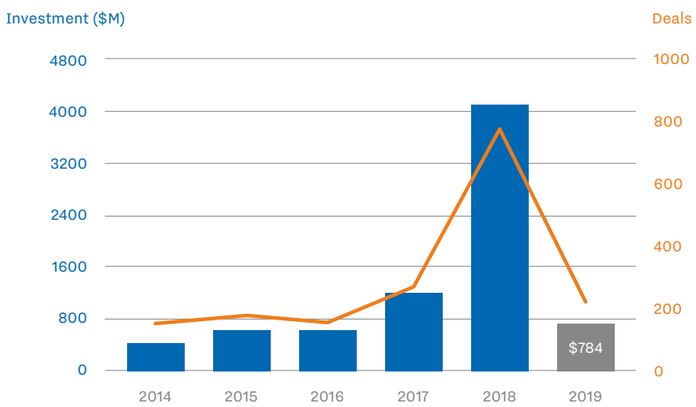
Blockchain's meteoric rise slowed in 2019

VC investment 2014 -2019 YTD (7/1/2019)



Silicon Valley, where scale matters

Silicon Valley, three routes to scalability
Following years of experimentation, in Silicon Valley three main themes have emerged, each geared to providing scalable solutions to potentially global markets. The region's players are now looking beyond specific use cases towards flexible platforms that can deliver greater adoption by providing the benefits of blockchain technology in day-to-day transactions while keeping the software as simple as possible.

Route 1: beyond crypto, the new wave of digital currencies
Crypto still dominates blockchain in Silicon Valley. A large number of venture capitalists have invested in crypto-related entrepreneurs and the technology has matured to a point where large tech companies, financial players and banks are starting to embrace it. Many have moved from crypto to stablecoin as a new, less volatile class of cryptocurrency in order to boost adoption. Facebook's Libra project, which is backed by a number of large tech players from various sectors, may prove a milestone here: they hope it will become a digital currency for large online platforms including Facebook's own Instagram and WhatsApp. If the Libra association is able to build a broad coalition of tech platforms and payment providers, this initiative could accelerate broader public adoption of payment system innovations, and raise awareness generally of blockchain-related technologies.

But while Libra combines the ease-of-use of 'classic' financial apps with blockchain's benefits (e.g. removing the need for intermediaries such as banks), a major digital currency controlled by a select group of powerful corporate players also brings regulatory challenges. Should legislators allow digital currencies to operate in the first place, whether alongside or in direct competition with banks? Libra is a wake-up call for regulators globally and will intensify the debate about adequate legal frameworks. At the federal level, Congress is concerned about the lack of oversight if Facebook introduces a digital currency. On state level Wyoming, Montana, Colorado and Nevada already have regulations in place aimed at paving the way for future blockchain ecosystems, while California has established a blockchain working group to study the issues.

Route 2: Digital identity, a logical next step
Facebook has also unveiled ambitions in the area of online ID management, including the development of an open identity standard. Silicon Valley is increasingly warming to the idea of disrupting this traditionally government-controlled domain. Many agree that current ID systems are outdated: offline systems are vulnerable to loss, destruction and fraud; and digital systems are centralized and thus prone to security breaches. Citizens are increasingly concerned about their privacy, fuelled by recent data leaks and identity thefts. The consensus among identity experts is that online identities need to be portable, verifiable, secure and private.

This makes ID management a promising use case: blockchain is immutable and transparent. Its decentralized nature potentially offers a more secure way of validating online credentials, as it reduces the risk of single-point failure. The use of so-called Zero-Knowledge Proofs allows users to demonstrate they meet a certain requirement while upholding their privacy (e.g. verifying someone's age without disclosing other data such as passport numbers). In addition to existing applications in Finance, such as Know Your Customer and anti-money laundering processes, an array of other industries might benefit from ID systems on a distributed ledger.

Players are looking to build flexible platforms that deliver greater adoption by providing the benefits of blockchain technology while keeping the software simple.

Route 3: BaaS driving adoption
Despite the emergence of providers of Blockchain-as-a-Service (BaaS) providers, adoption beyond the Financial sector remains low. Many businesses don't have the expertise or resources to build block chain applications themselves. Big players like Amazon, Microsoft and IBM are now offering ready-to-use blockchain networks that let companies build and run scalable, secure blockchain applications. In the medium-term, this should accelerate enterprise blockchain adoption in other sectors. But BaaS requires large cloud storage space, giving an advantage to today's tech giants, and most BaaS providers offer one of three blockchain protocols (*Ethereum, Corda or Hyperledger*). If this consolidation continues, fewer competitors will be able to enter the market, cementing Silicon Valley's position as the major hub for BaaS players.

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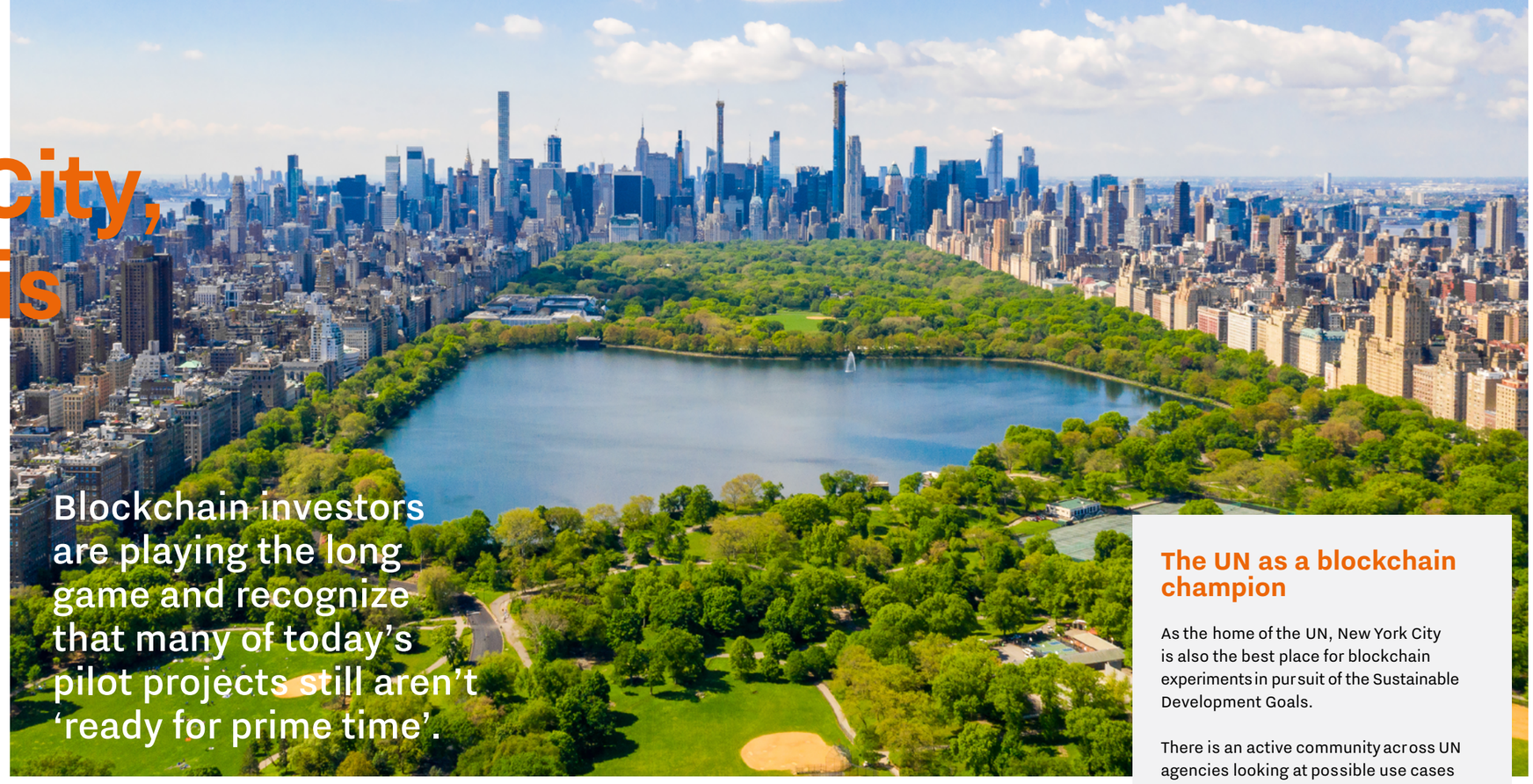
New York City, the future is hybrid



Blockchain investors are playing the long game and recognize that many of today's pilot projects still aren't 'ready for prime time'.

New York City, is at the spearhead of blockchain business applications and go-to-market strategies, with Wall Street the country's centre for payment systems, digital currency and online trading, including *Coinbase, Paxos, R3, Consensys, Gemini, Binance,* as well as startup hubs like the NYC Blockchain Center. This reputation has a downside. The financial world is dominated by large players with vested interests like banks, who are keen not to disrupt existing business models, and the country's complex web of financial regulatory agencies fuels uncertainty.

At the heart of the debate lies the question: what counts as a financial security and how do you guarantee that a digital asset offered online will keep a specific value over time? The Security Exchange Commission, mandated to look into such matters, has established a so-called 'Finlab' in Washington but has been reluctant to produce clear guidance on what developers and platforms can offer clients in terms of currency or digital tokens. Other federal agencies and various states have also been careful not to give blockchain players free reign. And with criminal actors having successfully used blockchain technology to fund illicit transactions, there is a strong incentive to move slowly. As a consequence blockchain investors are playing the long game and recognize that many of today's pilot projects are still not 'ready for prime time'. But they are keen to sustain the local ecosystem in New York and draw from the city's deep talent pool in the area of international finance.

Smart legal contracts

Beyond cryptocurrencies, many see traction in the field of smart contracts. Non-crypto blockchain was initially focused on reliably sharing data, then moved onto building ledgers for collective storage of value (such as wallets). Insiders say the next step will be to integrate the two into workable agreements that can be used to run transaction on an 'if-A-then-B' basis.
Such contracts effectively fulfill both the executive and notary functions, the latter being placed on a separate ledger for additional accountability.

Sectors starting to adopt smart legal contracts include Health, Telecom, Oil & Gas, Trade Finance and Media. But there is a snag: when operated on a public blockchain, users have to accept that information is freely available throughout the network. To get around this, platforms have started to build privacy safeguards that enable controlled access: as a user, you only have access to certain types of information. This should enhance trust in the technology amongst a wider audience and prevent illicit use by non-authorized parties. As smart legal contracts become more commonplace, agreements are also being written in 'classic' text on top of the encoded version. This allows for human oversight, for example in court. The next hurdle will be to develop terms for dispute resolution when blockchain entries are incorrect and must be altered in the chain.

Payment systems

Beyond the plethora of digital wallets that facilitate trading with cryptocurrencies, New York has seen the development of a number of next-level payment platforms. Nexa, for example, is a wallet app that allows users to spend cryptocurrencies on movie tickets and other services. As there is no US regulation of digital assets as a security, these are still closed systems that don't offer their own cryptocurrencies and use the US dollar as collateral. On a corporate level, there are initiatives like *JP Morgan coin* for internal payments within the company. Over time, there could also be public services applications, for example for municipalities to administer social benefits. Sacramento and other cities are already experimenting with blockchain-based micro bonds for financing local development schemes.

What next: hybrid solutions, standards and open source

The blockchain community looks set to invest in more hybrid approaches. Smart contracts with a 'classic' text attached to the coded agreement; solutions in hardware development, such as *R3's* collaboration with *Intel* to integrate secure chips that detect outside interference with R3's *Corda* platform. The emergence of AI and IoT are also likely to mean new combinations with blockchain, such as cryptographic proofs.

To facilitate developers and drive adoption, blockchain experts also expect more investments in open source software. Companies like *Blockstream* focus on open source applications that can be copied, amended and scaled in many different ways. But standards are required and already a number of consortium initiatives are working on voluntary guidelines for digital assets. These include the Token Taxonomy Initiative, a code of conduct for cryptocurrencies developed by the Association for Digital Asset Markets, and the Universal Trade Network's work on interoperability across different blockchains.

The UN as a blockchain champion

As the home of the UN, New York City is also the best place for blockchain experiments in pursuit of the Sustainable Development Goals.

There is an active community across UN agencies looking at possible use cases across the world where blockchain's accountability and transparency could help tackle problems. Once a year, a number of side-meetings during the UN General Assembly bring together tech entrepreneurs, social impact advocates and UN Staff to discuss lessons learned and existing initiatives. Examples to date include:

- UNTIL, which is working on blockchain-based land registration in Afghanistan.
- UNICEF using smart contracts in Kazakhstan and Kirgizstan to improve procurement and third-party service delivery.
- The World Food Program's Building Blocks project in Jordan which administers food vouchers to over 100,000 Syrian refugees.

Closely connected to the UN's blockchain work is the World Bank's budding blockchain portfolio, with initiatives that include the use of blockchain technology for palm oil supply chain management.

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Canada, an innovation culture building on its crypto past

Canada's innovation environment is well-placed to exploit digital tech. It has top-talent, supportive policies and several dynamic entrepreneurial clusters including Toronto, Montreal and Vancouver. There is also a willingness to invest and experiment, though this seldom translates into large-scale adoption and in this respect blockchain is no different.

With cheap energy sources, high-speed internet and relatively cool weather, Canada has attracted digital crypto-mining companies from around the world. In 2018, one third of all the electricity sold by Quebec's utility was to 300 companies in the sector. But beyond this overwhelming interest in cryptocurrencies, Canada now has a number of niche sectors experimenting with blockchain technology.

From finance to cannabis

There are various players in the financial sector working on blockchain-based payment systems. As early as 2016, the Bank of Canada began working with various partners on Project Jasper, which aimed to define international standards for payment systems. The lessons learned have led to new initiatives, but those involved admit there is much work still to be done to make decentral ledgers cost-effective, scalable and sufficiently risk-free. In 2019, a consortium led by *SecureKey* launched the www.verified.me platform, a blockchain-based online identification system developed for banking customers to securely access online services.

Beyond the financial sector, there are interesting pilots in the cultural industry to employ blockchain technology for new services for consumers in such areas as gaming, digital media, events and ticketing.

With top-talent, supportive policies, several dynamic entrepreneurial clusters, and a willingness to invest and experiment, Canada is well-placed to exploit digital tech.

Since 2018, another interesting niche market has emerged in response to the legalisation of the controlled production, distribution, sale and possession of cannabis. A growing number of startups are using blockchain technology to facilitate this new industry. For those working on credential systems and supply chain management, this is a sector worth watching: with no legacy systems, no dominant players and few vested interests, there's lots of room to experiment with opportunities aplenty for both startups and innovative technology solutions.

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CANADA

Japan, first out the blocks with blockchain

Given the history, it's no surprise that Japan has been at the forefront of blockchain technology from the outset. Satoshi Nakamoto, the Japanese name of a person or persons unknown, registered the domain name bitcoin.org, the world's first real implementation of blockchain technology, back in 2008. And in January 2009, 'they' released the Bitcoin software as open source code. Arguably making Japan block-chain's spiritual home.

Early recognition, early adopter
In 2017, the Japanese government launched the world's first licensing regulations for cryptocurrency exchanges, thereby formally recognising cryptocurrency as an asset and legal payment method. A number of big Japanese companies have followed suit, accepting bitcoin as a payment method. These include the department store Marui, car dealer L'Operiao, electronic retailers Bic Camera and electronics retailer Yamada.

The proportion of new blockchain-related ventures remains low, but companies in many sectors show interest in collaborating with foreign partners.

Meanwhile, businesses across sectors are investing in blockchain applications. The country's largest energy company, Tepco, is investing in blockchain startups; and many other companies, such as the financial services and brokerage companies SBI, Rakuten, Nomura and Daiwa, are all busy implementing blockchain technology.

Innovations employing blockchain keep popping up. For example, commercial giant Sumitomo Corporation has partnered with a sister company of cryptocurrency exchange bitFlyer to launch a blockchain real estate business that enables the entire rental process via your smartphone. While Soramitsu has developed the Hyperledger Iroha, a digital identity platform designed to help businesses and financial institutions manage digital assets, identities and contracts via, amongst other things, mobile apps.

Getting creative in the sandbox

In June 2018, the Japanese government introduced a 'sandbox' framework, a policy instrument designed to accelerate the introduction of new business models and innovative technologies. Organisations and companies in and outside Japan can apply to demonstrate and experiment in a 'safe' environment, free from legal challenges or consequences, with new technologies like blockchain, AI and IoT in fields such as financial services, healthcare and transportation.

One of the six projects so far approved under the sandbox is a blockchain project led by Tokyo-based cryptofinance firm, Crypto Garage, who investigates ways to improve settlements between cryptocurrency exchanges, and are developing rapid and secure financial services based on bitcoin and blockchain technology.

Ready for collaboration

Despite its leading position in blockchain technology, compared to the US and EU, the proportion of new local blockchain-related ventures in Japan remains rather low. And that opens up major opportunities for Dutch businesses in the many sectors where Japanese companies show interest in collaborating with foreign partners, including finance, education, traceability and more. An opportunity that shouldn't be underestimated, with many in Japan believing this new technology will ultimately prove as important and revolutionary as the internet itself.

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Russia, a challenging yet dynamic environment

Russia's government, established companies and startups are engaged in projects across the country in search of winning applications for blockchain technology. There are also a number of multinational companies with offices of blockchain developers in Russia.

Mixed picture
Russia has a deep pool of talent, with some 30% of all blockchain developers globally having Russian roots. As of 2017, Russia also had more cryptocurrency ICO projects than any other country.

Furthermore, the government is taking legislative measures to help create an environment conducive to success. With sandboxes for testing blockchain applications, a crowdfunding policy and, from 2020, the regulation of ICOs. Blockchain and cryptocurrency technology are on the curriculum of Russia's leading universities, including the specialist ITMO (Information Technologies, Mechanics and Optics) university in St. Petersburg.

Some 30% of all blockchain developers globally having Russian roots.

On the other hand, a large share of the Russian market is state-dominated, leaving a relatively small slice for SMEs and private business. Moreover, economic growth projections are pessimistic, resulting an economy characterised by short investment cycles and a scarcity of capital for longer-term projects. The market is also relatively poorly protected, with only 50 blockchain-related patents having been issued in Russia as of August 2018, compared for example with 825 in China.

And finally, while current sanctions don't affect blockchain directly, they hardly help a culture of international collaboration. And possible financial sanctions and software export restrictions will only worsen the situation.

Dynamic environment
Despite all this, there are enough encouraging examples of projects and companies on the Russian blockchain landscape:

- The launch of the Telegram Open Network (TON) platform recently raised $2bln;
- Ethereum, the world's second-largest cryptocurrency;
- Bitfury Group, a multi-disciplinary blockchain company including Bitfury, a large international company specialized in mining and mining hardware production;
- Waves, a global top-20 decentralized crowdfunding platform;
- BlockNotary, a system for identification of remote clients and conducting interviews;
- I-chain, an open source platform for the $4+ trillion global insurance market;
- Startup Factorin is launching a payment system in collaboration with Dixy, a supermarket chain with 2% of the Russian market;
- The largest Russian banks and payment services are all actively experimenting in the cryptocurrencies field. Examples include preparations of a crypto-currency investment portfolio and Established Masterchain, a national blockchain platform for information exchange.

When it comes to block chain, Russia remains a country with challenges, but with enough dynamism and talent to generate exciting initiatives and guarded optimism.

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OVER
70 PERCENT OF
ALL THE WORLD'S
BLOCKCHAIN-
RELATED
PATENTS WERE
FILED IN CHINA

China, a balancing act between facilitiating innovation and retaining control

A regime like China's and decentralised technologies like blockchain may not seem natural allies. And it's true China is suspicious of cryptocurrencies, which enable moneylaundering and uncontr ollable transfers of capital. Strict control over currency transactions is a cornerstone of Central Bank (PBOC) policy, and since 2017 the use of cryptocurrencies, internet access to exchanges and ICOs are banned. Nevertheless, much of the world's mining activity still takes place in China, as electricity costs in poorer provinces are very low. But mining, too, will soon be banned as a "wasteful and unnecessary activit y".

Nevertheless, China is not decoupled from blockchain developments. The PBOC is developing a state-backed, blockchain-enabled digital currency to eventually supplant existing digital transactions. Blockchain was also added to the 13th Five-Year Plan, making it part of China's official technology policy. However, targeted applications reek of centr alised control (though not necessarily by government), rather than the distributed control one expects of blockchain projects. For China, the added value of blockchain is all about the cost savings and aut omatization it offers.

Varying government roles

Central and local government play different roles when it comes to blockchain. Central government is mostly involved in setting priorities and regulating where necessary. And compared to the US or Europe, China's attitude here is permissive, allowing business to push on and regulating only later if things go wrong. An approach also adopted for other new industries, such as bike sharing, gene editing and AI.

This means central government plays a limited role in funding. Since 2012, it has invested an annual average of 8m RMB (€1m) a year in blockchain-related research and 11m RMB (€1.4m) in other core technologies, such as peer-to-peer networks, public-key cryptography and consensus algorithms. For China, these are small amounts, less than 10% of central government spending on, for example, AI-related research. The major benificiaries of this funding include Wuhan University of Technology, Nanjing University of Post & Telecommunications, the Chinese Academy of Science's Institute of Software and Institute of Information Management.

In 2017, companies in other countries led the way in patent applications. A year later, over 70% of all the world's blockchain-related patents were filed in China.

By contrast, local municipalities compete to be first to roll-out working blockchain applications and are thus major drivers of the technology's development. Examples include Hangzhou, Nanjing's Jiangbei New Area, Guiyang and Shenzhen, who have set up funds of €1.4b, €1.3b, €80m and €70m respectively for blockchain-related research projects and startups. Hangzhou has set up a dedicated incubator for blockchain. Guiyang established a Blockchain Lab with the *Chinese Academy of Science's Institute of Software* and a *Joint Blockchain Innovation Center with Zhong'an Technology*, backed by *Tencent, Ant Financial (Alibaba)* and *Ping'an Bank.*

Commercial applications picking up speed

Chinese companies may have started about a year later than the world's frontrunners, but the country's boom in blockchain R&D activity now overshadows the rest of the world. In 2017, foreign companies led the way in patent applications, but by 2018 over 70% of the world's blockchain-related patents were filed in China. Interestingly, there were also twice as many patents filed by Chinese companies outside China as foreign patent applications within China, the reverse of the usual situation.

Chinese companies ignore digital currencies, focusing on blockchain technology applications in high-trust database-like applications, such as supply chain tracking, product lifecycle tracking, device authentication and unified patient databases. They share their foreign counterparts' interest in the more demanding applications of smart, automatically enforceable contracts, such as for legal services, smart grids and supply chain management. However, international companies still have an edge with their long-term experience in core blockchain-related technologies.

Powerful giants and innovative startups

Alibaba is by far the biggest contributor, and active in blockchain-as-a-service (BAAS), supply chain management and management of IP. Other Chinese tech giants like *Huawei, ZTE* and *Tencent* are also major applicants, with activities in BAAS, financial services and gaming.

Among the hundreds of fascinating startup and SMEs pioneering with blockchain technology are *CloudMinds Shenzhen Robotics*, using blockchain for a secure IoT network of robots; *Hangzhou Fuzamei*, who have developed several financial services based on proprietary 'parallel blockchain' core technology; and *Zhongrongjie*, who have developed EV-charging solutions using blockchain.

What next…?

Blockchain is hot in China, but less mature than other hot topics like AI and smart manufacturing. The central government will be willing to support blockchain development as long as it can retain control. Meanwhile, local government and internet giants are eager to exploit its potential benefits, but have rivalry from strong grass roots movements in academia, startups and SMEs. Together, it makes China one of the world's most important blockchain hubs, and a potentially valuable innovation partner. But as with any IT-related field, when entering the Chinese market you must always bear in mind its unique digital ecosystem and consumer characteristics.

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Korea, a frontrunner embracing blockchain across the public and private sectors

Since the initial Bitcoin hype that began in late 2017, South Koreans have embraced cryptocurrency and today South Korea is estimated to account for 30% of all cryptocurrency trading worldwide. Though Korean regulators prohibit all kinds of cryptocurrency fundraising, including Initial Coin Offering, trading in cryptocurrency is allowed. Most Korean crypto companies arrange financing via other countries. Various large exchanges, such as Upbit, Bithumb, Coinone and Korbit, are active in the local market.

Government careful but committed

Despite its cautious approach to cryptocurrency, the South Korean government recognizes the value of blockchain technology. Its 2019 budgetary plan includes blockchain as a key part of technology development, and the government launched six blockchain pilot projects for the public domain in 2018 and tendered an additional fourteenth. One example of such a project is Samsung SDS working with the Korean Customs Services to pilot the use of block chain for e-commerce products purchased from overseas. The project draws on experience Samsung SDS gained when utilizing its NexLedger platform for a logistics project with the Port of Rotterdam and ABN AMRO in 2017.

Korea is the third largest patent filer in blockchain technology after the US and China, but finds itself with a distinct shortage of blockchain developers and good technology.

Regional governments, too, are actively investigating blockchain applications. Seoul Metropolitan Government has a specific blockchain team launching pilot projects. Jeju self-governing province is looking into a regulatory free zone for cryptocurrency, as well as working with LG CNS to use its Monachain platform to track EV car battery reuse. While the city of Busan, one of the world's busiest ports, has also opened a Blockchain regulatory free zone, and announced the launch of four major projects around logistics, tourism, digital vouchers and a data trading platform, investing €20 million by 2021.

Global pacesetter

According to one study, Korea is the world's third largest patent filer in blockchain technology after the US and China; nevertheless, there are certain focus areas. In the public sector, there are active exchange companies but fewer blockchain developers or mining entities. While in the private sector, there are several local blockchain API platforms serviced by CoinPlug, TheLoop, Samsung SDS and LG CNS. These companies are also involved in international consortia, such as R3CEV (LG CNS), Hyperledger (Samsung SDS, CoinPlug, KODEX) and EEA (SK Telecom, Blocko, TheLoop, CoinPlug).

Many companies in the finance and IT sectors have dedicated blockchain teams running pilots in search of profitable business cases. A notable example is the mobile ID consortium founded in 2019 to apply DID (Decentralized Identifiers) and wallet systems, whose membership includes KEB Hana Bank, Wooribank, SK Telecom, KT, LG U+, Samsung Electronics and all the Korean mobile carriers.

With all this activity, Korea finds itself with a distinct shortage of blockchain developers/engineers and good technologies.

Dutch business opportunities

Joining government projects is difficult without a base or representative in South Korea. But the private sector is more open to foreign collaboration. While blockchain services and consulting are not yet truly valued in Korea, many Korean IT companies are seeking potential partner companies with competence in relevant technologies in order to license technologies and find new business opportunities.

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For direct contact see www.ianetwerk.nl. For this publication we have highlighted the countries which show great developments in the field of Block Chain Technology. This publication has been made in close cooperation with the Dutch Blockchain Coalition.

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