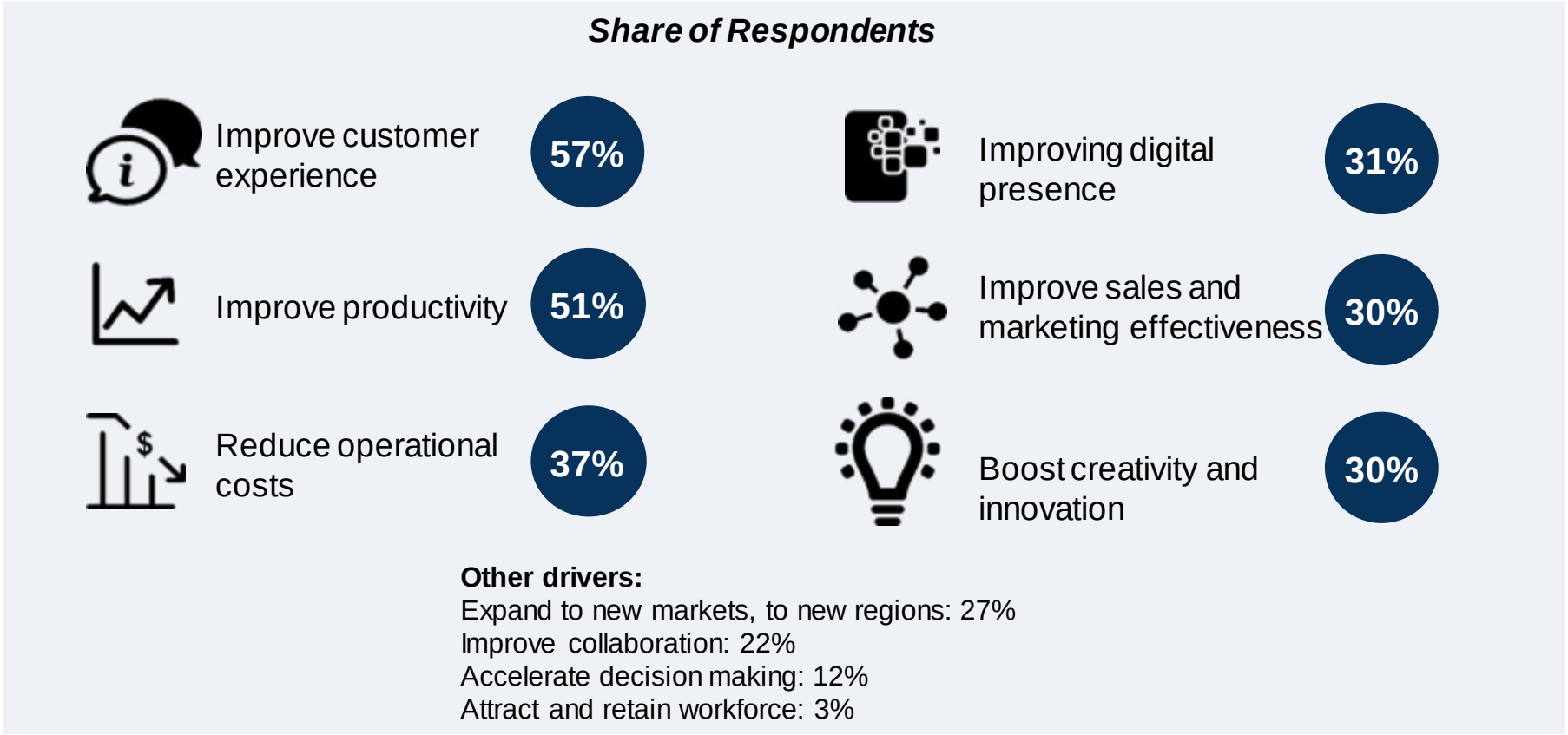
FROST & SULLIVAN

2019 SW전망과 Emerging Technology Issues

차세대 혁신기술을 중심으로

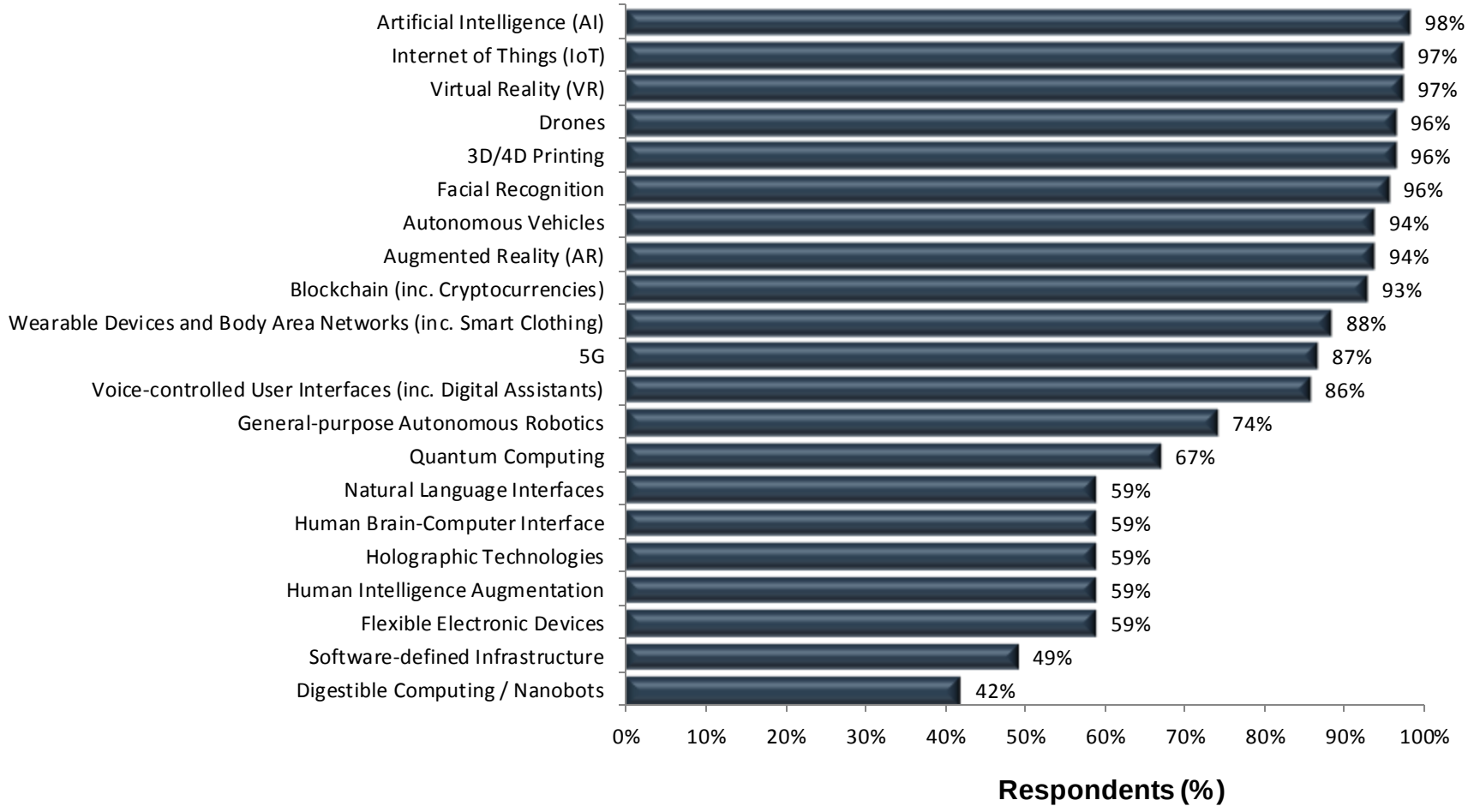
2018. 4. 12

Top Drivers of Technology Investment, Global, 2018



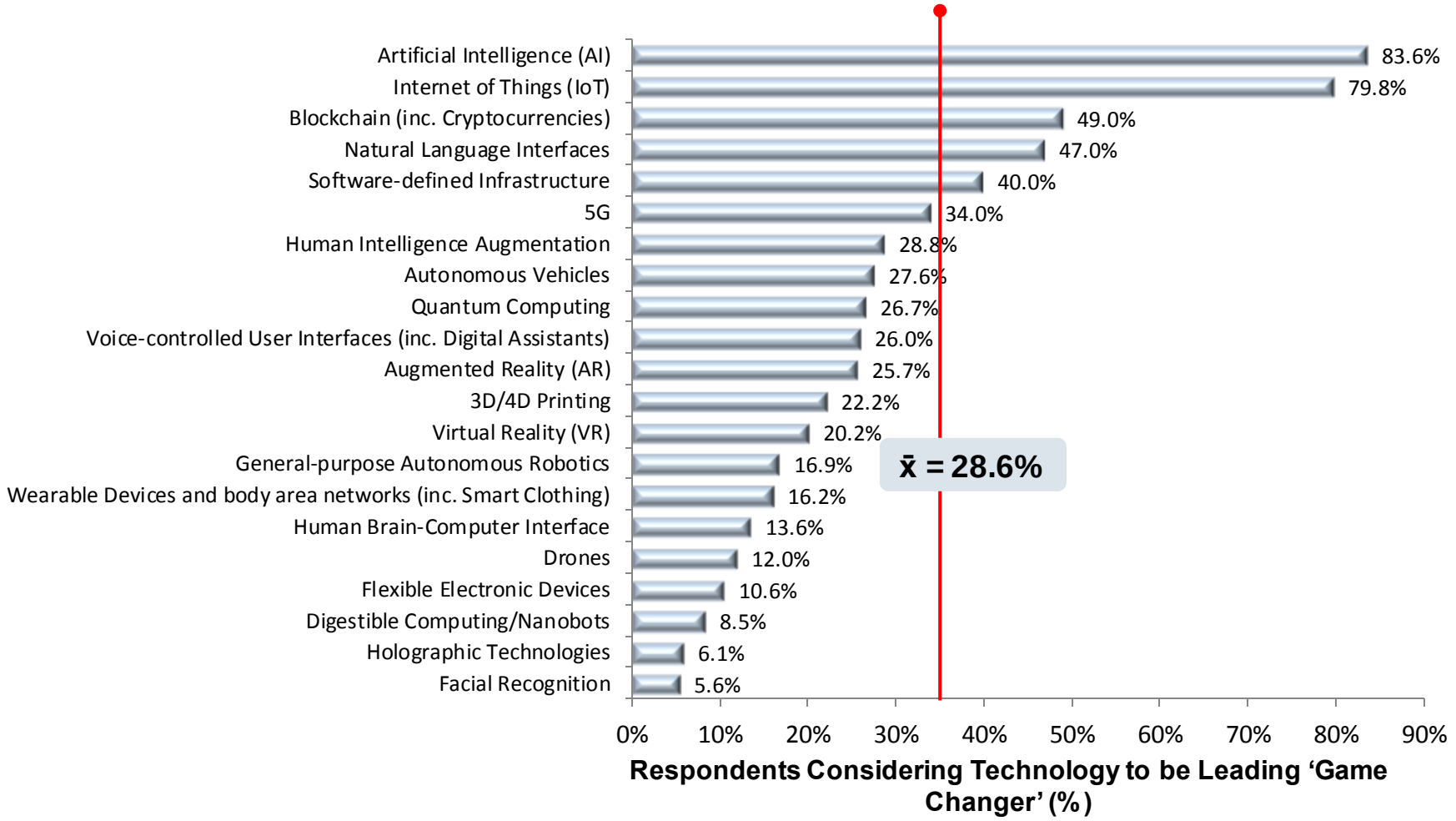
What are the key drivers of your organization's adoption of new technology?
Select the top 3 only N = 112

Technology Awareness, Global, 2018



Which of the following technologies have you heard of? N = 112

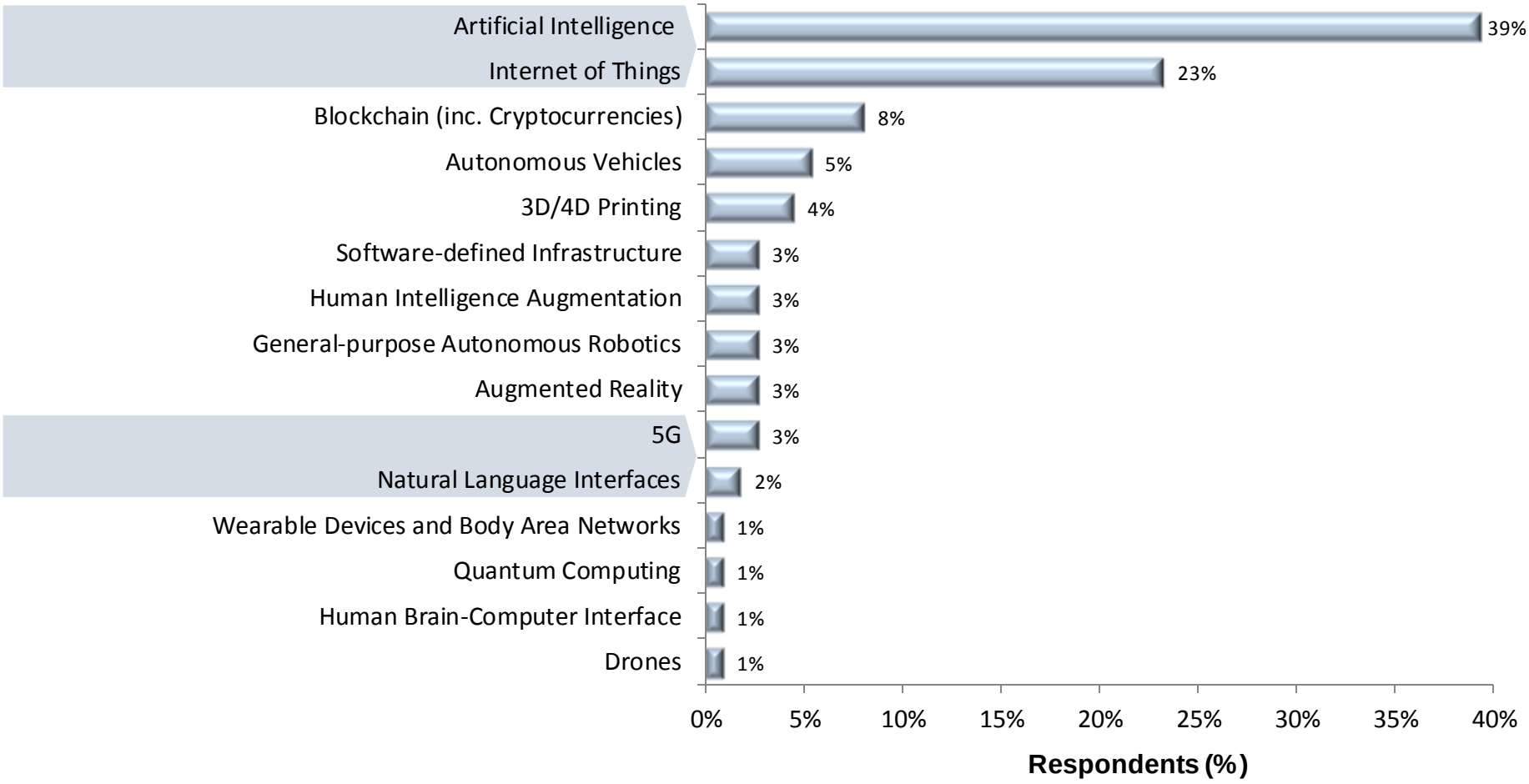
Game Changing Potential of Technologies, Global, 2018



Which of the following technologies have you heard of? N = 112

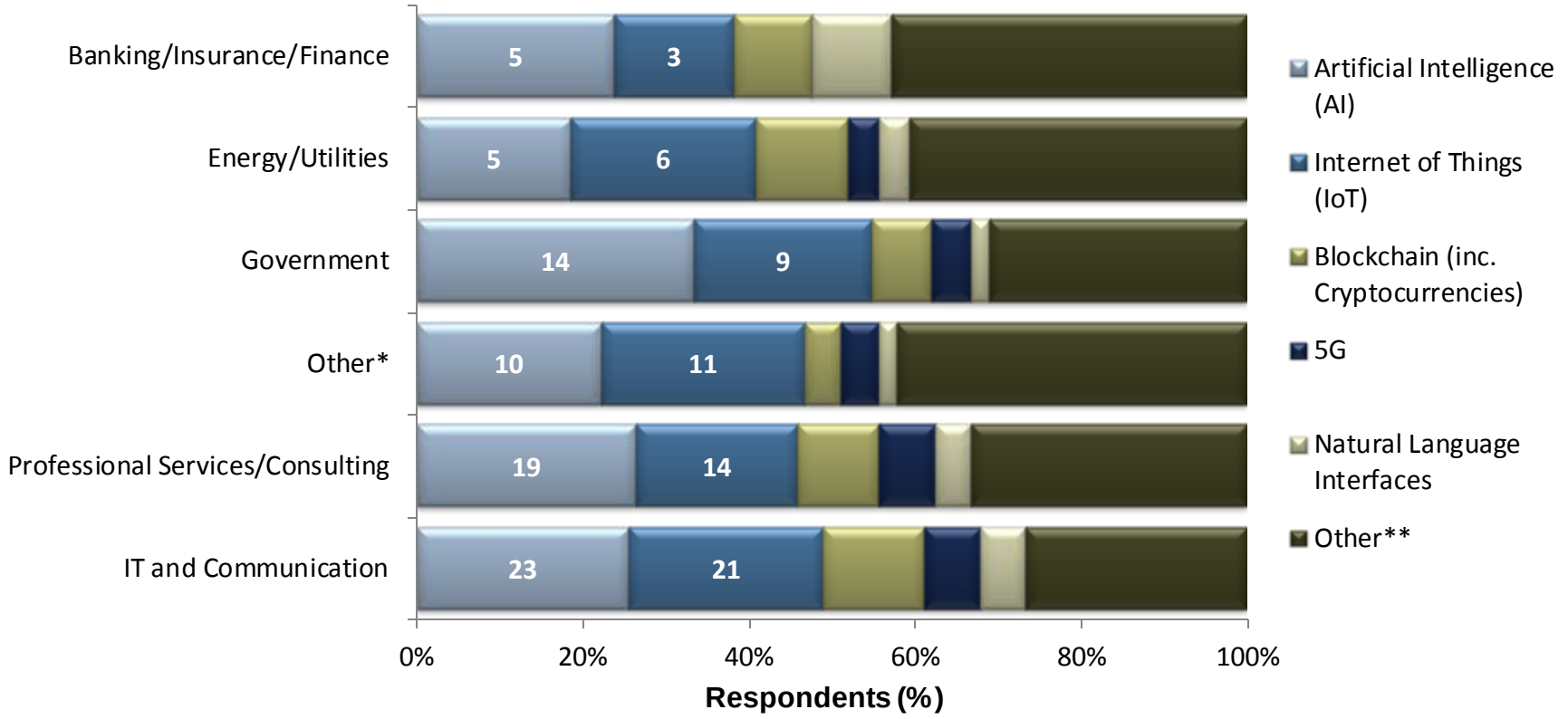
Of the technologies you selected, which have the most game-changing potential in your industry over the next decade? Select top 5 N = 112

Most Game-Changing Technologies, Global, 2018



Please note the most game-changing technology in your industry N = 111

Game Changing Potential of Technologies by Industry Sector, Global, 2018



** Other (industries) includes banking/insurance/finance, manufacturing, healthcare, travel/transportation, education and agriculture/mining*

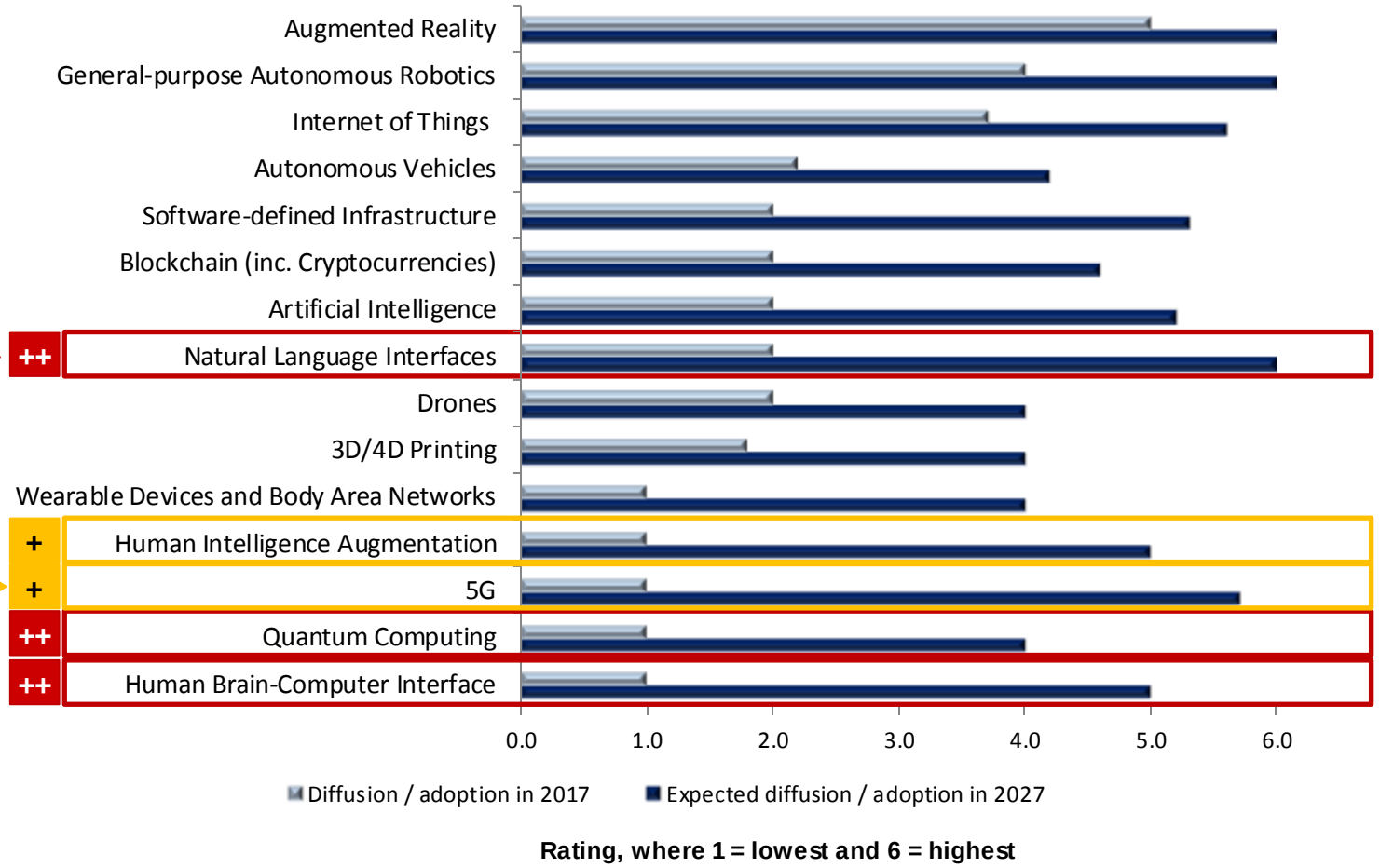
*** Other (technologies) includes autonomous vehicles, human intelligence augmentation, voice-controlled user interfaces (including digital assistants), 3D/4D printing, software-defined infrastructure, quantum computing, Augmented Reality (AR), Virtual Reality (VR), wearable devices and body area networks*

Expected Adoption of Technology, Global, 2017–2027

Most likely to be the next game changers: respondents see them as having the

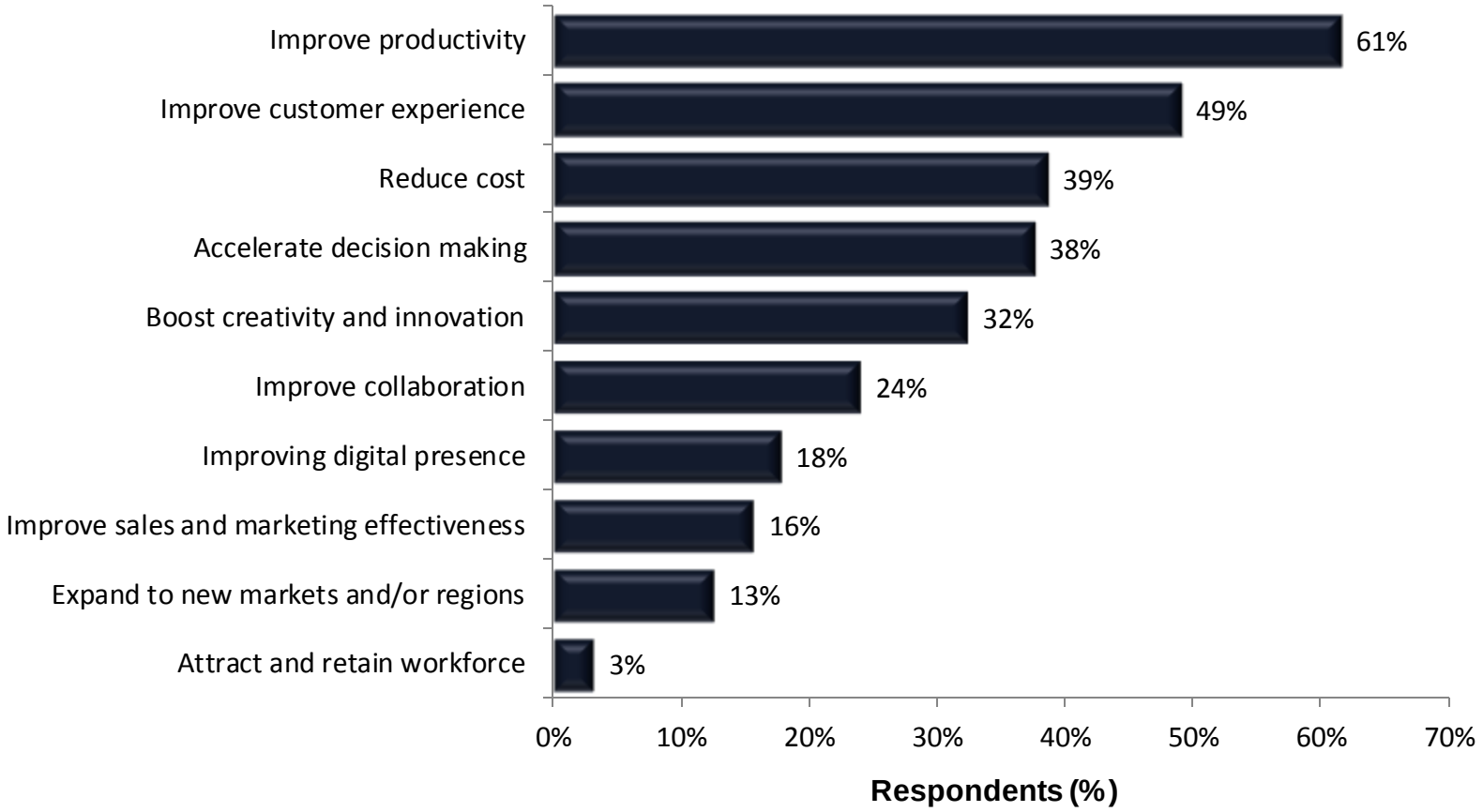
- greatest current/future adoption differential, and
- greatest disruptive potential

Further technologies are expected to experience great diffusion.



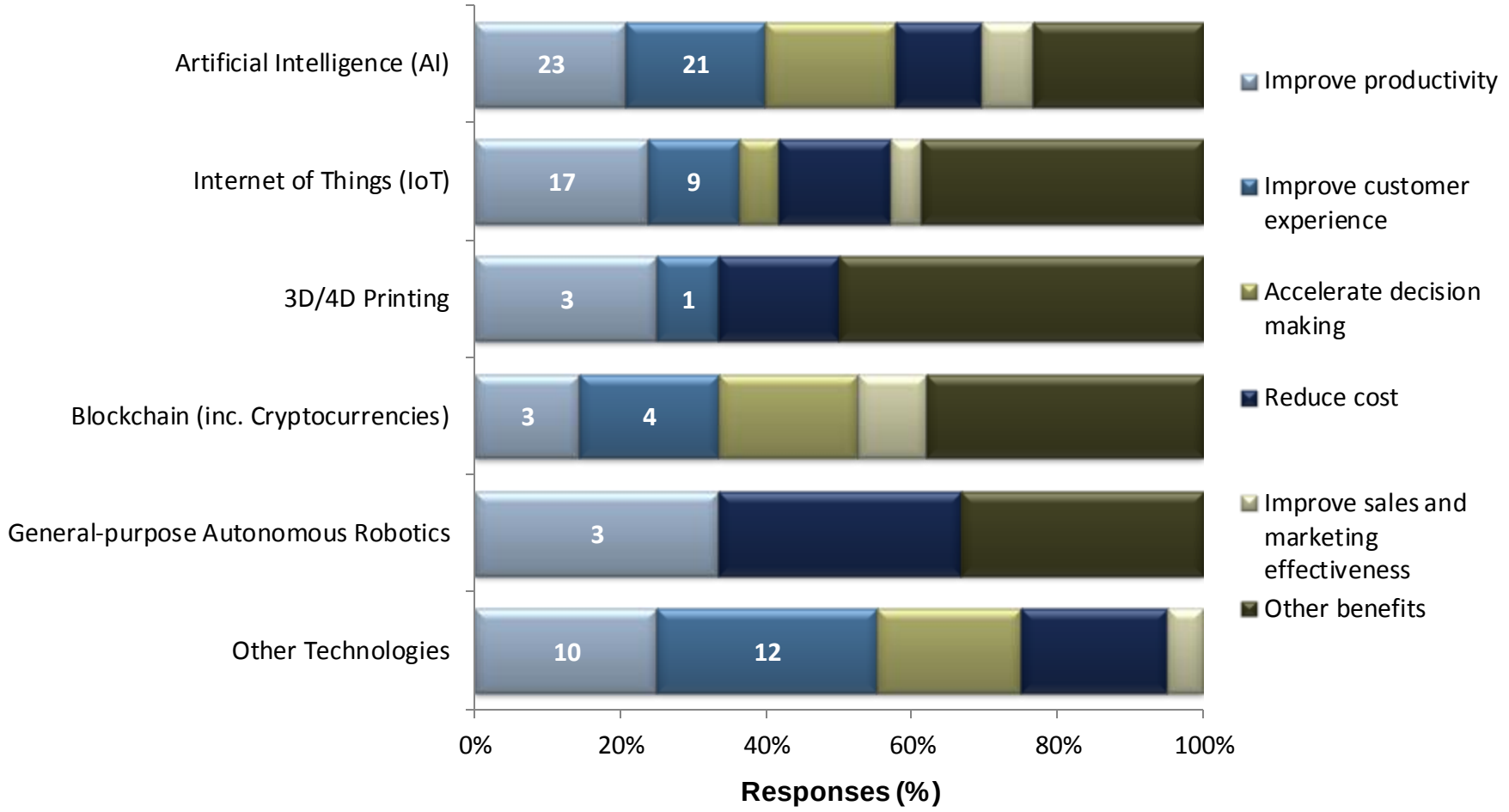
:Please estimate for the following technologies (you previously indicated as the most disruptive in your industry) their adoption in 2017 and expected adoption in 2027 in your industry N = 105

Expected Impact of Disruptive Technologies, Global, 2018 (1/2)



What impact do you expect from the technology you selected as being most disruptive in your industry? Please select the most important 3
N = 96

Expected Impact of Disruptive Technologies, Global, 2018 (2/2)



What impact do you expect from the technology you selected as being most disruptive in your industry? Please select the most important 3.
N = 96

Next-wave Technology Disruptors

Technology Disruptors of Today—already widely available and being deployed

- Artificial Intelligence
- Blockchain (Distributed Ledger Technology)
- Internet of Things

Next-wave Technology Disruptors—greatest current/future adoption differential; greatest disruptive potential

- Quantum Computing
- Natural Language Interface
- Human Brain Computer Interface

Next High-diffusion Technologies—widespread adoption expected, but lower impact anticipated

- 5G Technology
- Human Intelligence Augmentation

Artificial Intelligence

Progress

20th century: Programmed, rules-based AI (e.g., park assist, Roomba vacuum cleaner)

Today: Narrow AI, Machine Learning (ML); e.g., domain-specific business software, chatbots, Amazon Alexa digital assistant)

Challenges

Some business and academic luminaries see existential risks in uncontrolled AI development.

Proprietary data can be a competitive asset but lack of sharing will preclude the realization of societal benefits.

Regulation is trailing and slowing the realization of technological possibilities.

Key Participants

- Hardware: Intel, NVidia, Qualcomm
- Core tech: Baidu, Facebook, Google, IBM, Microsoft
- Enterprise: Gainsight, Clari, Wise.io
- Verticals: Prism Skylabs, Zephyr Health

AI is the single-most disruptive force across the economy, the enterprise, and society at large. It will optimize anything from planning, through operations, fraud detection, customer experience through predictive, and prescriptive analytics like no other technology ever has. AI is the next general-purpose technology/platform.

Humans driving may be illegal by 2050 or earlier due to greater safety and efficiency of autonomous driving. AI-enabled security will be paramount to ensure the safety and security of autonomous transport systems.

By 2040, AI could reach a general, human-level intelligence in all areas of life and be on course for becoming self-actualizing super AI (technological singularity).

Blockchain

Potential Impact

2018 has proven to be the break-out year as vapourware gives way to real solutions.

Entire sectors are waking up to the new imperative of Blockchain integration.

Regulation of crypto will vary widely until a balanced risk-reward emerges.

Challenges

Interoperability between Blockchains is advancing but still represents fragmented development in multiple ecosystems.

There is a great deal of experimentation around consensus schemes with no clear winner.

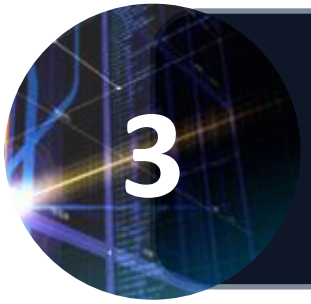
Policy and regulation among nations is also experimental and fragmented.

Key Participants

- Hedera Hashgraph
- Sirin Labs
- Several countries, including China, US, Switzerland, Singapore

Frost & Sullivan forecasts a near-term inflection point, when the value of transactions on private Blockchains surpasses that of Public ones (notwithstanding speculative cryptocurrency markets).

The development of Blockchain Native Operating Systems that enable increasing interoperability will accelerate the long-awaited convergence of Blockchains/DLTs, AI, IoT, and analytics capabilities.



DLTs, in the near term, will most likely still be centralizing rather than broadly decentralizing market forces.

Internet of Things

Potential Impact

Intelligence is essential in every level of an IoT solution.

Development of autonomy is dependent on deploying intelligent solutions.

Digital twinning details out implications of solutions before deployment.

Challenges

Securing IoT is essential to increasing the deployment of IoT in consumer and business environments.

Increasing investment in wireless networks (LoRa, Sigfox, Cat-M1, Narrowband IoT) is essential for the growth of IoT and increasing mobility.

Key Participants

Modules: ARM, Intel, Qualcomm, Telit

Cloud: Microsoft, IBM, AWS, Google

Networks: AT&T, Verizon, Vodafone

The rapid growth of distributed computing will increase the speed of deployment of IoT, resulting in an expected 60 billion connected devices by 2024.
This trend will be driven by the need for lower latency, greater cost efficiency, falling silicon costs, and demand for higher processing and analytics power at the edge.

IoT will continue to proliferate in business and consumer environments. However, business IoT will continue to help IoT ecosystems generate more than 80% of the revenue in the industry.

As 5G use cases keep emerging, autonomous driving will continue to gain traction. The ability to enable latency-free communication for Vehicle-to-Vehicle or Vehicle-to-Infrastructure (V2X) interactions will continue to frame the dialogue around 5G and IoT.

Quantum Computing

Potential Impact

An ability to undertake calculations too complex to do with classic computers.

It can be used for high-level cryptography impossible with a classic computer.

It can simulate quantum systems that, for e.g., allow drug development.

Challenges

Quantum computing needs qubits that behave in a predictable manner. Qubits can easily leave their quantum state when disturbed. This is known as 'decoherence'.

Materials required to contain Qubits in such a way that decoherence is eliminated are unavailable. Research is ongoing.

Key Participants

D-Wave Systems, Lockheed Martin, Rigetti, Google, Microsoft, NEC IBM, Nokia Bell Labs, Mitsubishi, Raytheon

One of the key challenges in the advancement of quantum computing is the increase in the maximum number of controllable qubits. As of 2018, the maximum size commercially available stood at 72 qubits (Google Bristlecone). Future quantum computers with 100+ qubits will be launched within the next decade.

Quantum computers can only operate at temperatures close to absolute zero (-273°C). Therefore, scientists are currently working on the development of materials for the containment of multiple controllable qubits.

Quantum computers will eventually be able to undertake calculations that are impossible to simulate with classic supercomputers. By this stage, researchers will be able to realize specific computational possibilities that have never before been applied.

Natural Language Interface

Potential Impact

NLIs are powerful tools for accessing information without computer skills.

People who are impaired in some way will benefit from it.

With diary access, it can be used as an electronic personal assistant.

Challenges

Language ambiguity and interpretation can be a problem.

NLIs need clear single instructions if they are to work at an optimum level.

In some applications, they may only respond to pre-programmed commands.

Key Participants

- Speech recognition software: Microsoft, Dragon, Apple.
- PA systems: Google, Apple, Tronton, Amazon, Microsoft

Chatbots will get smarter and will eventually be able to learn from human behavior such that their behavior will become even more human. However, some degree of responsibility will be required as shown by Microsoft's Tay.

The growth in connected devices due to the Internet of Things (IoT) will increase the popularity of NLIs that will allow for the voice activation of these connected devices.

Voice-enabled smart speakers will continue to grow in usage, and this will be further enhanced by improvements in the quality of voice-recognition software.

Human Brain Computer Interface

Progress

The development of BCIs has rapidly accelerated in the last 1 to 2 decades, mainly in the field of medical applications.

The interest is moving toward entertainment, especially for gaming applications (advanced controls).

Challenges

Filtering noise signals are received along with the signal from the brain.

Promising invasive approaches require regulatory approvals, the absence of which stymies investment.

There is evidence of limited collaboration, which is resulting in fragmented innovation that is largely driven by SMEs.

Key Participants

- Emotiv
- Facebook
- Interaxon
- iWinks
- MyndPlay
- Neuralink
- NeuroSky
- OpenBCI
- Puzzlebox
- SmartBrain

BCIs will become increasingly efficient. Together with progress in physical prosthetic devices, an increasing number of patients suffering from loss of most types of motor control will be able to regain significant mobility and quality of life.

BCIs will be at the nexus of blurring lines between man, machine, real, and virtual. It will become possible to interact with video games and virtual realities through brain impulses alone. Further down the line, it will be possible to jump back into the physical world and take control of physical robots, similar to renting a bike today.

BCIs will increasingly enable cognitive enhancement to improve logical skills, better attention, memory enhancement, improved alertness, wakefulness, and interfacing with cloud-based computers (see also section human intelligence augmentation).

5G Technology

Progress

5G frequency auctions have taken place globally and more are due imminently.

Many IoT services are being prepared (e.g., smart utility meters).

Operators worldwide are upgrading their networks to make them '5G ready'.

Challenges

Network upgrades are expensive even if cheaper software solutions are used.

Network owners will need a credible business model before they upgrade.

Collaboration with different companies will be necessary for new revenue generation.

Key Participants

- Operators: EE, Telefonica Espana, Telecom Italia Mobile, Verizon, T-Mobile
- Hardware suppliers: Huawei, Ericsson, Nokia

Autonomous driving will be the next big event in the automotive industry. There have already been a number of pilot projects in Europe and there is an automated bus service in France, but this will spread further during the next decade.

Human casualties of industrial accidents will become a thing of the past, with the spread of IIoT systems in manufacturing. 5G connectivity could be used to operate machinery such that dangerous tasks are undertaken remotely, and the potential for large scale industrial accidents could be detected before they happen.

Increased speeds and low latency will facilitate AR and VR applications for online games and eSports.

Human Intelligence Augmentation

Progress

"*Humans have always built tools of intelligence. We started with rocks… now AI. These are extensions of ourselves, and so, we've been increasing our intelligence through our tools... we are about to incorporate them into our biology and take an exponential leap forward in intelligence*." (Peter H. Diamandis)

Challenges

More basic research is needed to better understand how the human brain works.

Technological challenges still limit the accuracy of BCIs as the critical linkage between human brain and technology.

Regulatory barriers exist to invasive BCIs.

Key Participants

- Neuralink
- Kernel
- Government defense agencies, e.g., the US Defense Advanced Research Projects Agency (DARPA)

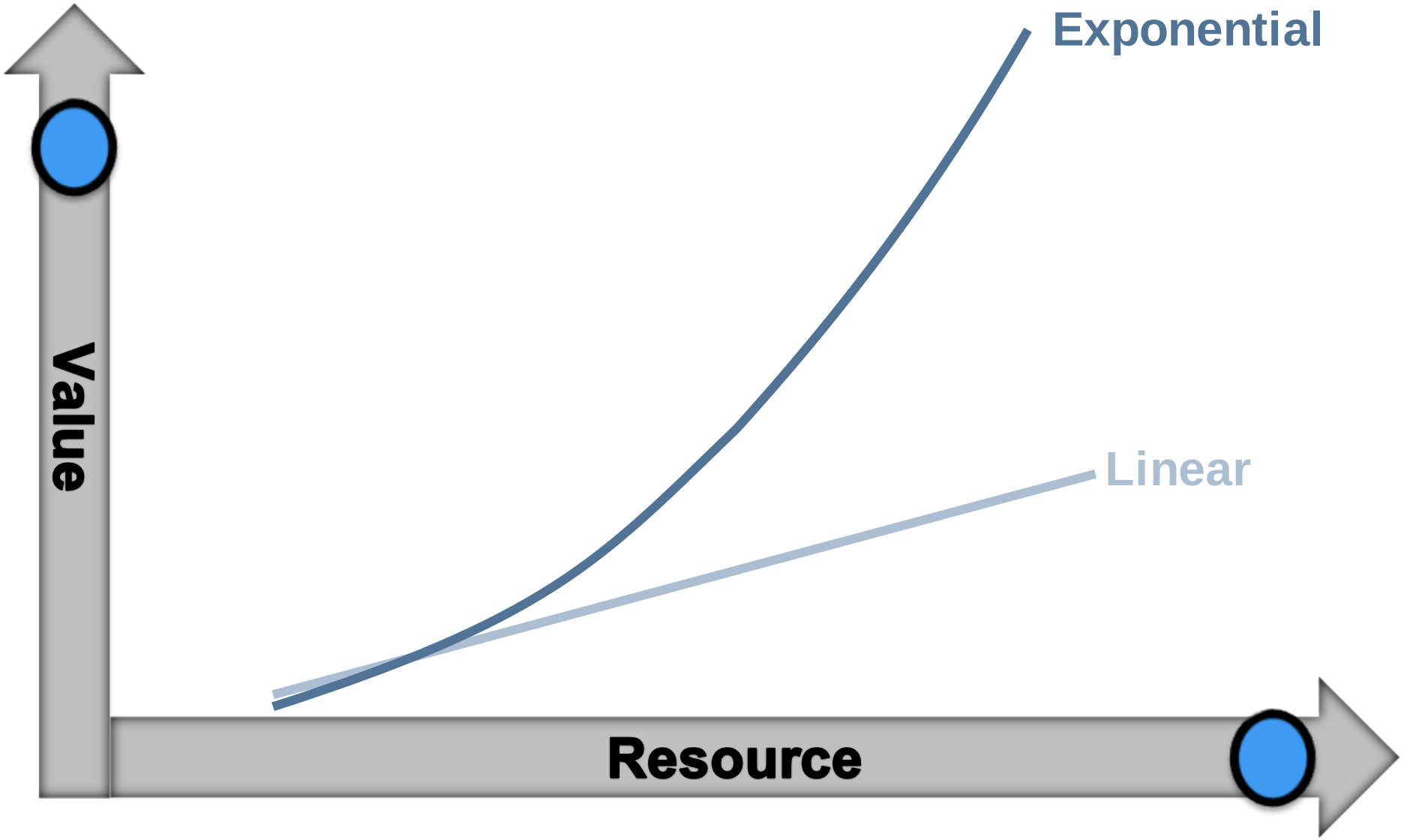
HIA will be widely undertaken to enable cognitively enhancing uses (e.g., improving memory through uploading/storing and downloading/accessing information when needed) through neural interfacing.

Humans will reach digital immortality. As an extension of the ability to interface with cloud-based computers, it will be possible to digitize human brains and allow the digital replica to live on even after the death of the physical body.

The ultimate motivation of many proponents of IA is to allow humans to keep pace with AI and co-evolve. Over time, the lines between biological and digital intelligence will blur.

Top 50 Technologies of 2019

Issue #1: Non-Linear



Issue #2: Every Company is a Technology Company

Issue #2: Fintech case

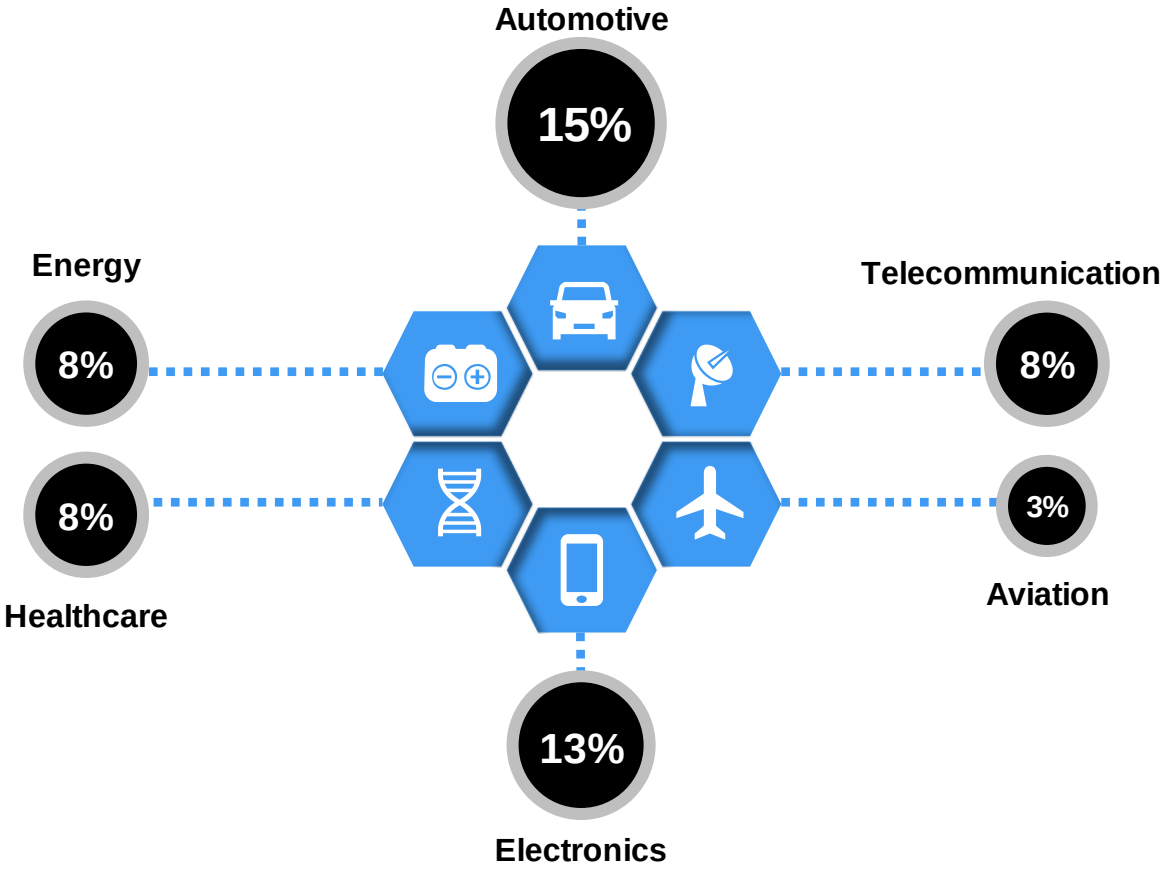
Importance of Technology to Banks

> *We are a Technology Company*
>
> Matt Zames – Group Chief Operating Officer JP Morgan Chase

Patent Applications to US Patent & Trademark Office, 2013–2015

	VISA	mastercard	Bank of America	Capital One	JPMorganChase	AMEX	citi
Mobile	336	214	165	46	43	19	26
Internet of Things	141	150	142	18	59	25	28
Date & Analytics	139	123	106	33	39	30	9
Cyber Security	123	70	77	19	19	18	7
Cryptocurrency & Blockchain	2	5	11	2	2	2	0
Cloud Computing	5	47	23	8	8	68	4
	746	**609**	**524**	**126**	**170**	**162**	**74**

Issue #3: Product-as-a-Service



MORE THAN

70%

of fortune 500 companies

will operate product-as-a-service business models by 2020

Issue #3: Pay as You Go

Rolls-Royce

(e.g. Pay as you go Model)

Michelin

(e.g. Pay per km)

Issue #4: Innovate to Zero

6 Key Growth Themes

Top 8 Global Trends

01 Design Takes The Center Stage in Application Development

02 Legacy Modernization will continue to roll

03 Automation will increase during SDLC and maintenance processes

04 Diverse Artificial Intelligence Applications will appear

05 Cognitive Analytics and Tools will see rapid use cases

06 XaaS will redefine fundamental goals of modernization

07 Simplifying IT Infrastructure

08 Data Analytics for unstructured data will grow

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Is your organization prepared for the next profound wave of industry convergence, disruptive technologies, increasing competitive intensity, Mega Trends, breakthrough best practices, changing customer dynamics and emerging economies?

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