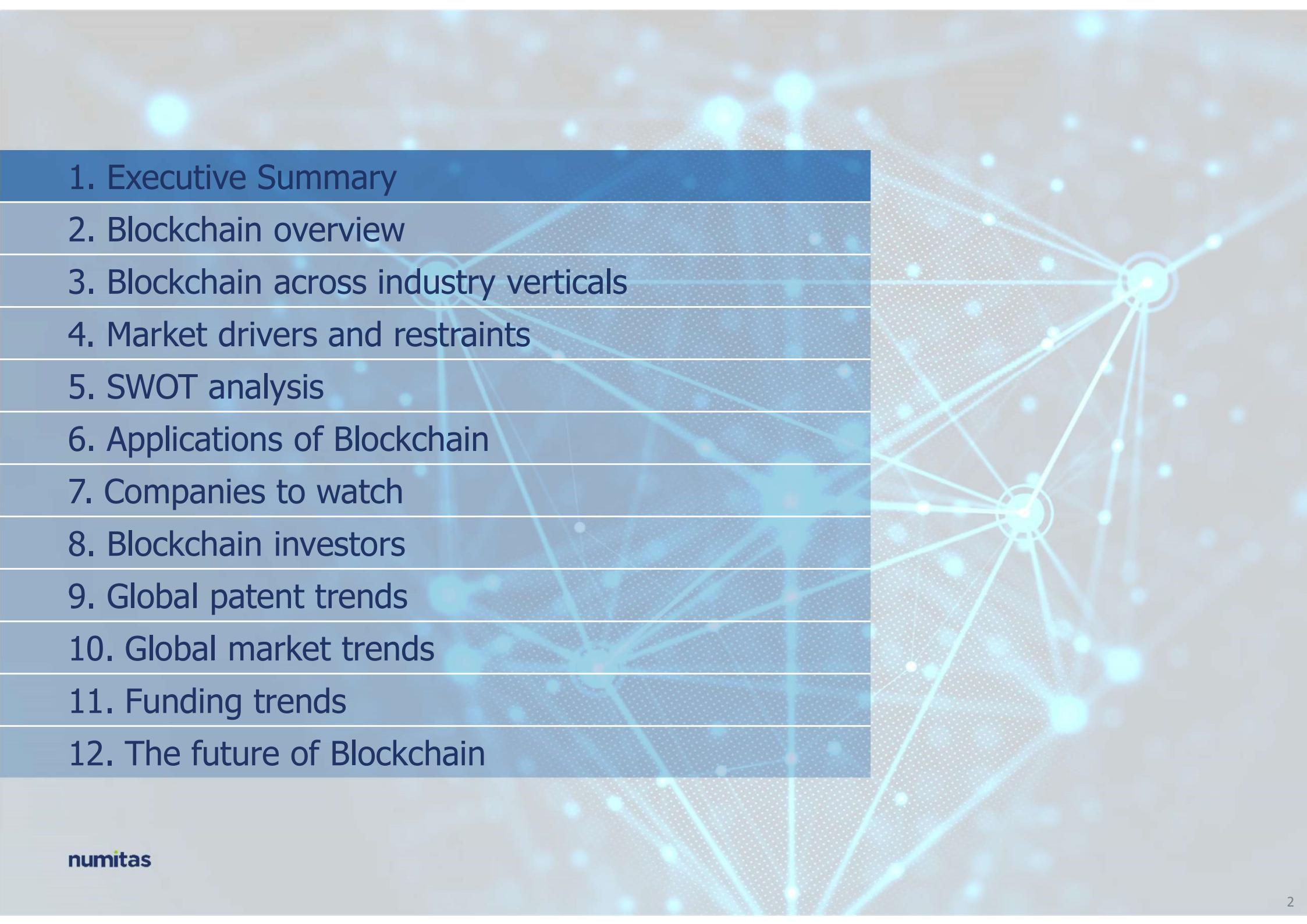




numitas

Future Applications of Blockchain and Technology

Emerging Opportunities for Blockchain

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 2. Blockchain overview
 3. Blockchain across industry verticals
 4. Market drivers and restraints
 5. SWOT analysis
 6. Applications of Blockchain
 7. Companies to watch
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1.1 Key Findings



Market growth

The global Blockchain market is expected to grow from US \$210m to \$2,312m by 2021.

The global financial crises and increase in acceptance of cryptocurrencies such as Bitcoin and Ethereum are further driving the Blockchain market.

In recent years Blockchain has witnessed significant growth and adoption, and the industry has witnessed record investments being poured into innovative start ups.



Adoption

Blockchain is expected to see massive adoption in the Media industry and will address the challenges associated with distribution cost, content privacy, content licensing and copyright infringements amongst others.

Being a secured and open-source platform, Blockchain will not only help banks minimise processing fees, but will also offer a platform to create new products and services that will generate renewed revenue streams.



Development trends

International business partnerships and alliances will foster Blockchain application's development.

Government involvement plays a major role in developing capabilities to address growing customer demands.

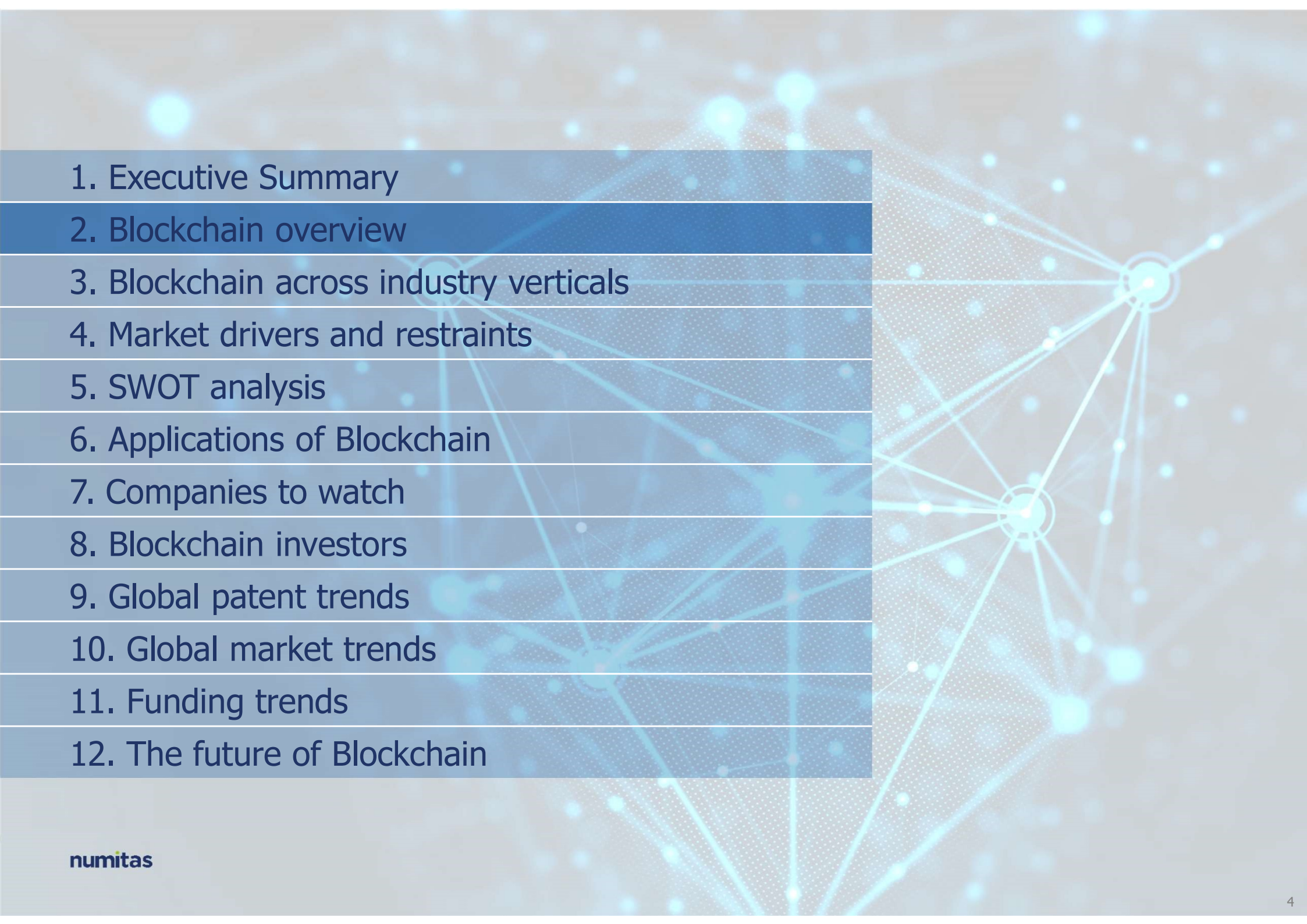
Global market participants work with an extensive network of partners to meet the requirements.



Internet of things

The convergence of Blockchain and IoT would help to create a secure mesh through which all IoT sensors would be able to communicate with each other in a reliable way and will avoid network threats such as distributed denial-of-service and device spoofing.

Patent filings and patents granted have been on the rise. This trend clearly indicates the growing R&D in the field currently.

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2.1 What is Blockchain

What is Blockchain?

A Blockchain is a distributed ledger that stores data in the form of blocks. Each block maintains a time-stamp and is linked to the previous block. Once recorded, the data in blocks cannot be altered or tampered with. The entire process is completed in real-time by eliminating the need for any central authority or a third-party financial institution to verify the transactions. A Blockchain can be programmed to record all financial and non-financial transaction data in all manners. Blockchain can be programmed to record all financial and non-financial transactions of all value.

Factors Driving Tech Disruption



Faster settlement

Traditional international fund transfers are very slow, requiring days to process and implement them. With Blockchain, money can be transferred with instant speed.



Cryptographically Secure

Each data change or a transaction made is irrevocably added to a ledger, in real time, using advanced cryptography, which cannot be tampered with or modified in any manner.



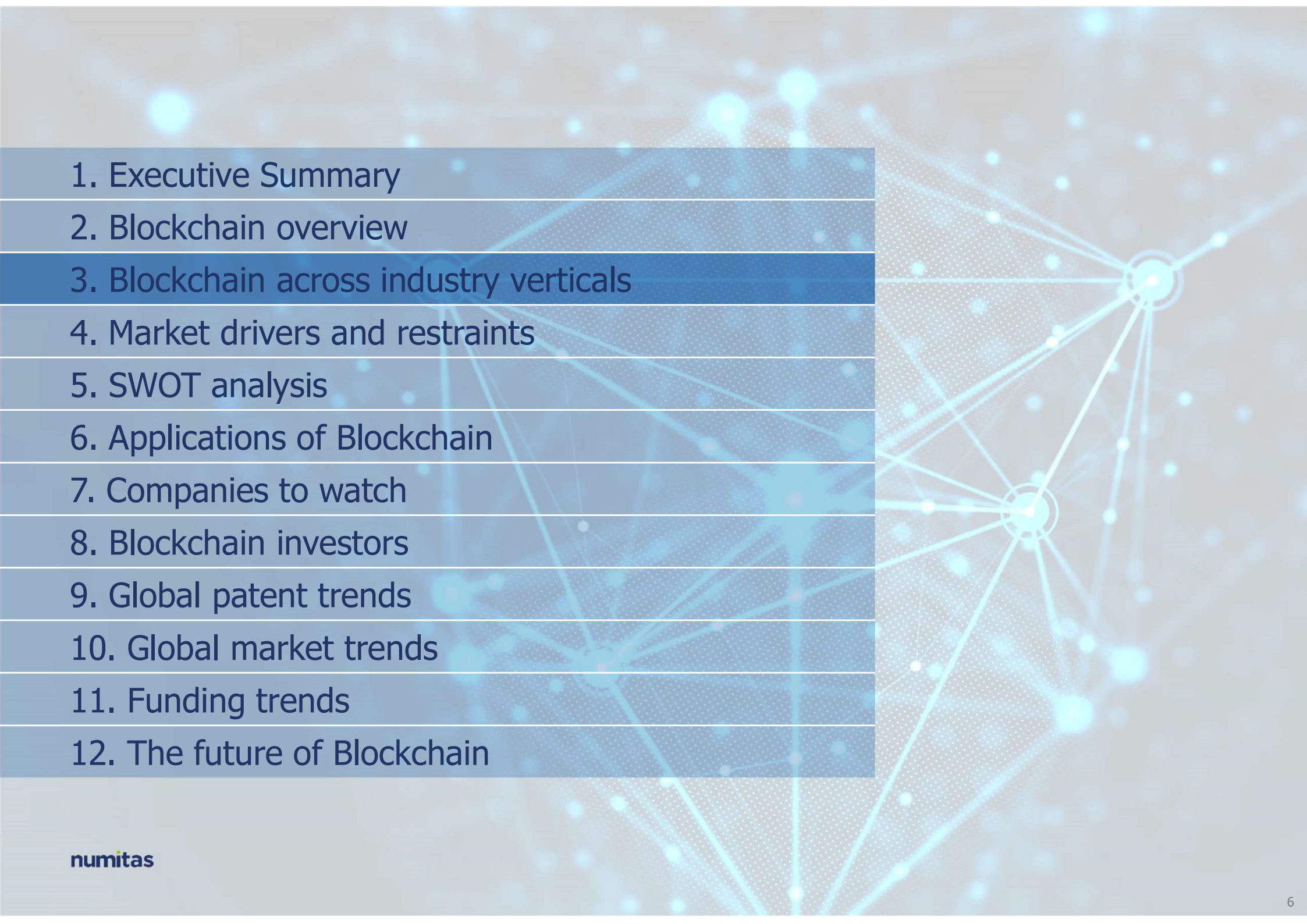
Distributed

A Blockchain system is run by thousands of independent nodes or users. Each manages the process of verifying transactions or data changes by consensus, then adding them to the Blockchain ledger.



Peer to Peer

Transactions occur between two parties without the need for an intermediate or central bodies such as Banks, Agents, or Exchanges. Blockchain's irrevocable ledger is used to determine transaction viability, creating algorithmic trust.

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3.1 Application Impact Rating of Blockchain Across Industry Sectors



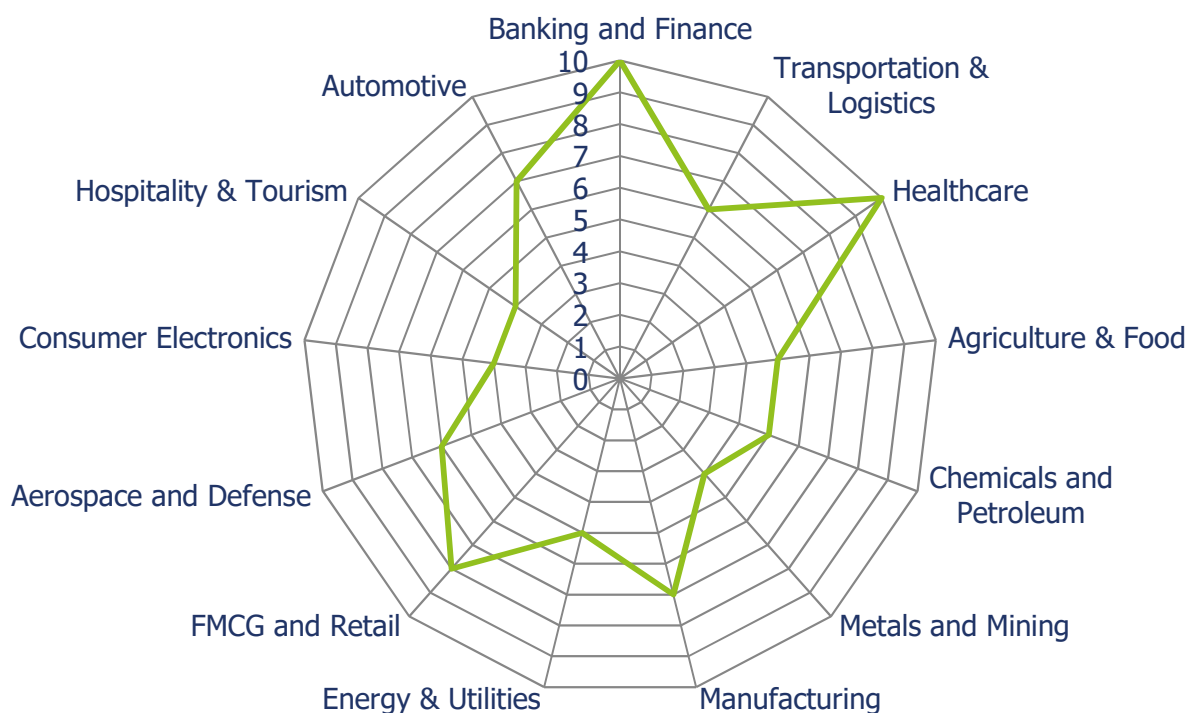
Application Impact

The impact sectors have been identified on the basis of IP Activity, Funding, Regional Adoption and Market Potential.

The highest impact area of Blockchain powered application is found in Banking and Finance followed by Healthcare, Retail, and Manufacturing.

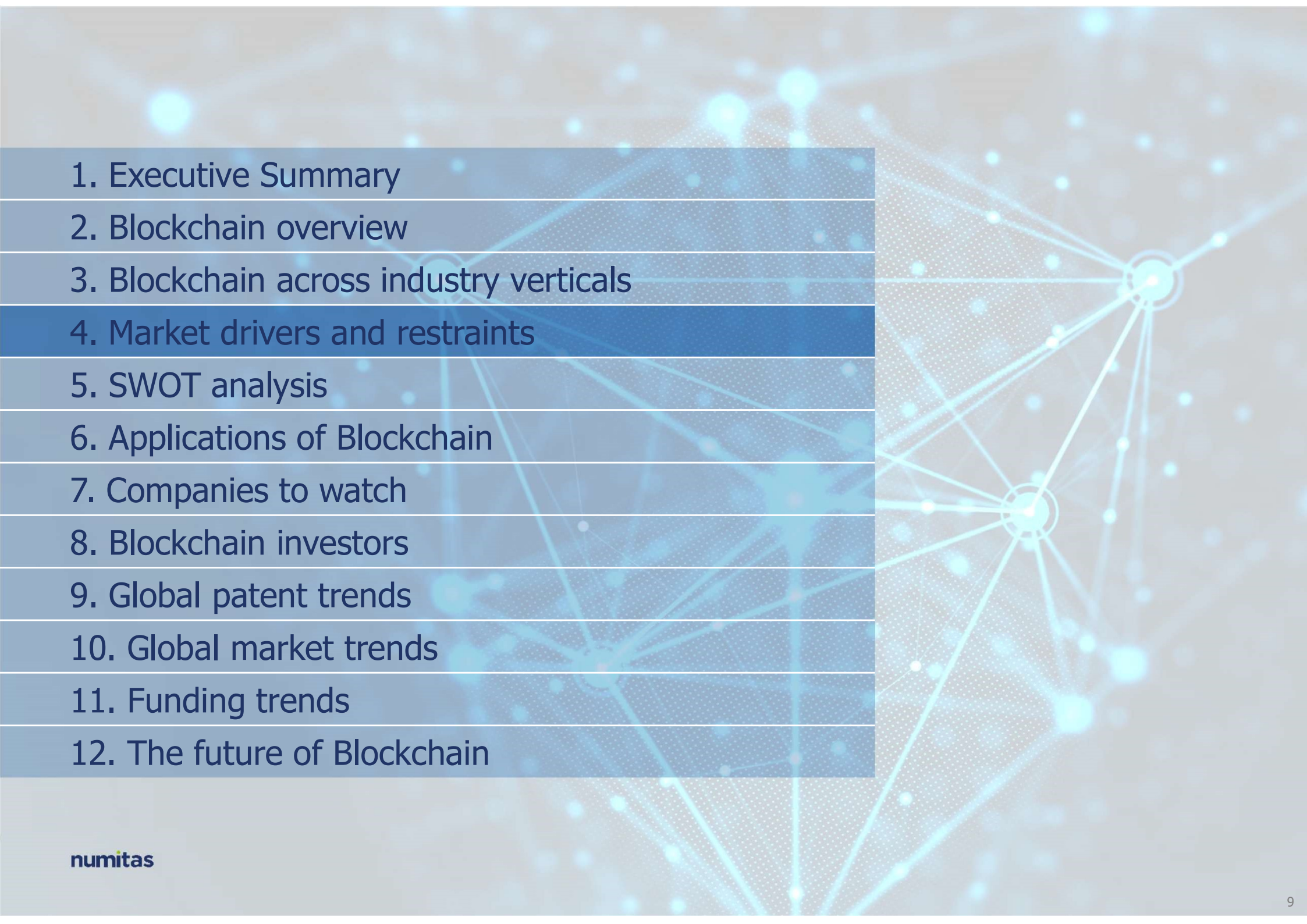
In Banking, Blockchain is playing a key role in the areas of KYC validation, asset allocation, clearing and settlements, smart contracts, and cross border payments.

With further evolution, the application will impact sectors such as Aerospace and Defense, Energy, Materials and Mining. Many innumerable fields are certain to be influenced following the launch of its innovative applications. The result will transform these sectors.



3.2 Blockchain Across Distributed Industry Verticals

	Industries	Blockchain Applications		Disruption rate	Impact
	Insurance	• Claim settlement • Fraud Detection	• P2P insurance • Track ownership	High	3 years
	Banking and Finance	• KYC Verification • Asset Allocation, Smart Contracts • Payments	• Currency exchange • Remittances • Settlements • Trading Platforms	High	3 years
	Healthcare	• Population Management. • Payment and Payers Contract • Medical Trials	• Patient generated Health Data Device • Interoperability and accessibility of medical records	Low	> 5 Years
	Retail	• Locate stolen merchandise • Identify Fraudulent Transactions	• Identify counterfeit products • Supply Chain Management	Medium	4 years
	Energy	• Energy Distribution • Smart Payments		Low	> 5 Years
	Public Sector	• Real-estate record keeping • Digital Voting	• Birth Certificate Notarization	Low	> 5 Years

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4.1 Factors Influencing Adoption – Market Drivers and Restraints



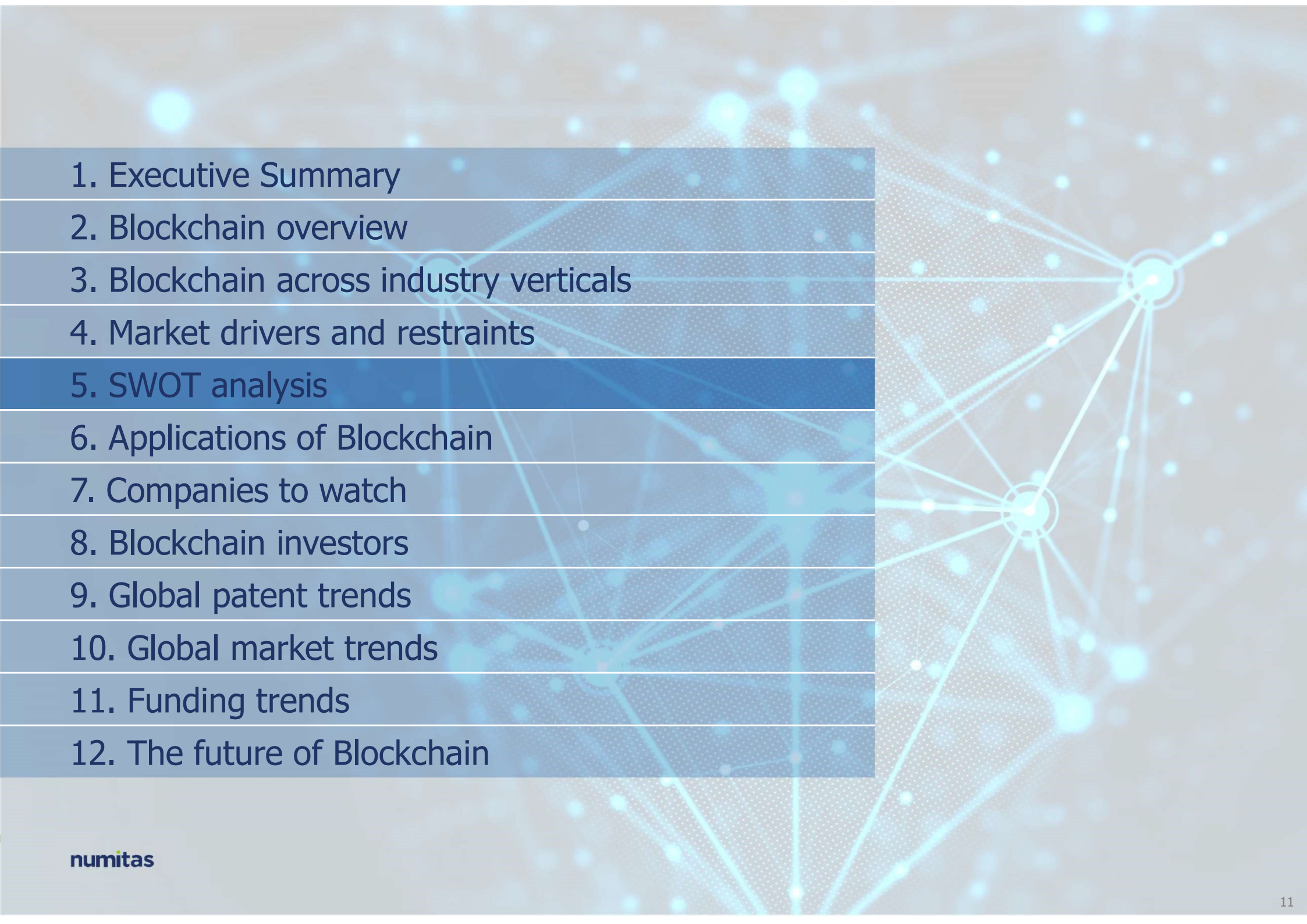
Drivers

	Short Term (1 - 2 years)	Mid Term (3 - 4 years)	Long term (> 5 years)
High Data Quality	H	H	H
Faster transactions	H	H	H
Eliminates Central Authority	H	H	H
Funding	H	H	L
No Point of Failure Malfunctions	H	H	H



Restraints

	Short Term (1 - 2 years)	Mid Term (3 - 4 years)	Long term (> 5 years)
Mining Requires Huge Power	H	M	M
Nascent Technology	H	H	M
Uncertain Regulatory Status	H	H	M
Cyber Security Returns	H	H	M
Lack of Awareness	H	M	L

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5.1 SWOT



Strengths

- With technology evolvement Blockchain will be used across all Industrial sectors for a secure and faster transactions economically.
- Blockchain has the ability to eliminate a central authority for transaction verification. It increases the scope manifold for a secure data exchange. It has the capability to make data exchange simpler and hassle free between entities.
- Significant amount of funding from government and private investors is driving the Blockchain market.



Weaknesses

- Since Blockchain is still in its nascent stage there is a lack of availability of skilled experts to develop Blockchain-based applications.
- Lack of availability of miners to mine transactions is the other key issue of Blockchain.



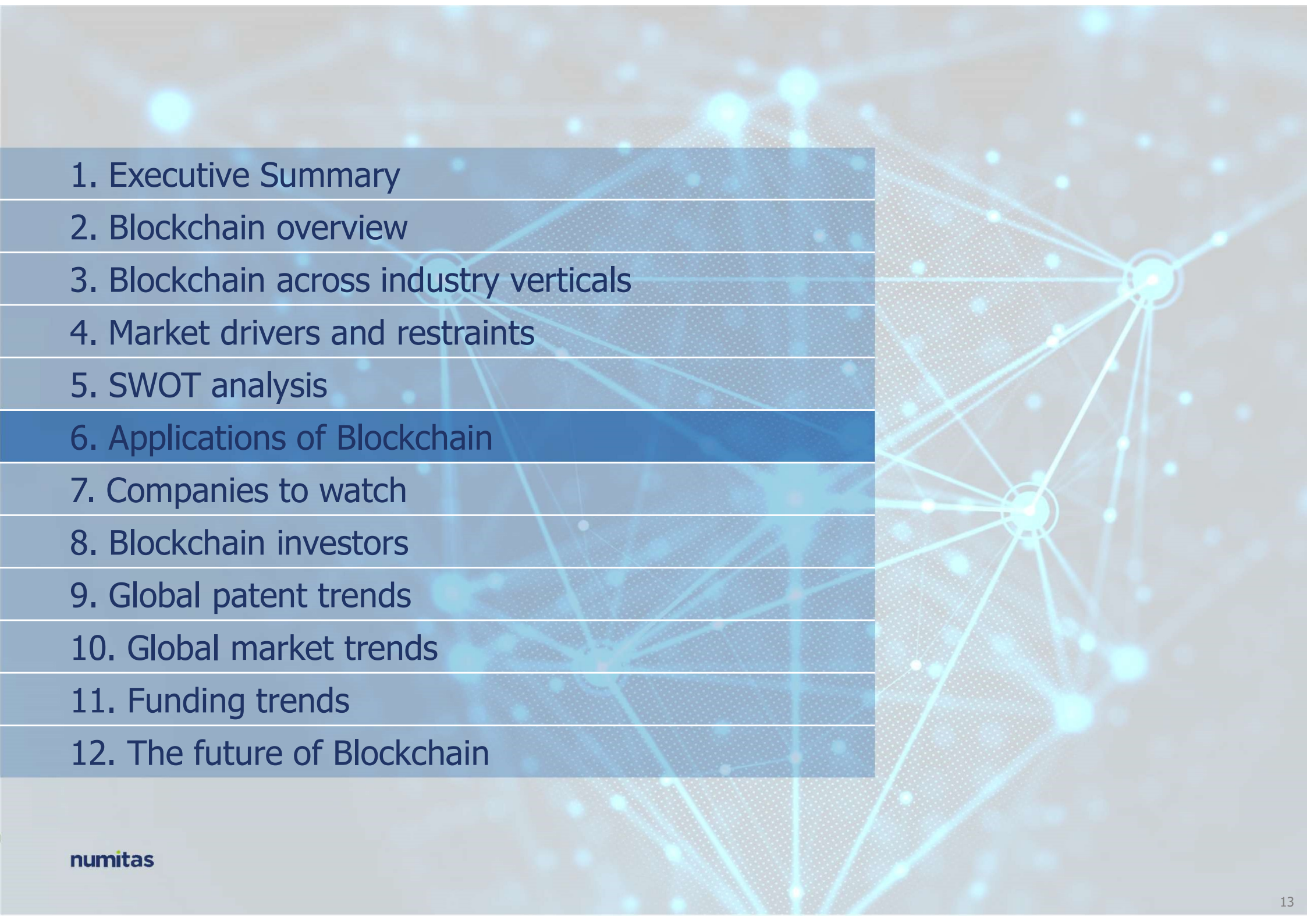
Opportunities

- Blockchain is increasingly being adopted in the areas of Banking and Finance, Manufacturing, Healthcare, and Retail.
- With the speed at which Blockchain is being embraced across the industry, it is expected that it will radically change the business model.



Threats

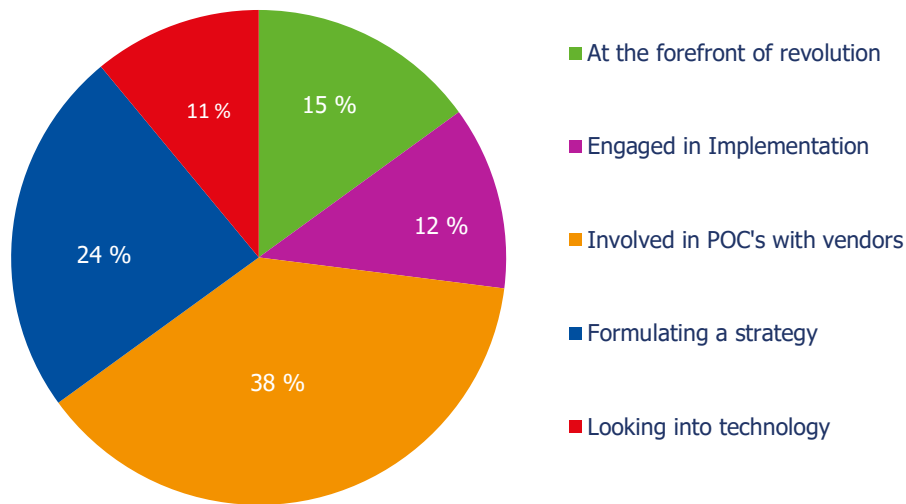
- The rise in cyber threats and cyber attacks against cryptocurrencies have left Trade and Business concerned whether new Blockchain technology can be made secure enough from cyber criminals.
- Effort to validate Blockchain transactions requires a significant amount of computer power.

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6.1 Implementation of Blockchain in retail

- With the growth of online shopping and an increase in counterfeit products, small margins and increasing competition is squeezing retailers worldwide. While there is no way to solve all the said challenges in one go, a sophisticated technology like Blockchain has the ability to address most of the retail challenges.
- Using Blockchain's distributed ledger concept and powerful encryption capabilities along with its ability to generate smart contracts, retailers can significantly collaborate and enhance trust across the value chain.
- Implementation of Blockchain into the Retail Industry will enable retailers to provide more information about their products to customers.

Retail current stage in Blockchain adoption



Key players exploring Blockchain in retail

- Walmart
- Woolworths
- Walgreens
- Alibaba

Blockchain Impact on Retail Industry

Current



5 years from now



6.2 The use of Blockchain in retail



Locate Stolen Merchandise

Blockchain can be used to tag and verify products (based on authenticity) immediately post consumer purchase. In regard to the product being stolen or missing, it will be incredibly easy to trace, as any subsequent transaction will be recorded in Blockchain, instantly notifying the legitimate owner.



Supply Chain Transparency

Blockchain will help the consumer to track product movement right from manufacturing to sale, by creating a permanent history of the transaction. This would dramatically reduce time delays, human errors and added costs that are effecting todays transaction.



Loyalty Programs

With a variety of loyalty programs offered by different vendors, Blockchain will offer a single platform for instant redemption and exchange of multiple loyalty points.



Secure Transactions

Blockchain powered transactions will reduce the need of third-party authentication for transaction verification. This will minimize transaction time and transaction cost.



Product Authenticity / Identifying Counterfeit Products

Blockchain can be utilized as public ledger where information on all new products can be registered. This will help to track the owner of the product. If a duplicate entry appears on the Blockchain without proper authorization, this is identified as a counterfeit product.

6.3 Blockchain application in retail

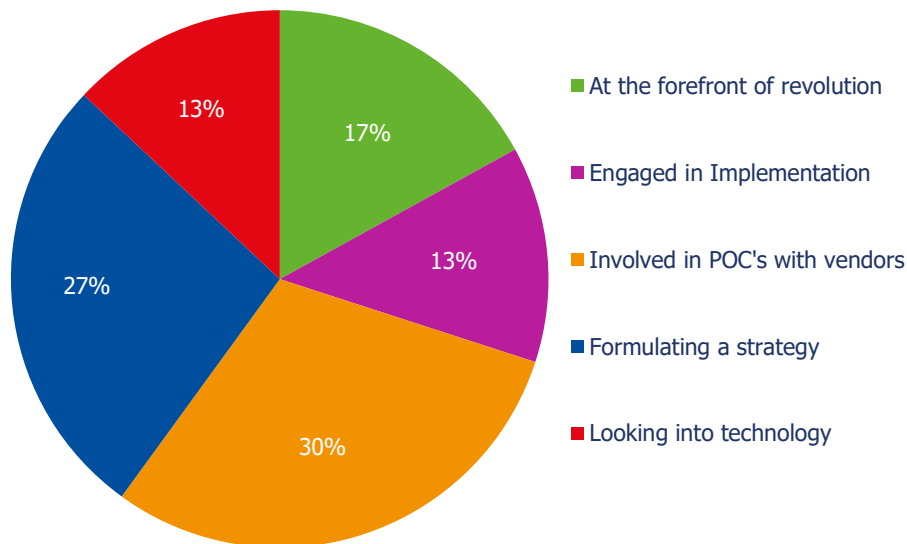
INSTITUTION:	Microsoft	IBM	IBM	Foodler	Future Group Retail
PARTNER:	Mojix	Walmart	Hejia	NA	NA
DESCRIPTION OF PROGRAMME:	Mojix is teaming with Microsoft to offer a Blockchain-enhanced version of its solution so that members of an enterprise supply chain - retailers, suppliers and logistic providers - can view their transactions related to RFID tags read via Blockchain-empowered smart contracts.	Global retail giant Walmart has partnered with IBM to develop a distributed, transparent supply chain tracker. The tracker will help to track product from origin to Walmart store. Blockchain along with adequate IoT sensors allow tracking of products quickly and efficiently in a trusted and reliable way.	Yijian Blockchain Technology Application System is a permissioned Blockchain platform, which will solve financial challenges that occur in the Chinese pharmaceutical industry. The platform is designed to track the flow of drugs.	US based online food ordering company, Foodler, has started accepting digital currencies as a mode of payment for food deliveries.	Future Group Retail (India) has launched a Consumer and Digital (C&D) Lab, that will help Blockchain technology companies to collaborate and develop applications to solve retail business issues pertaining to payments and supply chains.

6.4 Implementation of Blockchain in banking

- Blockchain is expected to radically change today's Banking and Financial business, it is emerging as one of the most enhancing technologies which has the potential to change the financial industry by making transactions faster, cheaper, secure and transparent.
- Being a secured and open source platform, Blockchain will help banks to minimize processing fees and also offer a platform to create new products and services. They will generate a new revenue stream. Banks are experimenting various use cases to determine how they can leverage Blockchain to attract new customers.



Banks current stage in Blockchain adoption



Key Players exploring Blockchain in banking

- | | | |
|-------------------|----------------------|---------------------|
| • Barclays | • Standard Chartered | • ING |
| • CITI | • Lloyds Bank | • Visa |
| • RBS | • ABN- Amro | • JP Morgan Chase |
| • BNP Paribas | • HSBC | • Commonwealth bank |
| • Bank of America | • NASDAQ | • Societe Generale |
| • DBS | • Deutsche Banks | • Morgan Stanley |
| • BNY Mellen | • Santander | • Westpac |
| • Western Union | • Fidor Bank | • ANZ |

6.5 The use of Blockchain in banking



Clearing and Settlements

Clearing and settlement is expected to be the most active use case. Blockchain will reduce the clearing and settlement cycle by eradicating intermediaries between two parties. As a result, the payment process would be optimized, faster and more secure.



In-Trade Finance

Finance transaction involves cumbersome paperwork that requires international courier services and is vulnerable to documental frauds. Blockchain will offer secure electronic record-keeping that will help all parties to track documentation without the need of a third-party and will also speed up trade transactions.



Know Your Customer (KYC)

According to a survey, Financial Institutes spend more than \$60m on KYC compliance. Blockchain creates a secured shared ledger, which will reduce the effort and time spent in performing repeated due diligent processes. By leveraging a Blockchain powered KYC system, time and efforts of verifying documents is much saved.



Insurance Price Quoting

Improved accuracy of insurance plans via transparent quantification without the need of any brokers or insurance advisors.



Insurance Claim Settlement

Using smart contracts, Blockchain will offer automatic payments to insurers and will provide transparent proof of claim.

6.6 Blockchain application in banking

INSTITUTION:	ANZ Bank	IBM	Westpac	NASDAQ	UBS
PARTNER:	Ripple	Europe Banking Consortium	Ripple	CITI and Chain	Clearmatics
DESCRIPTION OF PROGRAMME:	The partnership is testing various banking uses to experiment the potential use of Blockchain.	EBC are developing a Blockchain based platform to simplify trade finance for small and medium business. The consortium will work with IBM to help small business in Europe to manage and track domestic and international trade transactions.	Westpac, in partnership with Ripple, is developing a low cost, cross-border payment platform.	NASDAQ and CITI has partnered with a Blockchain start-up chain to link Citi's business payment services to Nasdaq's Blockchain platform that has been used for activities such as buying and selling shares of private companies.	UBS is developing an enterprise-wide product called 'utility settlement coin' in partnership with Clearmatics to experiment various Blockchain usage cases pertaining to banking and finance, such as smart bonds.

6.7 Implementation of Blockchain in healthcare



- Advancement in IT has helped the Healthcare industry in genetic research and precision medicine, and has provided an innovative approach for disease prevention and treatment.
- Healthcare is expected to have maximum benefit from Blockchain, especially in the areas of Health Management, Payment and Payer Contracts, Medical Trials and Patient Generated Health Data.
- Present IT healthcare infrastructures do not provide security or interoperability for connected living. Blockchain-powered health solutions will provide a solution to health data interoperability. Most importantly Blockchain will provide secure data exchange systems.

Blockchain in healthcare – case study

Challenge: Counterfeit drugs are one of the serious problems in the pharmaceutical industry according to Health Research Funding Organization (HRFO), 10%– 30% of drugs sold in developing countries are counterfeit. The globally counterfeit drug market is valued at US \$200billion annually. According to the World Health Organization, 16% of counterfeit drugs contain wrong ingredients or unnecessary ingredients, which can trigger unexpected secondary effects.

Solution: Blockchain will play a key role in eradicating counterfeit medicine by providing traceability and security. The manufacturer will assign a unique code to each drug, the information is then stored on Blockchain. Once the distributor receives the medicine they will check for authenticity in the Blockchain ledger and record its confirmation in Blockchain. The pharmacist verifies the origins of the products and registers them in Blockchain. It is a full circle of verifications.

Benefits: Blockchain will provide complete drug traceability allowing companies to track their products across the supply chain and making it difficult for counterfeit products to enter the market.

6.8 The use of Blockchain in healthcare



Population Health Management

Blockchain will create secure networks, which can be used within specified populations or communities for managing and sharing patients medical records and information such as patients health patterns and information on doctors visits.



Patient Generated Health Data (PGHD)

PGHD has lots of potential in managing health conditions of patients. With effectively no solution to store the data available at the moment, this data is not utilized properly by a physician. Blockchain can be used to store PGHD data securely without the fear of tampering. This data can be integrated with Electronic Health Record and clinical visits improving overall patient experience.



In-Drug Supply Chain

Blockchain will help track the movement of drugs from manufacturer to end consumer. Blockchain will create a transparent tamper-proof network, which will record the flow of drugs from end-to-end. This will make the counterfeit product difficult to enter the market.



Payments and Contract

Blockchain will ease the job of insurance and medical companies. By using Blockchain, a single network can be created which brings together hospitals, insurance companies and patients for hassle free and well integrated payments in one go. Blockchain helps to reduce redundancies across the industry, leading to significant savings in cost and efforts. In addition, Blockchain-based 'smart contracts' can trigger automatic notifications to providers and patients in the event of potential threats.

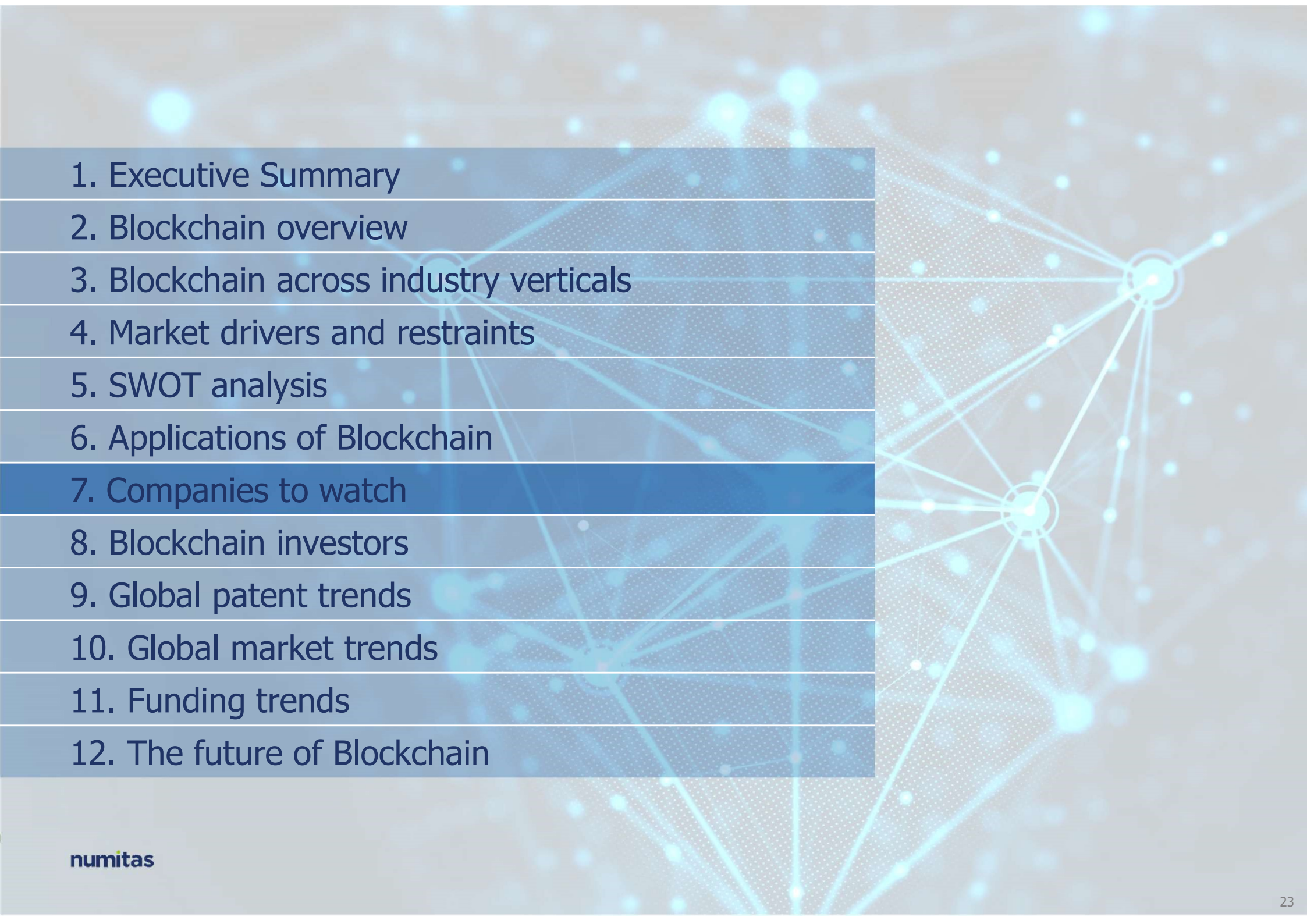


Medical Trials

Blockchain can be used to increase the trustworthiness of medical trials results. Blockchain will address the challenge of outcome switching, data dredging and selective publication, which plagues clinical trials.

6.9 Blockchain application in healthcare

INSTITUTION:	Philips Blockchain Lab	Estonian Health Records	Beth Israel Deaconess Medical	FDA	DeepMinds
PARTNER:	Tierion	Guardtime	MIT Media Lab	IBM Watson	NA
DESCRIPTION OF PROGRAMME:	The partnership is developing various healthcare use cases especially in the areas of patient and provider identity, clinical data sharing and health care finance information.	The Government of Estonia has partnered with data security startup Guardtime to develop a Blockchain based platform to secure medical records of more than 1 million patients. The system integrates Keyless Signature Infrastructure and an oracle database engine for authentication.	Researchers are working on a pilot program called MedRec. The program is planned to track blood records, vaccination history and other therapeutic treatments.	The Food and Drug Administration is using IBM Watson to study Blockchain tech and to explore how data from electronic health records, clinical trials and health data from wearable's would better be served using Blockchain.	The company is working on a tool called "Verifiable Data Audit" that will allow hospitals, and potentially even patients, to see exactly who is using health-care records, and for what purpose.

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7.1 Companies to watch – Identity and Reputation



ShoCard

Based in California, Shocard has developed an identity management solution using Blockchain. The solution deploys a public/private key encryption technique for data hashing and to store and exchange identity data. This includes fingerprints, facial recognition, retina iris patterns, and voice. This solution helps users to manage and carry his/her identity on handheld devices.

Funding: \$1.5 Million



uPort

Uport is simple, an easy-to-use open source self-sovereign identity system for business, people, organisations and bots. The solution is built on top of Ethereum. The uPort mobile app allows the user to create a self-sovereign identity and allows to send/receive credentials.

Funding: undisclosed



Netki

Headquartered in California, Netki has developed Blockchain powered identity solution to address compliance challenges for Banks. Netki identity solution provides automated onboarding validation of new clients and easy sharing of digital identities. The company has partnered with Caribbean based Fintech company Bitt for product development.

Funding: \$3.5 Million



Civic

Headquartered in Palo Alto, Civic allows a user to know when a new account is created with their personal information using its decentralized architecture with Blockchain and bio-metric. Civic gives you the control to identify which ones were authorised by you and take action on the ones that were not.

Funding: \$2.75 Million

7.2 Companies to watch – Financial Services



Chain Core

Chain Core is an enterprise-grade Blockchain infrastructure that helps enterprises to develop better financial services using their Blockchain platform. Chain Core enables entities or users to run transactions directly without the need of third-party verification.

Funding: \$43.7 Million



Paxos

Paxos flagship product Bankchain is a next-generation Blockchain based settlement platform that streamlines the post-trade process. The solution delivers instantaneous settlement, cost savings and increase operational efficiencies.

Funding: undisclosed



Zebpay

Headquartered in Singapore, the company has developed sophisticated mobile Bitcoin wallets that enable Bitcoin transactions using a mobile number without the use of a complex Bitcoin address. Using this mobile app, the user can buy, sell, receive, transfer and store Bitcoins using the combination of mobile number and four digit PIN.

Funding: \$1.13 Million



Ripple

Based in California, Ripple offers real-time payment systems that help financial institutes around the world to directly transfer funds, without the need of a central authority for verification. The funding is backed by prominent investors such as Avant global, Blockchain Capital and AME cloud ventures among others.

Funding: \$2.75 Million

7.3 Companies to watch – Retail



Provenance

Based in London, Provenance is using cutting-edge technology of Blockchain for traceability of products and materials. It uses open protocol standards for traceability to ensure that supply chain becomes more transparent and traceable. Provenance supply chain solution helps track products' origin history and allows the consumer to track attribute and ownership.

Funding: \$0.65 Million



Wave

Located in Kfar Saba, Wave is a decentralized, peer-to-peer network that connects members across the international trade supply chain. With the use of decentralized distributed ledger technology, it enables direct exchange of documents between trade parties more securely and at a cheaper cost.

Funding: \$2.0 Million



Warranteer

Warranteer is a Tel-Aviv headquartered company which delivers a Blockchain and Cloud powered platform for warranty claims. The Warranteer mobile app takes a copy of product warranty, from paper to Blockchain ledger. Warranties are automatically activated once the customer purchases a product and alerts the customer when the warranty is about to expire.

Funding: Undisclosed



Open Bazaar

Open Bazaar is Blockchain based online E-commerce platform that connects buyers and sellers via a peer to peer platform. This network is not owned or controlled by a Company rather it is a decentralized network. It allows users to connect with other users in the platform and trade with them. There is no mandatory fees to pay.

Funding: \$4.2 Million

7.4 Companies to watch – Healthcare



Blockchain Health Co

Head quartered in San Francisco, Blockchain Health Co(BHC), leverages Blockchain technology to create a direct connection between doctors and patients. BHC allows patients to share health vitals directly to physicians, to monitor their health using their sophisticated platform built on Blockchain.

Funding: Undisclosed



MedRec

MedRec as a solution tuned to the needs of patients, the treatment community, and medical researchers. It is a novel, decentralized record management system for EMRs that uses Blockchain technology to manage authentication, confidentiality, accountability, and data sharing.

Funding: Undisclosed



Tierion

Tierion is one of the companies harnessing the opportunity of Blockchain-based recordkeeping. Tierion offers a set of APIs and Web services to allow simplified Blockchain data verification and receipt creation for applicants. Tierion's solution grants data immutability and historical validity. This will be used in Audit trails for medical claims and insurance.

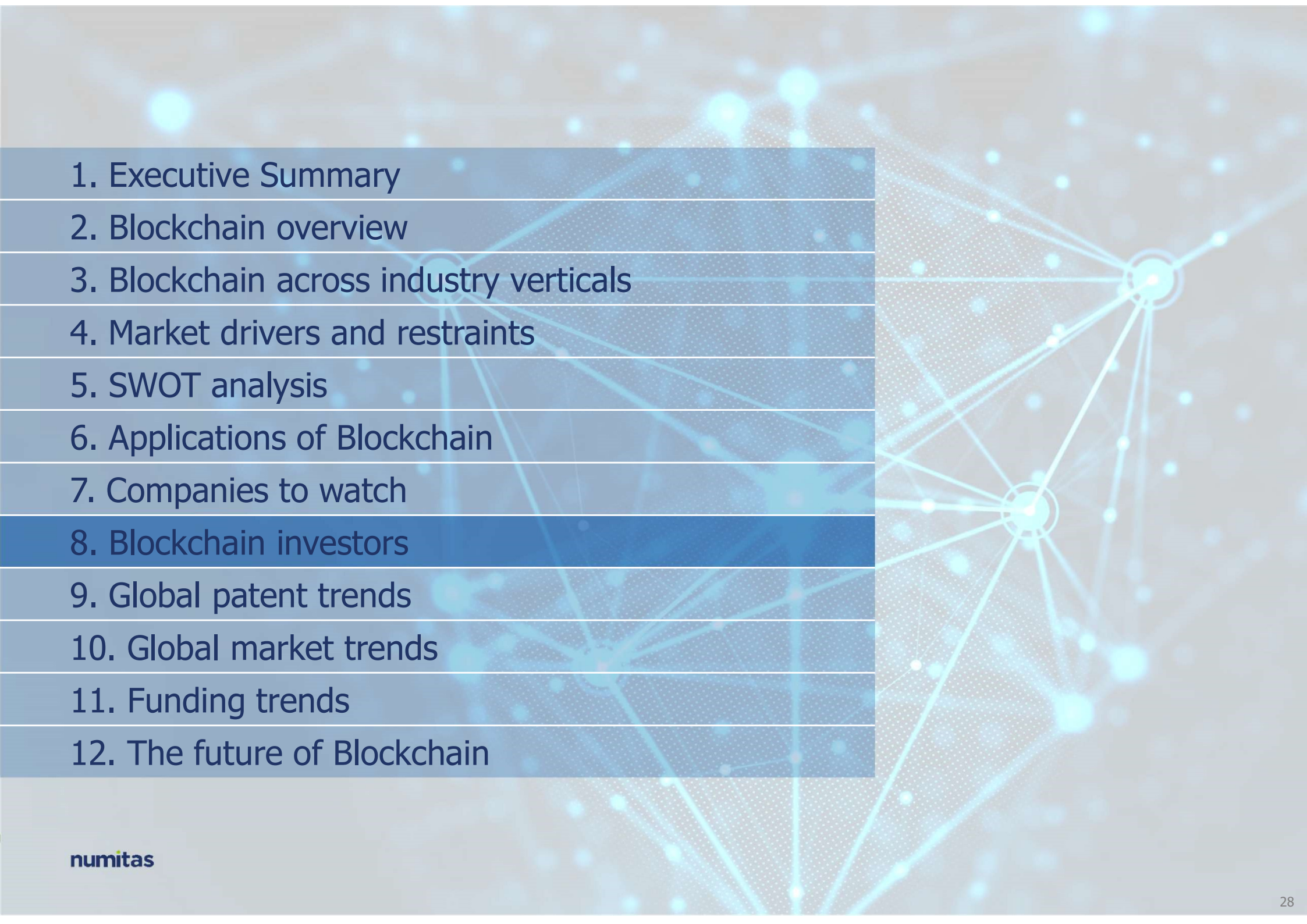
Funding: Undisclosed



iSolve

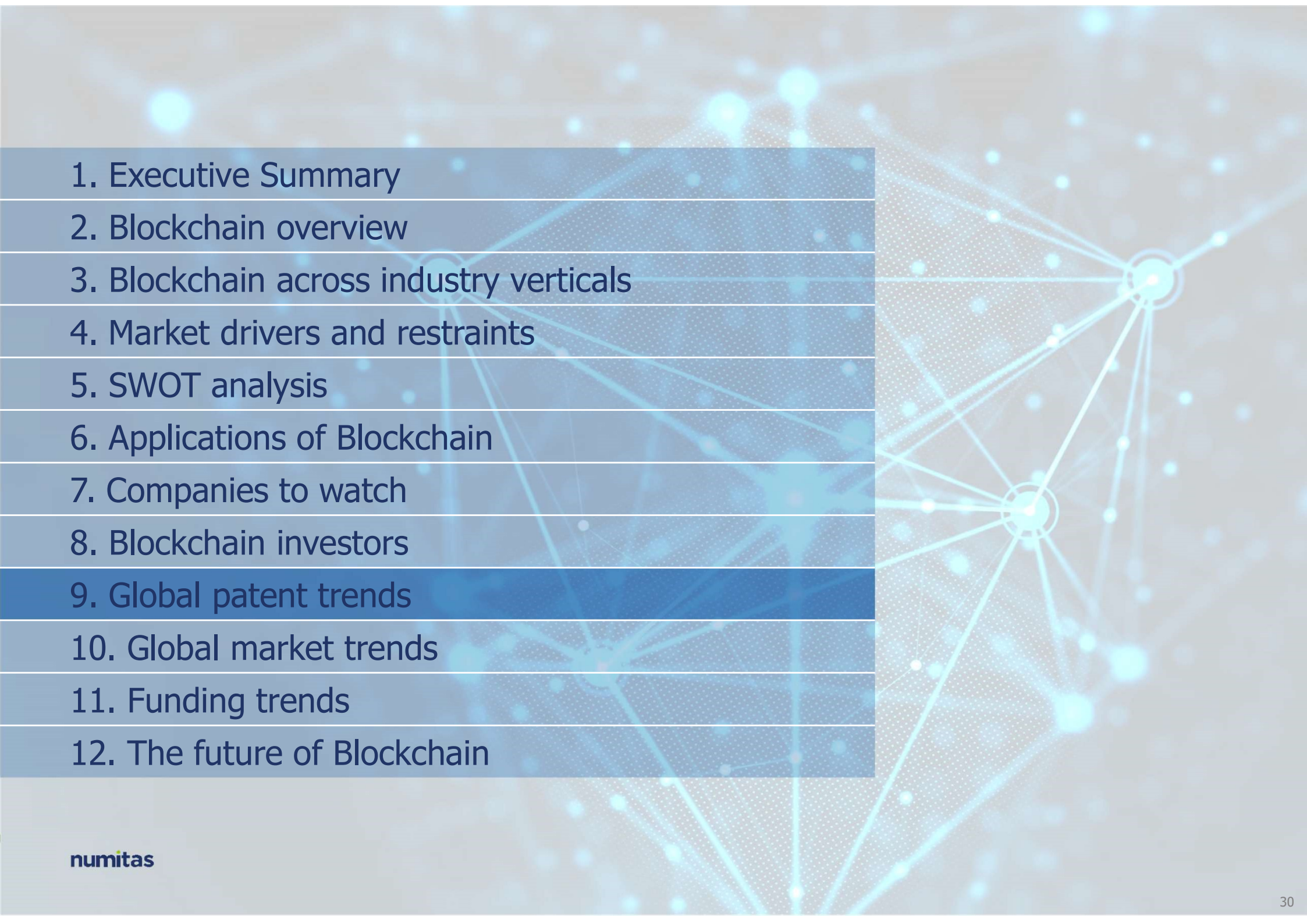
iSolve helps the biotech and pharmaceutical industry to succeed through collaboration, partnership, and technology. Through Blockchain the company helps to advance the drug development activities, by sharing their views, suggestions and process to other pharmaceutical company and doctors securely.

Funding: Undisclosed

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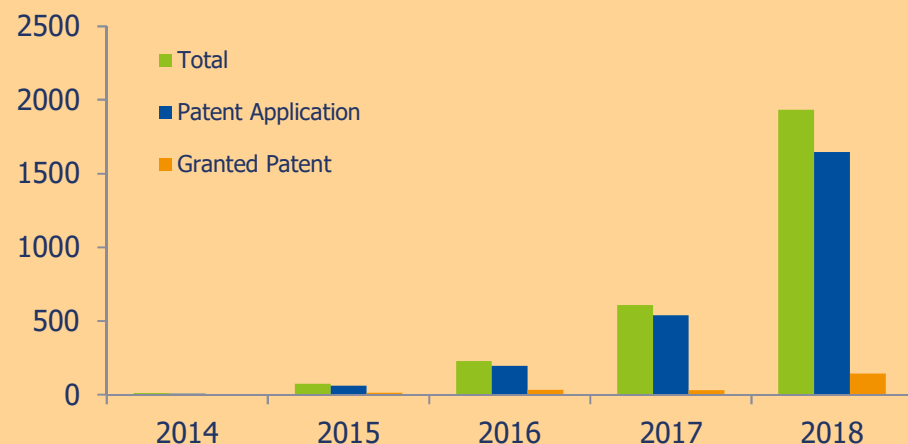
8.1 Blockchain Investors

Blockchain Capital	IDG Capital Partners	Goldman Sachs	Breyer Capital	Bank Of Tokyo - Mitsubishi UFJ	Draper Fisher Jurvetson (DFJ)	Andreessen Horowitz
Accel Partners	General Catalysts	RRE Ventures	Khosla Ventures	AXA Strategic Ventures	Digital Currency Group	Binary Capital
QueensBridge Venture Partner	China Credit Limited Holdings	Accenture	Google Ventures	Lights speed venture capital	SBI Group	Cisco Investments
Qualcom Ventures	RRE Ventures	Andreessen Horowitz	DFJ Growth Fund	Union Square Ventures	NYSE Euronext	Y Combinator
Kleiner Perkins	SVB Capital Partners	NAP Ventures	Digital Currency Group	500 Startups	Capial One Growth Ventures	CITI Ventures
NASDAQ	RRE Ventures	Thrive Capital	BNP Paribas Private Equity	JP Morgan Chase	PNC Financial Service	DTCC
Digital Currency Group	Enspire Capital	Morado Venture Partners	AME Cloud Ventures	Future Perfect Ventures	Lightspeed Venture Partners	Mosaic Ventures
Anthemis Group	innogy SE	RWE Ventures	IDG Capital Partners	Core Innovation Capital	Santander InnoVentures	AXA Strategic Ventures
Digital Garage	Horizons Ventures	Winklevoss Capital	Momentum London	Pantera Capital	Millenium Blockchain	CRCM Ventures
Oreilly AlphaTech Ventures	Colle Capital Partners	Fenbushi Capital	Anthemis Group	Partech Ventures	Wicklow Capital	Virgin Group
Prudence Holdings	Light speed Venture Partners	FunFair Technologies	Polychain Capital	Fenbushi Capital	KEC Ventures	Pelion Venture Partners
	Tekton Ventures	Harvest Equity	Amino Capital	Final Frontier	Credit China FinTech Holdings	

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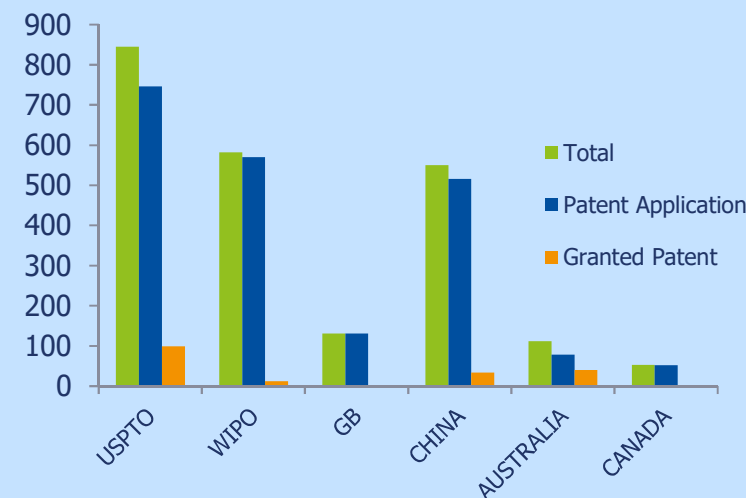
9.1 Blockchain patent by regions

Global patent filing by year, 2014 - 2018



- Patent filings and patents granted have been on the rise, with 2018 registering the highest number. This trend clearly indicates the growing R&D in the Blockchain technology field.
- With robust sustenance from Government and Private funding, developing economies like India and China are progressively emerging with Blockchain-based applications for the banking and financial sectors.
- Applications are being developed for cross border remittances, KYC (Know Your Customer) validations and multi-assets trading platforms in these countries.

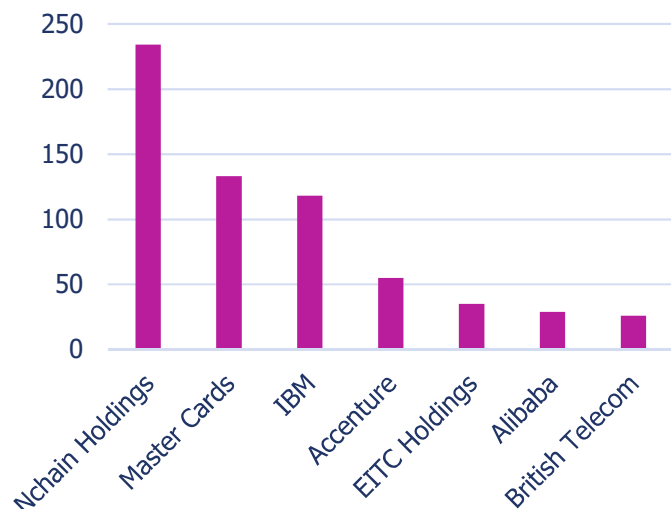
Global patent filing by country 2014 - 2018



- The patent landscape on Blockchain has been dominated by the USA, this is due to the presence of a large number of start-ups, technology giants and Government initiatives.
- The US Department of Defence has urged the United States Foreign Relations Committee to adopt Blockchain to combat cyber threats.
- Patents are being filed especially in the areas of identity management, cross border remittance and transfer application.

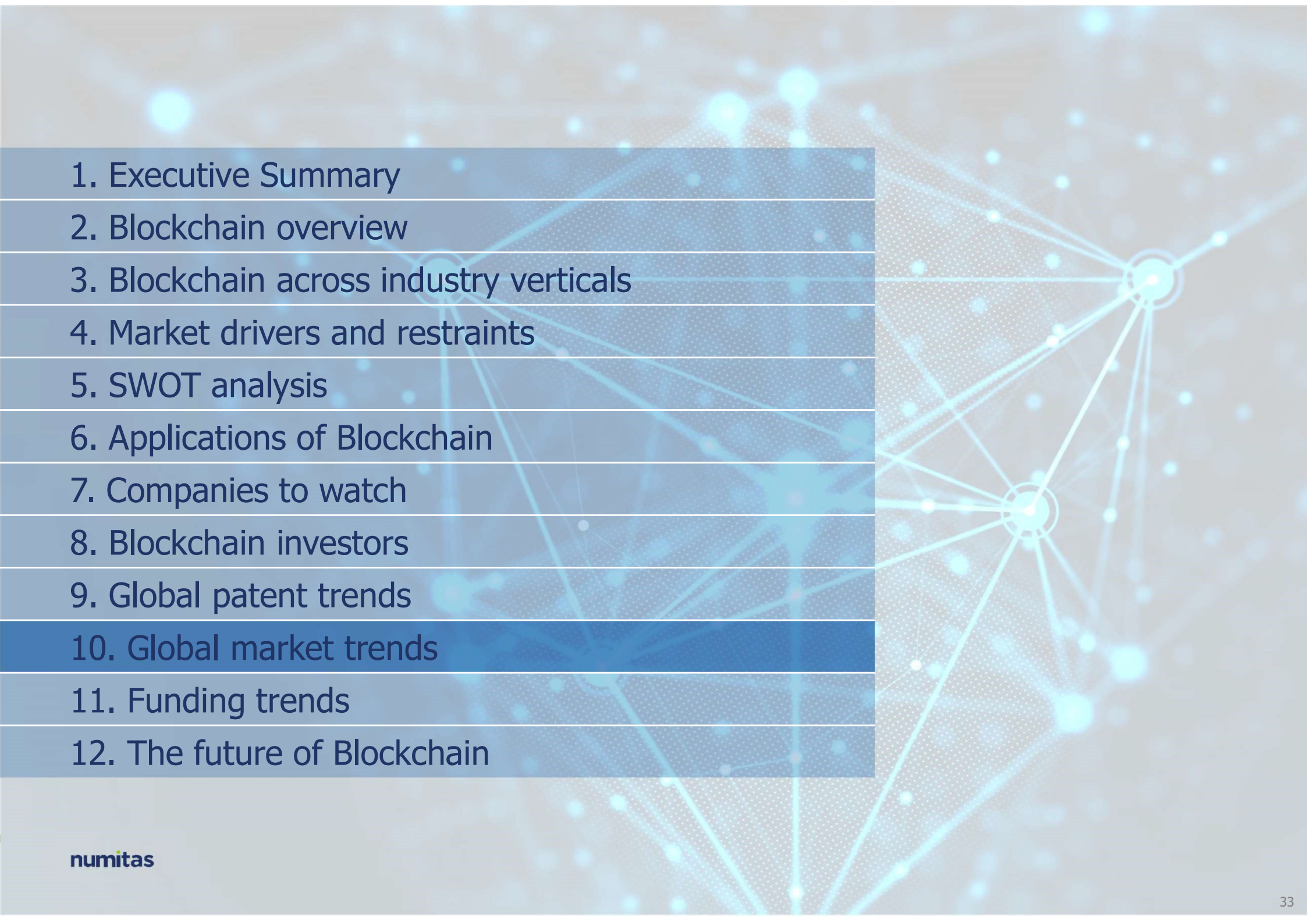
9.2 Blockchain patent by company

Top Patent Applicants, 2014-18, Global



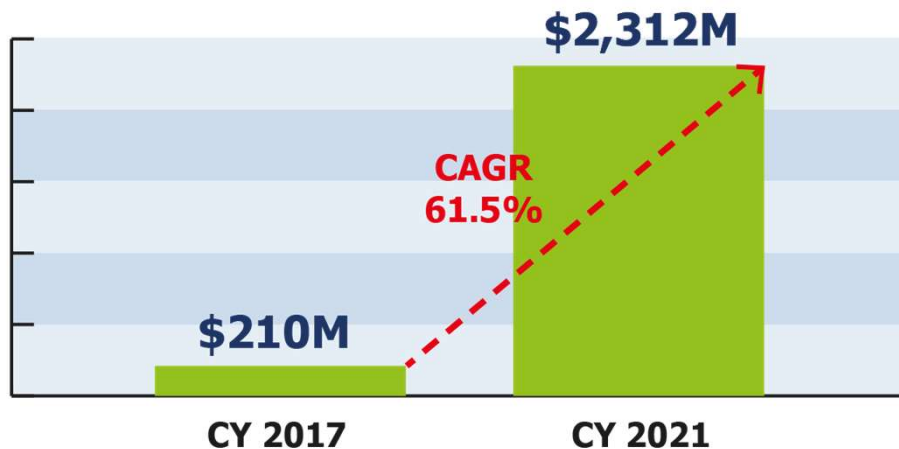
- Nchain Holdings Ltd holds the highest number of patents followed by Mastercards and IBM.
- With many retail giants embracing Blockchain based application to track counterfeit products, it is expected in coming years that patent filing will reach nearly 2,000.

#	Company	Key Focus Area
1	Nchain Holdings Ltd	• OS for IoT devices • Implementation of Logic Gate functionality using Blockchain • Secure peer-to-peer connection networks • Voting and Distribution
2	Mastercard International Inc	• Method and system for fraud control of Blockchain-based transactions
3	IBM	• Blockchain in optimum data storage configuration • Shipment tracking • Enterprise Blockchains and transactional systems
4	Accenture Global Solutions	• Product identification verification • Data security • Secure 3d model sharing using Blockchain
5	Eitc Holdings Ltd	• Smart contract for data privacy • Platform for Trading, clearing and settling securities transactions using Blockchain technology • Authentication and verification of digital data utilizing Blockchain technology
6	Alibaba Group	• Counterfeit product detection • Supply chain transparency
7	British Telecom	• Blockchain powered distributed computing environment • Blockchain based access control

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10.1 Market drivers

Blockchain Market (US \$m)



What is driving the market

- The global Blockchain market is expected to grow from USD \$210m to \$2,312m between 2017 – 2021 with a CAGR (Compound Annual Growth Rate) of 61.5 %.
- The global financial crises and increase acceptance of cryptocurrencies such as Bitcoin and Ethereum across the globe are further driving the Blockchain market.
- The need of a decentralized database, which eliminates intermediaries to validate a transaction is another key factor that drives Blockchain technology.
- In Consensus 2017 Nick Giurietto, CEO of the Australian Digital Currency Commerce Association (ADCCA) stated that reducing regulatory barrier will boost Blockchain adoption.

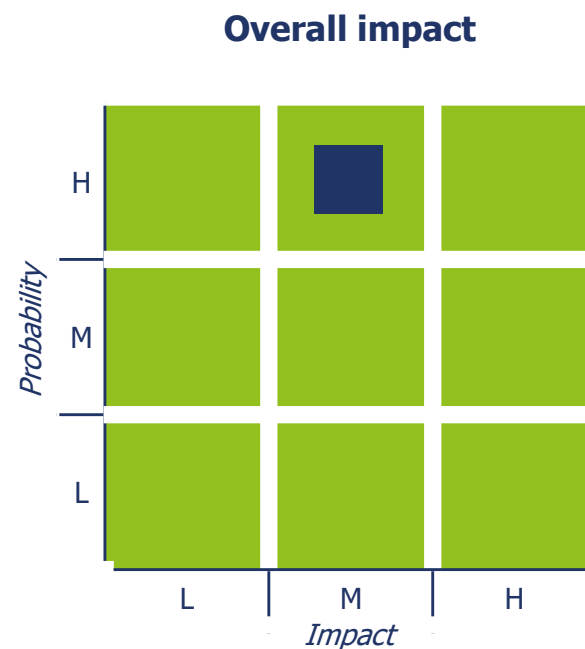


Discussion

- The rising demand for a secure, fast and transparent payment system by end-users and financial institutes has made Blockchain one of the fastest growing technologies in the world. Innovations are widespread across industries and are led by a balanced mix of funds from technology giants such as IBM, Microsoft, and prominent start-ups like Chain Inc, Bitfury and GuardTime.
- According to the World Economic Forum, it is expected that world's 10% of GDP information is to be stored in Blockchain technology by 2027.
- With its growing popularity, many venture capitalists are increasingly investing in Blockchain startups to develop applications primarily in non-FinTech sectors. Over 50 deals have been made in 2016, nearing a total investment value of \$500 million.
- The Reserve Bank of India, which controls monetary policy in India, has successfully tested Blockchain technology for trade application and stock exchanges in partnership with New York based Blockchain company MonetaGo . This will help banks in India automate trade settlements with huge cost savings.

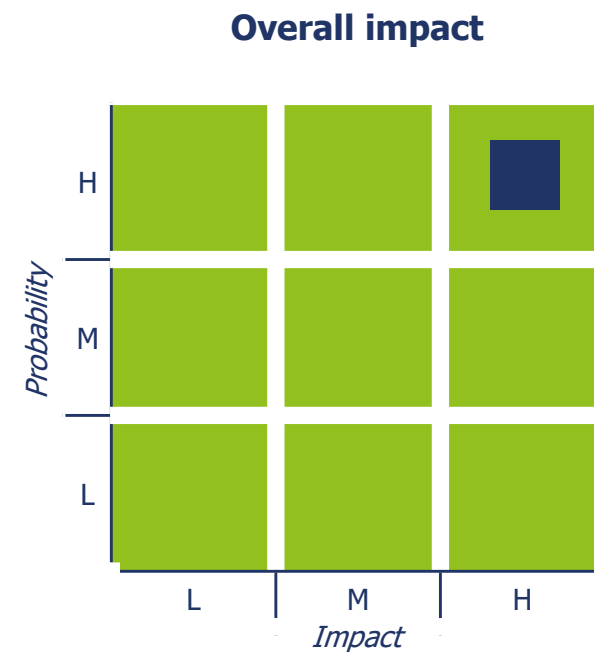
10.2 Middle East market trend

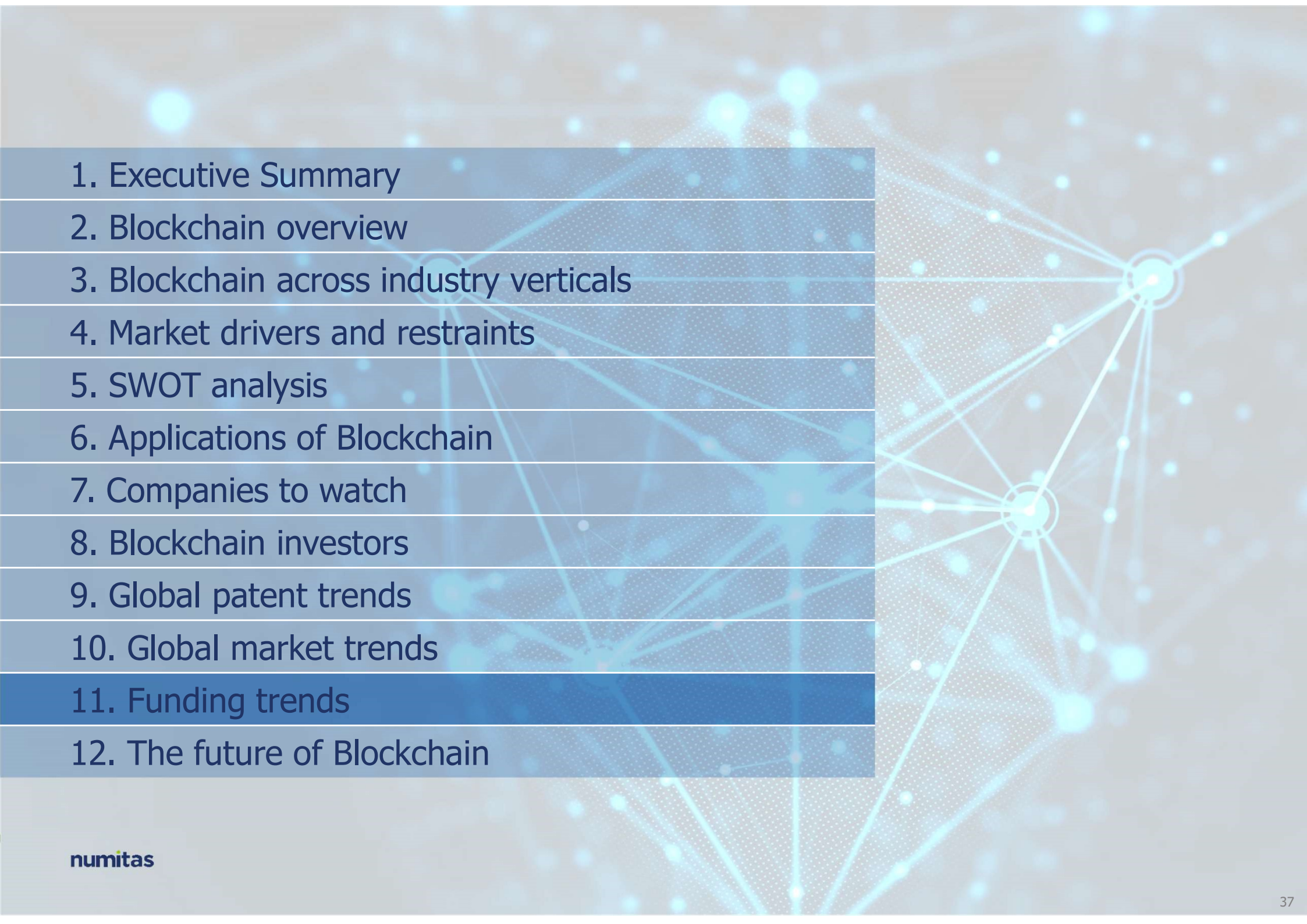
- Countries like Bahrain and UAE are one of the early adopters of Blockchain in the Middle East. Bahrain is adopting Blockchain in the financial sector, especially in the areas of bilateral payments, trading, settlements and automated issuance of securities via smart contracts.
- The Government of Dubai has partnered with technology giant IBM to develop Blockchain applications for smart cities. The government is planning to develop citywide Blockchain payment systems.
- Dubai's largest bank, Emirates NBD, has partnered with India's largest private sector bank, ICICI, to develop a Blockchain based remittance transfer system. This partnership will help workers in Dubai to transfer funds to India without any intermediary charges.
- The world's largest Islamic bank, the Saudi Arabian Al Rajah Bank, recently completed a Ripple Blockchain trial, where it successfully transferred money between Saudi Arabia and Jordan bank branches. The bank is also working to develop Blockchain application for KYC verification, remittances, trade finance and syndicated loans.
- Qatar's commercial bank and Indian software giant Infosys has developed an international money transfer pilot using a cloud-based Blockchain. The bank revealed that it would look to gain regulatory approval for its Blockchain based remittance service while targeting high-remittance corridors between the Middle-East and Asia.



10.3 European market trend

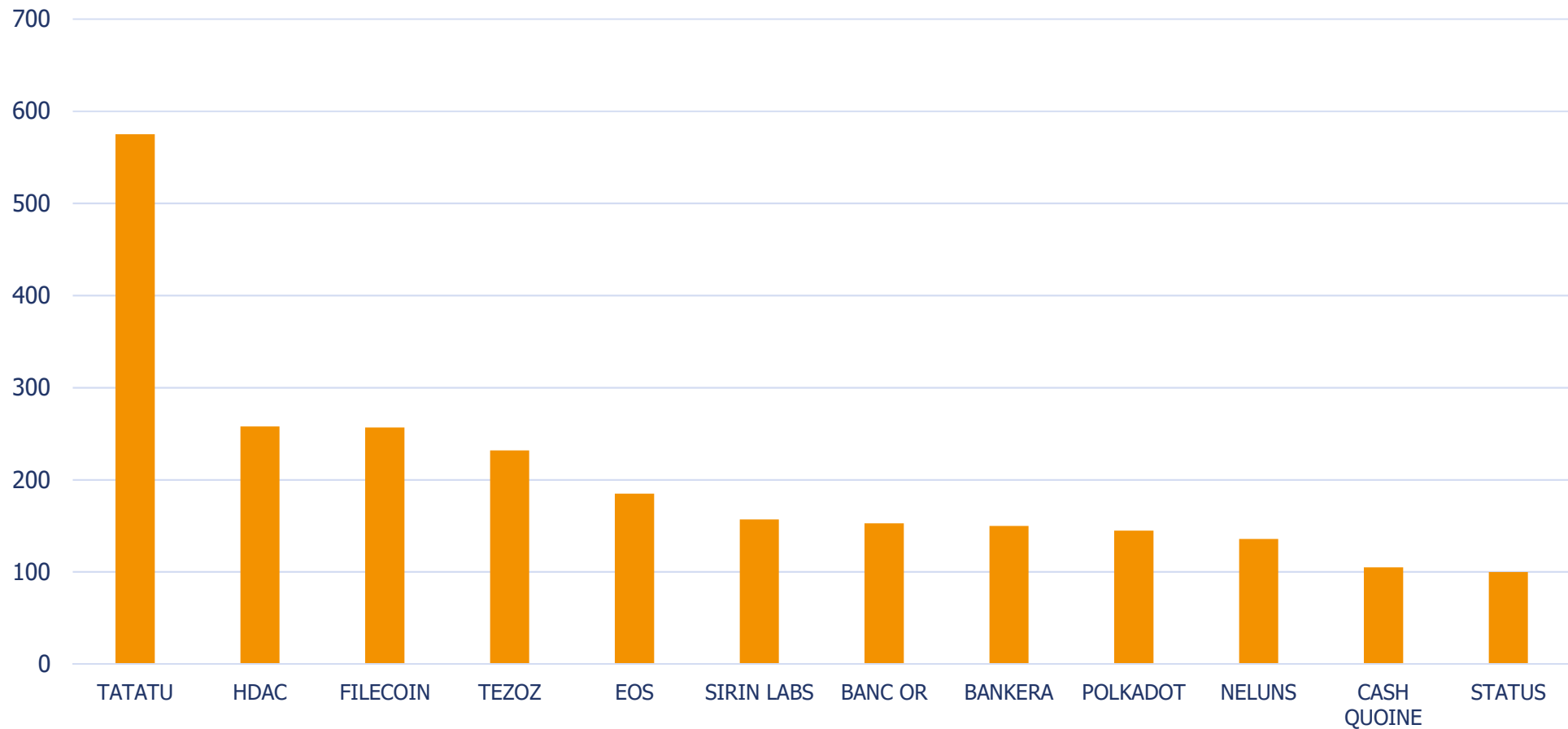
- High impact has been noted in the Banking and Finance sector. Seven of Europe's biggest banks have partnered with IBM for low-cost International trade platforms. The banks includes Deutsche Bank, HSBC, KBC, Natixis, Rabobank, Société Générale and UniCredit.
- European Commission's Joint Research Center (JRC) in collaboration with The Directorate-General for Internal Market has launched a platform named *Blockchain 4EU* for industrial transformations. The objective of the program is to use Blockchain to solve complicated industrial cases such as supply chains, assets monitoring, intellectual property rights and certification authentication.
- Italian energy giant Enel SpA is testing a Blockchain platform called Enerchain for wholesale power and natural gas markets. Strong funding from private investors and government is further driving the Blockchain market in this region. The European union has invested 5 million euros to develop application and tools for the investigation of transactions in underground markets.
- German based Blockchain startup BigchainDB has developed a reliable Blockchain database with powerful functionality to automate the business process. The company works with some of the well know giants like Capgemini, Cognizant, Microsoft and Toyota.



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11.1 Top ICOs 2017-18

- Initial Coin Offerings are one of the easiest and efficient methods of raising funds. The biggest ICOs in 2018 were led by TATATU, HDAC, FILECOIN.
- In spite of regulatory uncertainties, the ICO space is growing at a rapid pace. ICO's are happening more and more today and it is expected to see rapid growth in the future.



11.2 Venture Capitalist funds

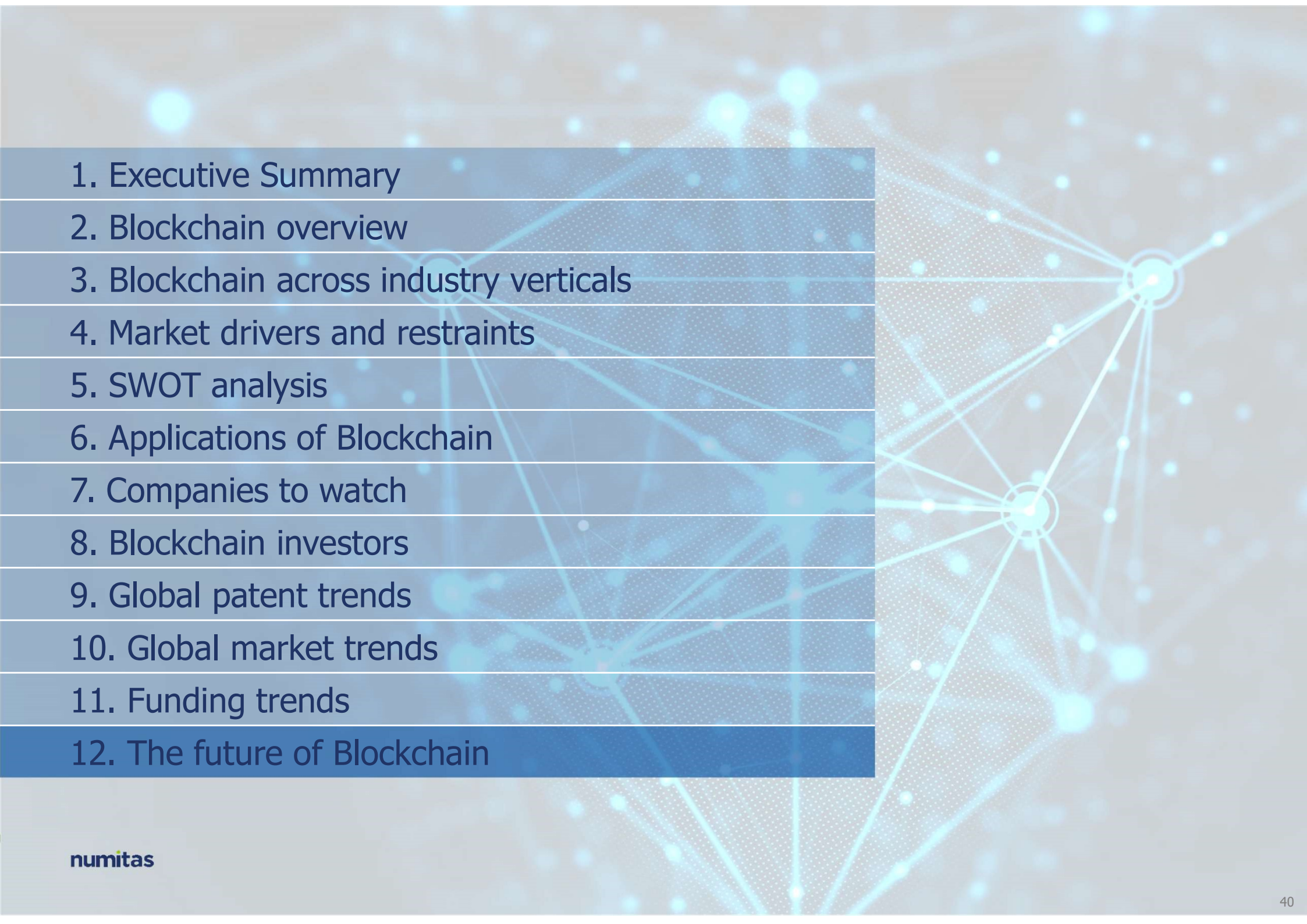


- Half of the venture capitalist fund goes to silicon valley. This is because of the presence of companies like Bitfury Group, Blockstream etc.
- With its growing popularity, many venture capitalists are increasingly investing in Blockchain start-ups to develop applications primarily in non-FinTech sectors.

Location	Value (\$ m)	No. of Companies
Silicon Valley	566.2	39
Rest of the World	543.0	99
Total	1109.2	138

Top Blockchain Investment 2017-2018

Company	Close Date	\$ m	Round	Lead Investors	Headquartered
Digital Assets Holdings	Oct- 2017	40	Private Equity	Jefferson River Capital	New York
burstIQ	Feb-2018	5	Series A	Millenium Blockchain	Colorado
Bitfury Group	Jul-2018	80	Series C	Final Frontier	California
Circle	May-2018	110	Series E	Breyer Capital	Boston
Coinbase	Oct-2018	300	Series E	Andreessen Horowitz, Polychain, Kisley Advani	California
Blockstream	Nov-2017	25	-	DG Labfund	British Columbia

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12.1 Blockchain Road Map



2018

- Blockchain is in nascent stage.
- Blockchain is being tested and developed especially in the areas of finance and supply chain.



2019

- Cloud providers like Azure and AWS will offer Blockchain development platforms for ease of deployment and to combat counterfeit products.



2020

- A new Blockchain based cloud will re-invent the cloud.
- Blockchain will simplify connectivity and communication in Internet of Things devices.
- Giants like Microsoft and IBM will offer Blockchain as a Service Platform



2021

- More than 100 companies will develop Blockchain powered applications.
- Blockchain to be used as proof of authorship and ownership to create smart contracts.
- Convergence of AI will help to analyze data securely and help make predictions.
- Used in digital voting to avoid tampering of EVM.
- Birth certificate notarization through Blockchain.



2022

- AI, IoT and Blockchain will combine for device lifecycle management.
- Blockchain will enhance security of EHR and to revolutionize EHR interoperability.

12.2 The future of Blockchain



Short term (1-2 years)

- The technology is still at a nascent stage and has started to take a different tone. Many sophisticated and innovative applications are being developed and tested in the areas banking and finance, retail and healthcare.
- In banking and finance, developments are noted especially in the areas of cross border payments and KYC compliance. Further developments have been noted in retail to combat counterfeit products.
- Giants like Microsoft and IBM are planning to offer cloud platforms to deploy Blockchain applications.



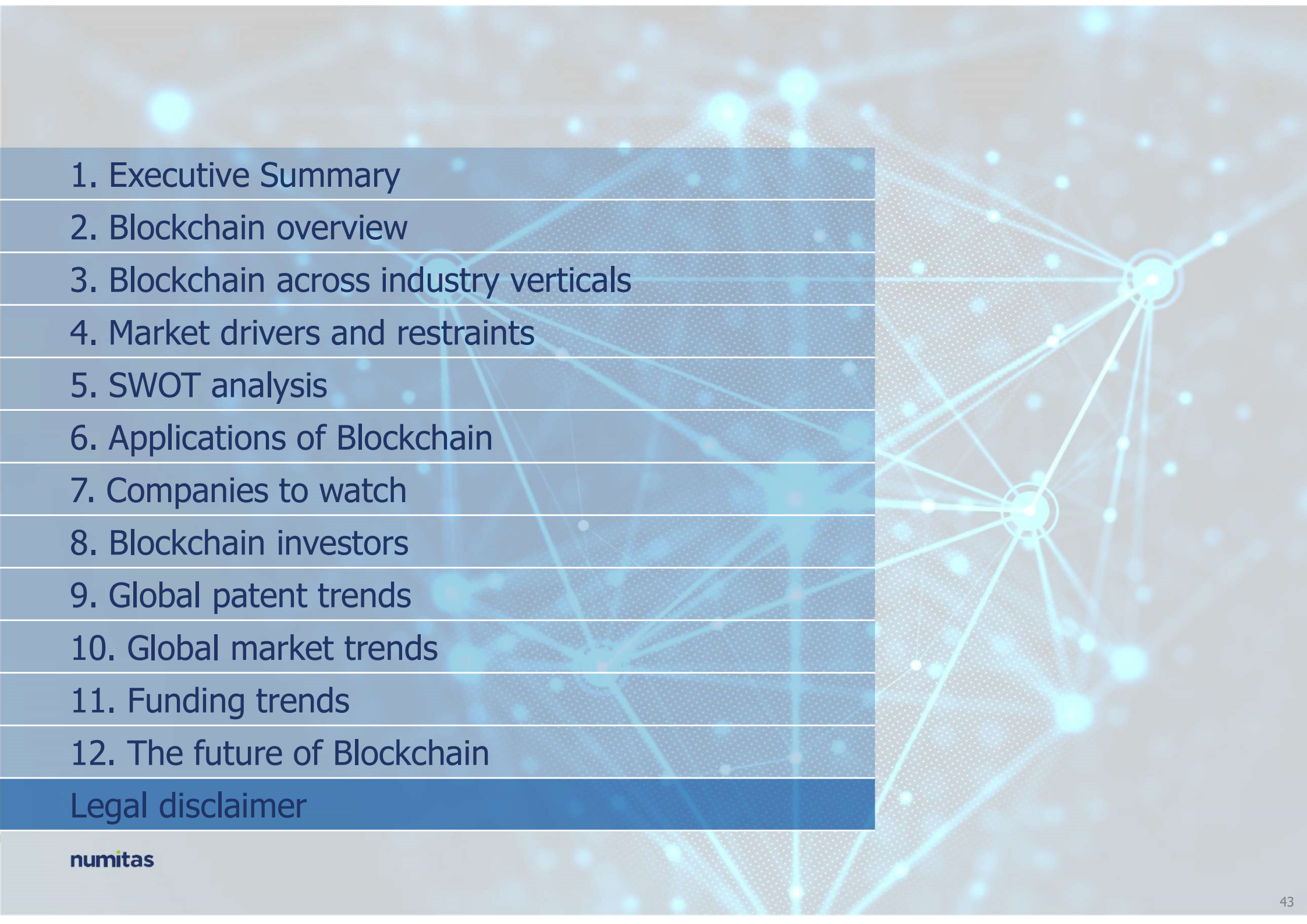
Medium term (3-4 years)

- Due to the usage of Blockchain in various businesses, technology giants Microsoft and Accenture offer Blockchain as a Service (Baas) to simplify the complex job of developers and to increase user experience.
- IBM is developing an application for supply chain transactions, global logistics, and financial services.
- Blockchain is likely to converge with IoT . Blockchain technology would help to create a secure mesh network in which all IoT sensors would be able to communicate with each other in a reliable way and can avoid threat such as distributed denial-of-service and device spoofing.



Long term (5-6 years)

- The Blockchain market is expected to be valued at \$2.3 billion. More than 500 companies will develop Blockchain powered applications.
- Blockchain will be used in real-estate record keeping and to manage property deeds.
- Blockchain application will be seen in digital voting in which users can check and verify whether their vote was successfully transmitted while remaining anonymous. It will also avoid tampering of Electronic Voting Machines.
- Blockchain in convergence with AI will streamline the process of approvals, possession etc.
- Blockchain will eradicate billing fraud, false claims and will solve EHR interoperability issues.
- Blockchain will be used in music streaming platforms to avoid illegal downloads of music and videos and in micro payments.

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- Legal disclaimer

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