Cc

C is for
collaborative-
inventors

Dd

D is for
dark data
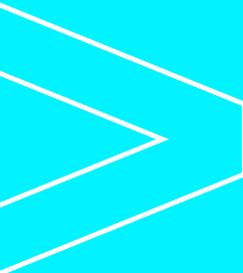
Ll

L is for Life
long learning

EMBRACING ARTIFICIAL INTELLIGENCE

ENABLING STRONG AND INCLUSIVE AI DRIVEN ECONOMIC GROWTH

accenture

ARTIFICIAL INTELLIGENCE (AI) HAS REACHED A TIPPING POINT.

The combination of the technology, data and talent that make intelligent systems possible has reached critical mass, driving extraordinary growth in AI investment.

G20 countries have been building up their artificial intelligence capabilities. Companies are moving beyond a long period of experimental AI into an era of exponential AI. Nevertheless, most enterprises are not fully prepared to seize the enormous opportunities that AI presents. They also face profound challenges relating to the consequences for workforces, regulation and ethical business practices.

Governments can play a proactive role in creating the following conditions to support sustainable AI-based growth: by helping to cultivate dynamic innovation ecosystems, by supporting the creation of inclusive and highly skilled workforces, and by establishing principles of trust and human centricity that underpin what we call Responsible AI.

Accenture and the G20 Young Entrepreneurs' Alliance have a number of recommendations for policy makers which are outlined at the end of this report. We first set out the landscape of AI innovation in G20 economies and how organizations are improving their Artificial Intelligence Quotient (AIQ)—our measure of their ability to balance in-house innovation with external collaboration.
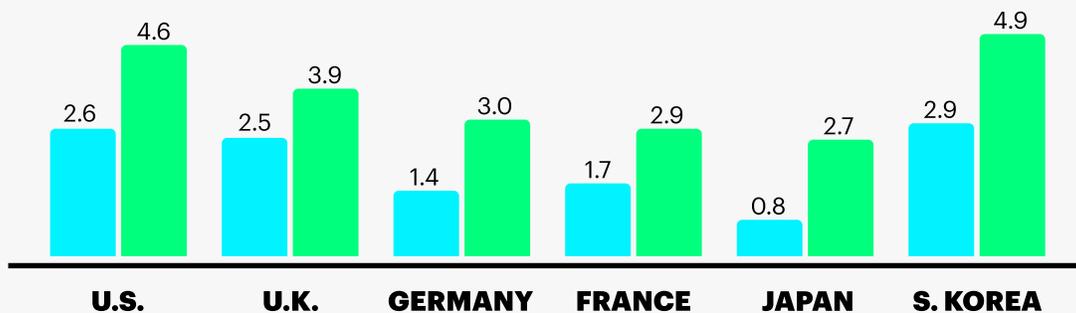
THE OPPORTUNITY FOR AI DRIVEN GROWTH

Accenture's analysis of select economies has found that AI has the potential to double their annual growth rates by 2035[1] (Figure 1). This is partly based on a potential boost in productivity of up to 40 percent, as AI overcomes the limitations of capital and labor. It is also based on the creation of entirely new products, services and customer experiences that will drive new revenue streams and form new markets.

Funding for AI startups has been growing at a compound annual growth rate of nearly 60 percent since 2010.[2] But this healthy picture belies a geographic divergence within and between G20 economies. Without proper guidance and incentives, the financing priorities of venture capitalists and other investors will likely reinforce the advantages of early-movers and the expectation that the AI market will consolidate behind clear market leaders. There is therefore a danger that patterns in AI investment could magnify inequities between and within the G20 economies.

FIGURE 1

ECONOMIC IMPACT OF AI—SELECT G20 COUNTRIES

By 2035, AI has the potential to nearly double annual growth rates in the countries analyzed

	U.S.	U.K.	GERMANY	FRANCE	JAPAN	S. KOREA
BASELINE	2.6	2.5	1.4	1.7	0.8	2.9
AI STEADY STATE	4.6	3.9	3.0	2.9	2.7	4.9

Real Gross Value Added (GVA) (%, Growth)

Source: Accenture "Why Artificial Intelligence is the Future of Growth"

THE EMERGENCE OF AI ECOSYSTEMS

The most critical levers to help small enterprises develop their AIQ are: access to data, technology and people.

These are explained in our accompanying report, Boost your AIQ, Transforming into an AI Business.[3] However, companies also need access to funding and to the value chains of larger organizations to which they can provide data and AI-based services. AI requires significant financial investment to develop core technologies and applications; big data to train and garner machine intelligence; and diverse talent to equip intelligent technology with the cognition and empathy of humans. Combinations of technologies, multi-variant data and interdisciplinary skills—these are not in the possession of any single player. There will be a handful of, typically, large players that will be able to navigate this complex AI landscape. However, smaller companies could be at a disadvantage, especially with regards to access to data. This matters on two levels: data is the essential raw material for AI-businesses of any size; and there are risks that large digital platform players, in particular, have a degree of market power that could limit healthy competition.

Accenture analyzed AI innovation in 10 leading countries in Asia, Europe and North America[i]. Our research shows that vibrant ecosystems are based on five pillars: universities, large companies, startups, policy makers and multi-stakeholder partnerships (Figure 2). The relative role of these five varies between geographic markets, partly depending on the maturity of industry and the nature of political culture of each country.

"The AI oligopoly is the data oligopoly"

PROFESSOR WENDELL WALLACH, CHAIR TECHNOLOGY AND ETHICS
RESEARCH GROUP AT YALE INTERDISCIPLINARY CENTER FOR BIOETHICS

[i] Australia, Canada, China, France, Germany, India, Japan, South Korea, United Kingdom and United States

UNIVERSITIES

Universities and research institutions are the seedbed for AI ecosystems and offer fertile ground for leading scientists and engineers to get their start and develop their ideas into new businesses. But beyond fundamental research, it is the ecosystem that can develop around universities that makes the university setting so important.

In France and the UK, many AI startups have been seeded at universities. In India, South Korea and the US, large companies are sponsoring AI research projects and fellowships at universities and research institutions. In China, government spending on university scientific research has grown by double digits annually for the past decade, spurring AI progress.

STARTUPS

Entrepreneurial dynamism in AI varies significantly from country to country. The United States AI startup ecosystem dominates, based on startup financing deals and dollars from venture capitalists between 2010 and 2016. However, competition to make the first rank is intensifying. While China's early AI startup efforts lagged, it is now aggressively catching up to the level of the U.S. In recent years China had the highest average deal size of all G20 countries and the United Kingdom had a higher number of startup AI financing deals than China. AI startup financing activity is picking up in other countries as well, namely Australia, India, France, Germany and Japan.

The most active AI segment among startups is machine learning, which represented more than 40 percent of financing dollars in each of the United States, United Kingdom, France and Germany. Investors are attracted by the big opportunity of applying machine learning in products across a range of markets, whether that's optimizing user experience like startup Drawbridge[4] or creating customized loan offers like Avant.[5] Computer vision and natural language processing are the next most active segments of AI startup investment.

LARGE COMPANIES

Incumbent industry players that have the financial strength and business experience to invest in AI research and development (R&D) lead the strategic charge on global competitiveness.

Analysis of AI patents finds that core technologies and applications are clustering in different countries: the United States has focused on machine learning, neural networks, natural language processing and recommendation engines; China on sensors, predictive maintenance and intelligent robotics; Japan on edge computing analytics and image recognition; Korea on intelligent mobile terminals and display reality; and Germany on gesture recognition, vehicle control and augmented reality.[6] Each country is intensifying its AI push in sectors where it already has a strong position globally to ensure continued competitive edge.

POLICY MAKERS

What are governments doing to improve access to the essential ingredients of successful AI innovation? Analysis of the 10 countries shows a clear pattern of hybridization. One type is driven more by private sector companies in countries such as the United States and the United Kingdom, though even here the role of technologically influential government organizations in nourishing the private sector should not be dismissed. That said, in another group of countries, governments play a more deliberate and explicit role, as in China or Japan (Figure 2). For example, in Suzhou, leading AI companies can secure approximately U.S. $800,000 in subsidies for setting up shop locally, while Shenzhen is offering up to U.S. $1 million to support AI projects established there.[7] The country also benefits from a single regulatory regime that gives it an advantage over other more fragmented markets. Its central government direction also gives it the potential to drive major infrastructure changes, such as roads optimized for self driving vehicles.

Germany has a well-established ecosystem connecting the different stakeholders, while Canada is starting to walk down a similar path. Private companies in Australia and India are taking steps forward, though they are far from the high levels of AI investment seen in the United States and China that are clear leaders at an aggregate level. In both types of hybridization, governments have a critical role to play to enable the three factors of successful AIQ development— technology, data and people[ii] —are accessible to all stakeholders of the AI ecosystem.

MULTI-STAKEHOLDER PARTNERSHIPS

The collaboration of these stakeholders, usually through some partnership negotiated between the public and the private sectors, is critical to the development of an accessible AI ecosystem. In China, for example, Baidu has been appointed by the National Development and Reform Commission, the country's top economic regulator, to lead the national lab on deep-learning technologies and applications. The lab will not exist in a physical structure, but via a virtual, digital network of researchers working on problems from their respective locations.[8]

Germany's well established private-public ecosystem includes the German Research Center for Artificial Intelligence (DFKI), a non-profit multi-stakeholder partnership which is considered a blueprint for top-level research. Numerous renowned German and international companies are represented on the DFKI supervisory board that oversees its cutting-edge research— so ensuring its "application-oriented basic research" focus is industry relevant. DFKI also serves as a talent funnel from academia to industry.[9]
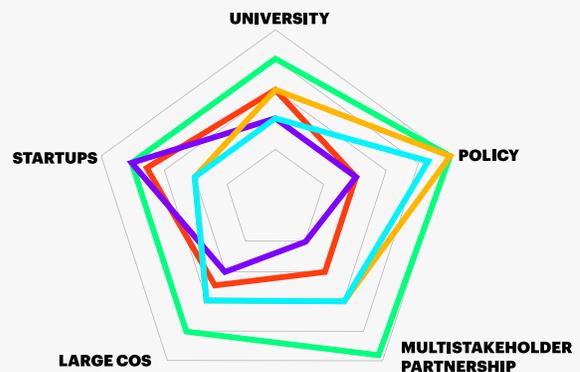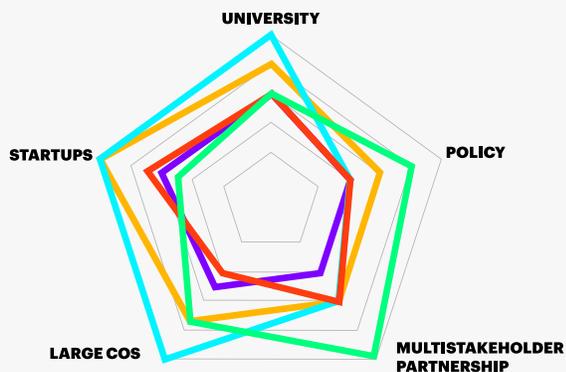
FIGURE 2

CONTRASTING APPROACHES TO AI DEVELOPMENT

Vibrant AI ecosystems are based on five pillars, though their relative role varies between markets

Europe and North America

Asia Pacific

KEY: France   U.K.   U.S.   Canada   Germany

KEY: Australia   India   China   Japan   S. Korea

Source: Accenture Research, see "About the Research" for methodology

ii See Boost your AIQ: Transforming into an Intelligent AI Business", Accenture 2017 www.accenture.com/AIQ

THE PATH TO RESPONSIBLE AI

Beyond the support that governments can give to innovation ecosystems, there are additional challenges to sustainable growth in AI that policy makers can help address. Accenture refers to Responsible AI to describe five principles that help to drive trust and address unintended consequences, unintended bias and the resulting compliance challenges.

These principles are: Honesty, Transparency, Fairness, Accountability and Human Centricity. These elements are essential to safeguarding the interests and confidence of employees, customers and citizens.

FUTURE WORKFORCE

There are legitimate concerns about the potential impact of AI on the workforce. Certainly, intelligent automation will displace some roles and tasks that are repeatable. In the first instance, AI may impact roles involving manual tasks. We are already seeing this in agriculture and on factory floors for example, though in time other roles, for example back-office functions, are likely to be impacted. New categories of work will be created, however, in both technical and creative domains.[10] Indeed, the requirement for more human focused work will grow, such as the provision of more tailored and bespoke services. Here data analytics and AI will inform these roles and therefore augment workers' capabilities. Nevertheless, the pace and scale of change is such that radical approaches will be required to keep workers relevant and adaptive. This includes preparing those still in education, reskilling existing workers and putting in place opportunities for life-long learning.

DATA PRIVACY AND SECURITY

The pace of AI development and the growing sophistication of its constellation of technologies require balancing innovation needs with privacy and security concerns when building AI into business and operating models. If Big Data did not already prompt some level of self-reflection around the primacy of data, data-hungry AI will drive companies to reorient themselves around their data. This necessarily leads to adherence to existing principles governing data privacy and security. Companies need to consider the operational implications of complying with data protection rules, in the context of AI deployments. The EU's General Data Protection Regulation for example provides for a possible "right to explanation," where individuals may have a right to ask for an explanation as to how a decision was made (if no human was involved in the decision-making process).

ETHICAL AI

Today's AI is what can be described as 'augmented intelligence' systems whose functions and actions remain largely under the management of people. But we will increasingly see AI systems that are capable of independent action, which will require new parameters to underpin the fairness and ethical behavior of systems and to guarantee the accountability of those who own and manage them. Emulating human intelligence means including accepted concepts of values and norms—which may be accepted in some countries, but the subject of debate in other parts of the world.

These matters of ethical values-along with the challenges and opportunities AI presents to workforces-amount to creating and safeguarding trust at the heart of AI-driven systems and business models.

SMART REGULATION

Meanwhile, new business models and ways of working are outpacing the evolution of policies, standards and regulations. Governments need to provide a regulatory framework that safeguards Responsible AI, while supporting the capabilities of AI and the innovation that enables them. One example is the area of autonomous vehicle insurance. In the UK, the Department for Transport has proposed plans for new, two-in-one insurance products for automated vehicles, which cover motorists when they are driving and the car when it is in driver-less mode. Claims made against cars which crash while in driver-less mode will be paid out by insurance companies who will then recover costs from the party responsible for the incident, which may be the manufacturer.[11] In the US, we estimate that the switch to autonomous vehicles will generate at least $80 billion in new insurance revenues between 2020 and 2025 driven by three new business lines—cybersecurity, product liability for sensors and software algorithms, and public infrastructure—that will require new capabilities and actuarial models.[12]

"Legal, ethical, policy and planning should progress alongside technology. Too often, policy lags technology and we can't afford that to happen with AI."

BYOUNG-TAK ZHANG, HEAD AT COGNITIVE ROBOTICS AND ARTIFICIAL INTELLIGENCE GROUP, SEOUL NATIONAL UNIVERSITY
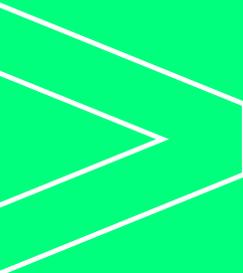
AI POLICY RECOMMENDATIONS

Uneven adoption of AI across countries, industries and entrepreneurial ecosystems raises risks of weak growth and greater divergence between countries.

But AI is not just a local issue and demands a global response, particularly on issues relating to the regulation of data, standards and intellectual property. Promoting access to the critical ingredients of AI development and creating a level playing field for all stakeholders, particularly entrepreneurs within and across countries, is a G20 priority.

These recommendations are not comprehensive, but help focus policy makers on supporting the AI ecosystem, preparing the future workforce and adopting smart regulation that safeguards trust while supporting innovation.

1

SEED PUBLIC—PRIVATE PROGRAMS TO SHARE RESOURCES AND BEST PRACTICES IN THE AI ECOSYSTEM

With the goal of developing industry-supported guidelines and best practices, governments, industry and civil society should work together to weigh the range of technical issues and ethical questions that AI applications raise in different sectors. Multi-stakeholder initiatives have the strongest influence on creating industry cross-fertilization and equal access to AI resources for entrepreneurs and big players alike. For example, the state of Baden-Württemberg is establishing an AI research community in the Stuttgart region, including industry partners such as Daimler, BMW and Bosch. This new model of cooperation between science and industry will promote technology transfer from basic research to applied research to create a stimulating environment for startups in AI, emulating what Stanford University has done in Silicon Valley.[13]

2

STRENGTHEN THE INTERNATIONAL AI R&D ECOSYSTEM THROUGH BETTER G20 COOPERATION

Governments should strengthen research and development in AI to lower the bar for entry, facilitate innovation and promote accessibility to participants in the ecosystem. The G20 must encourage international collaboration on AI research in core technologies, particularly AI safety and cybersecurity breakthroughs. The history of technology development tends to show that a foundational technology, such as the Internet, can serve everyone in the long run by enabling startups as well as incumbents to pioneer new applications. Governments should encourage the setup of open source technology platforms that share AI frameworks and tools mainly for accelerating their development, and consequently, make AI more accessible to small companies.

3

INCORPORATE AI IN THE PUBLIC SECTOR ITSELF AND CREATE NEW OPEN DATA PLATFORMS TO SUPPORT AI DEVELOPMENT

Governments should look for ways to incorporate AI wherever possible. National governments should ensure their own datasets can be leveraged by AI stakeholders by creating new public data platforms that enable open access. Public sector procurement policies should be redesigned to attract the participation of smaller enterprises and startups. Governments should encourage the setup of democratized databases by private sector players for sharing anonymized and encrypted data that can be publicly accessed to support AI development. Australia's Department of Human Services is applying Microsoft AI technology to help employees respond faster to citizens' inquiries.[14]

4

SUPPORT THE CREATION OF THE FUTURE WORKFORCE, FOSTERING INCLUSIVE WORKFORCE MODELS

The G20 Governments are committed to encouraging investment in education and vocational training that prepares people for the new multi-disciplinary and STEAM skills—science, technology, engineering, arts and mathematics—demanded by AI. Supply has not kept pace with demand, which is fueling the AI talent race among large companies, and which risks making talent unaffordable for small companies.[15] Public and private sectors should invest in worker retraining programs and ongoing education for those already in the workforce. Additionally, governments can provide incentives and financial resources for private and nonprofit organizations to develop and deliver high-quality workforce retraining programs.[16] Meanwhile, young entrepreneurs will need access to advisers and mentors experienced in AI. For example, Youth Business USA and Accenture have co-created an entrepreneurship platform called SkysTheLimit which itself uses a mentor matching algorithm to connect young entrepreneurs with mentors.[17]

Given the new range of skills required to support AI growth and the risks for those in lower level skilled employment, efforts must also be made to educate and train those easily left behind by such fast moving developments: minority groups, women, mothers who wish to return to the workforce, and those from disadvantaged communities seeking employment or greater advancement in work. State training programs, community colleges and trade school curricula should incorporate appropriate coursework to ensure AI employment opportunities are inclusive.

5

EMBRACE SMART REGULATION TO SAFEGUARD RESPONSIBLE AI

G20 governments should support policies that enable Responsible AI practices. At the heart of Responsible AI is the concept that AI should be human-centric—meaning that, at its core, AI should be deployed for the benefit of humanity. The challenge for policymakers is to approach AI with the twin goals of promoting trust and preserving maximum flexibility to innovate. This requires smart regulation that adapts to the shorter innovation cycles of AI. When developing new regulations to address AI technologies, government, in consultation with industry, must first assess where current authority, oversight, regulation, or voluntary industry best practices already exist and work effectively. Policymakers should resist the urge to create AI-specific legislation or regulation, stepping into select areas only. These include new market developments, such as autonomous vehicles or concerns over safety, such as the use of drones.

Policymakers and standards bodies should also work with businesses that are advanced in AI in order to learn from how those businesses are developing their own Responsible AI practices. These private sector efforts can help inform future public policy.
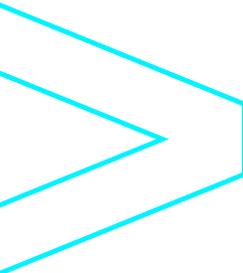
PEOPLE FIRST AI

At a time when many economies are struggling to recapture rates of productivity and growth, AI promises to provide a solution. A full and responsible implementation of AI will open new growth opportunities that would not otherwise exist.

Policy makers find themselves pulled both ways: having to manage the uncertainties and fears about the impact of AI on society, while encouraging innovation that can benefit communities and workforces. Despite the ethical and workforce risks of AI, there is a greater risk to economic wellbeing from inhibiting development of AI.

These recommendations complement those made by the B20 Taskforce on Digitalization[18] and focus on improving access to AI and the key factors that will fuel its adoption: technology, data and people.

While government support for innovation ecosystems is critical, a prerequisite is the establishment of inclusive workforce strategies and Responsible AI practices that underpin this profound technology revolution. The guiding principle should be to create "People First" policies and business strategies, centering on using AI to augment and extend people's capabilities for the benefit of human kind.

CONTACTS

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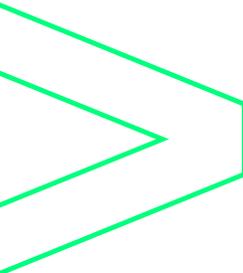Global Managing Director
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LAURENCE MORVAN

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*Sponsor of the Accenture relationship
with B20 and G20 YEA*

MADHU VAZIRANI

Thought Leadership Principal Director
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ABOUT G20 YOUNG ENTREPRENEURS' ALLIANCE

The G20 YEA is a collective of leading entrepreneurially minded organizations representing the G20 countries who seek to promote youth entrepreneurship as a powerful driver of economic renewal, job creation, innovation and social change. The G20 YEA provides leadership to G20 political leaders in promoting youth entrepreneurship through policy recommendations and sharing best practices.

ABOUT THE RESEARCH

Conducted between January and May 2017, Accenture undertook research and analysis on behalf of the G20 Young Entrepreneurs' Alliance. The research program included:

Analysis of Artificial Intelligent Quotient (AIQ) development in 10 G20 countries (Australia, Canada, China, France, Germany, India, Japan, South Korea, United Kingdom and the United States) using the below approach:
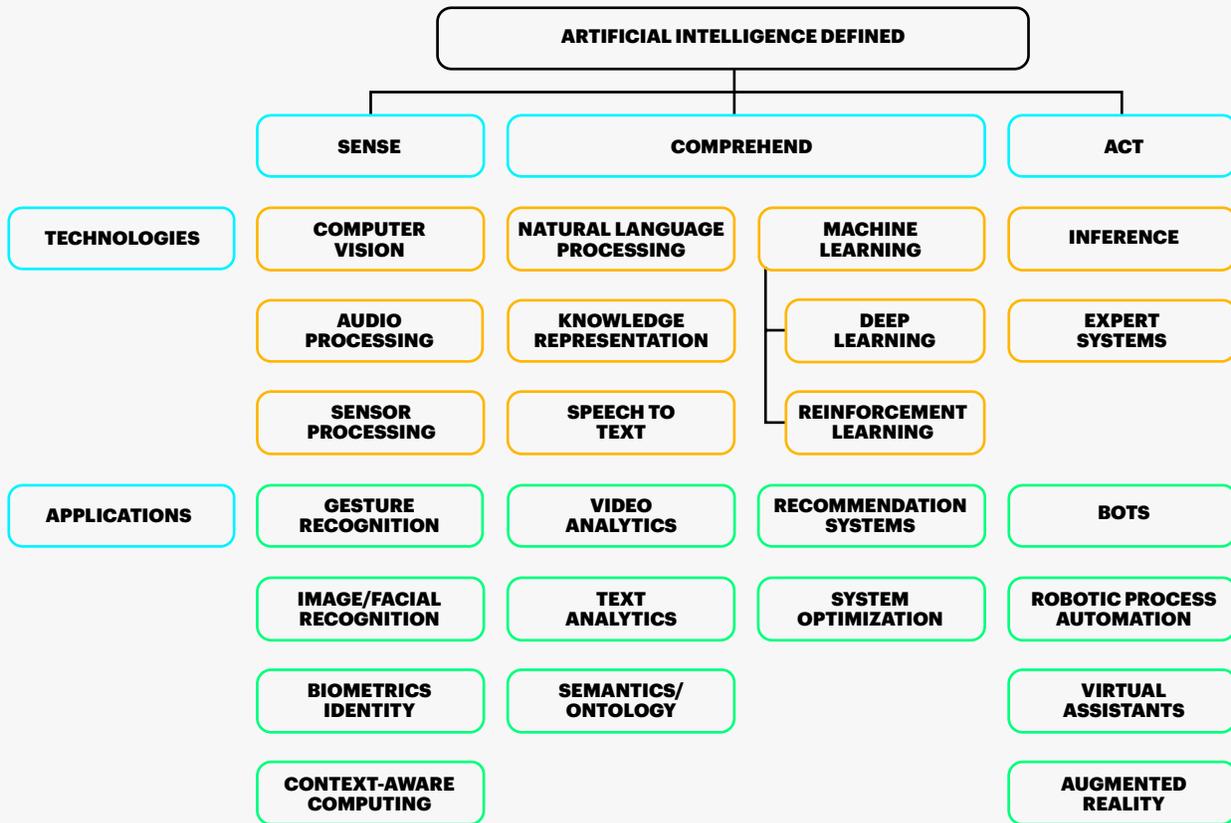
STAKEHOLDER	PARAMETERS TO ASSESS AIQ DEVELOPMENT
1 UNIVERSITIES	• Number and citation of patents on AI technologies filed by universities (sources: DWPI from Thomson Innovation © Thomson Reuters 2017) • Evidence of startups seeded by universities and partnerships with industry
2 START-UPS	• Investment in AI startups: number of deals, financing dollars and growth rate for period 2011–2016 (source: CBInsights, Tracxn) • Evidence of startups' performance at country level, e.g. time to IPO, number of startups acquired by companies, startup business growth where ascertainable.
3 LARGE COMPANIES	• Number and citation of patents on AI technologies filed by companies (source: DWPI from Thomson Innovation © Thomson Reuters 2017) • Number of announcements on AI keywords (source: web crawling of news)
4 POLICY & REGULATION	• Evidence of policy and regulatory initiatives, including direct funding to develop AI in–country and international co-operations (source: media releases)
5 MULTI-STAKEHOLDER PARTNERSHIPS	• Evidence programs that bring together stakeholders across public and private sectors to move AI forward (source: media releases)

AIQ Development at country level was built using a mix of secondary data, qualitative analysis and AI-powered web crawling tools.

For each country, we identified evidence of AI activity at the four stakeholders and their partnerships-and assigned an initial score on a scale of 1 to 5. The overall AIQ development is the relative positioning of each country in the group of 10 countries.

We validated AIQ development findings with more than 45 leading AI experts from different specialties.

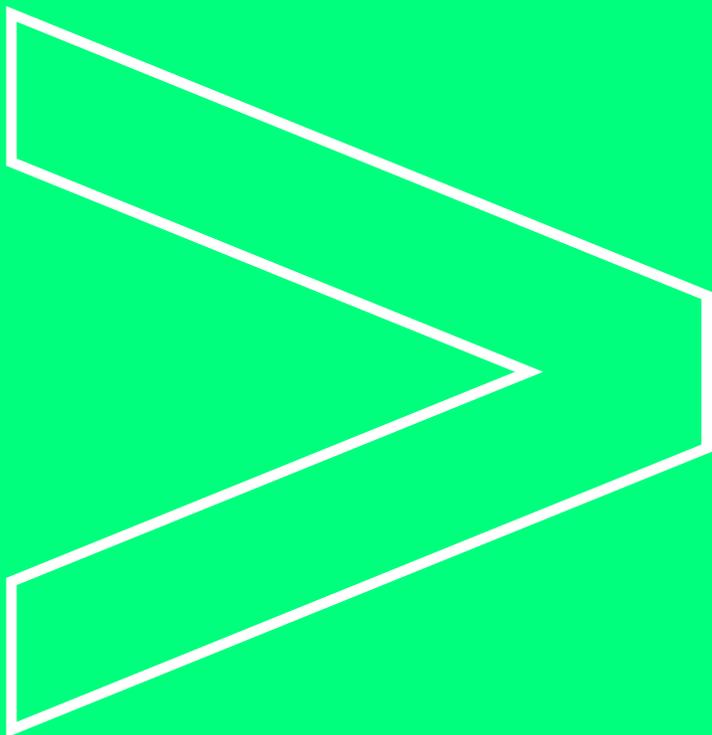**ASSESSMENT OF AI TECHNOLOGIES** and applications in search strings:

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                    ┌─────────────────────────────────────────┐
                    │      ARTIFICIAL INTELLIGENCE DEFINED      │
                    └─────────────────────────────────────────┘
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	SENSE	COMPREHEND		ACT
TECHNOLOGIES	COMPUTER VISION	NATURAL LANGUAGE PROCESSING	MACHINE LEARNING	INFERENCE
	AUDIO PROCESSING	KNOWLEDGE REPRESENTATION	DEEP LEARNING	EXPERT SYSTEMS
	SENSOR PROCESSING	SPEECH TO TEXT	REINFORCEMENT LEARNING	
APPLICATIONS	GESTURE RECOGNITION	VIDEO ANALYTICS	RECOMMENDATION SYSTEMS	BOTS
	IMAGE/FACIAL RECOGNITION	TEXT ANALYTICS	SYSTEM OPTIMIZATION	ROBOTIC PROCESS AUTOMATION
	BIOMETRICS IDENTITY	SEMANTICS/ ONTOLOGY		VIRTUAL ASSISTANTS
	CONTEXT-AWARE COMPUTING			AUGMENTED REALITY

As a system that possesses human-like intelligence and learning capabilities

As a collection of technologies that, together, enable human-like intelligence

Note: Classification of Technologies vs. Applications or Capabilities is subjective to individual interpretation. The list is not exhaustive.

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