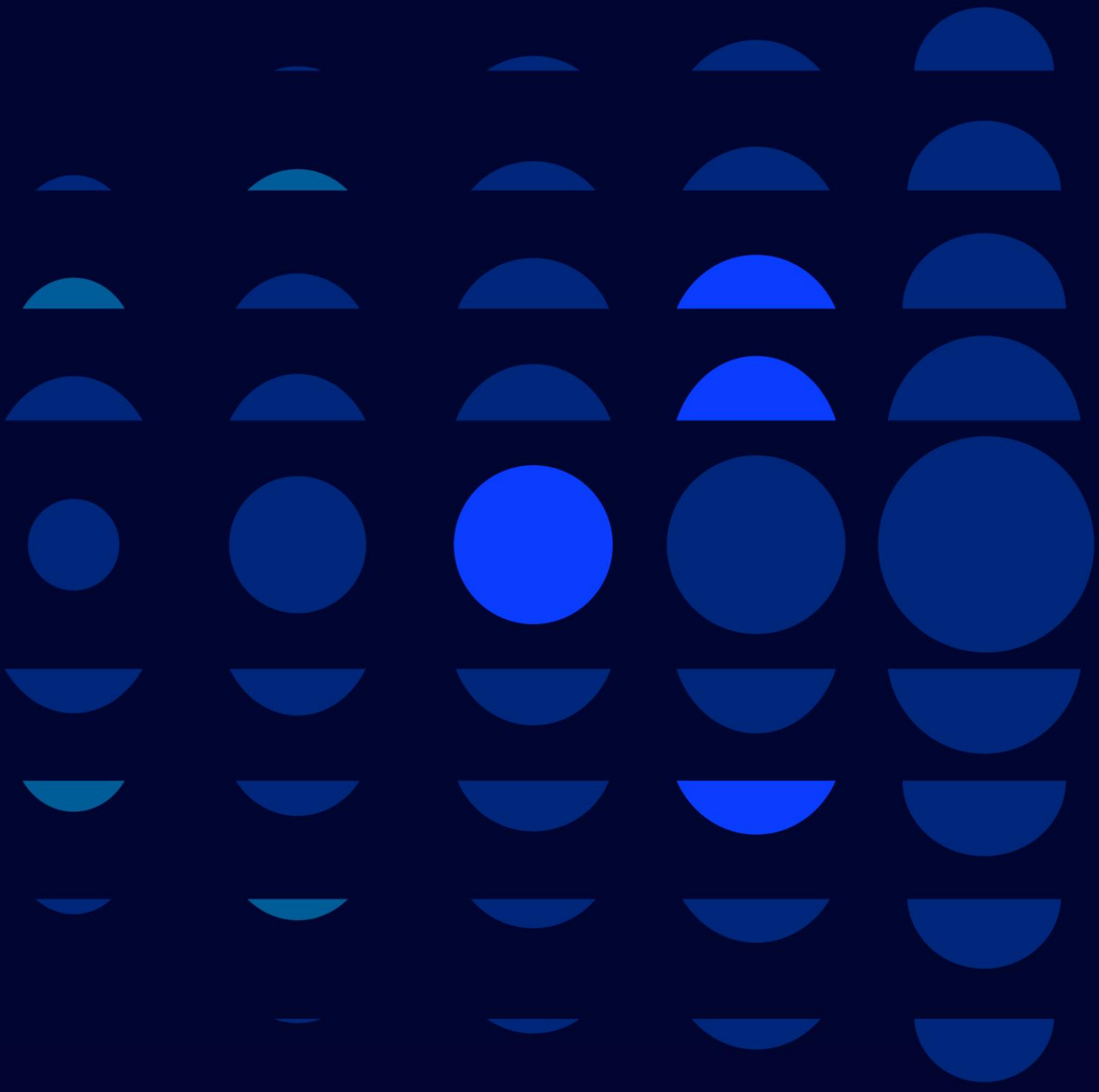
patsnap



2023

GLOBAL INNOVATION REPORT

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About the report

What is Patsnap's view on Technology Innovation?

Technological innovation is advancing at an ever-increasing pace. Over the past decade, global research and development (R&D) spending, a pivotal driver of technological innovation, has grown from 2.00% of GDP to 2.63%. After over a century of combined effort, 100 million patents were filed as of 2017, serving as legal proof of technological innovation. This number is expected to double within the next ten years.

Technology innovation is measurable. How can we effectively assess a company's technology innovation performance? We propose moving beyond qualitative evaluations to a **systematic approach** that relies on **abundant data.**

Patsnap has developed our proprietary Innovation Capability Evaluation Model. A comprehensive set of methodologies is constructed for quantitatively measuring a company's real technology innovation prowess. Our model consists of five dimensions: one related to enterprise competitiveness and four focused on technology. These four technology dimensions—***Technology Size, Technology Quality, Technology Influence, and Technology Globalization***—comprise the core of this report's evaluation.

Patsnap has amassed a wealth of data and developed robust metrics for conducting quantitative evaluations. We systematically track the continuously increasing patents from companies and institutes worldwide. Utilizing advanced AI capabilities, we process this information into comprehensive innovation metrics. To date, our data covers approximately 100 million technology companies and the 180 million patents associated with them.

The comprehensive model along with the extensive dataset enables us to assess the innovation capability of each company, uncovering comprehensive innovation characteristics. Furthermore, we diligently maintain historical records of these companies' innovation scores. This ensures easy access for individuals, businesses, investors, and researchers, catering to their specific needs.

Patsnap's Innovation Capability Evaluation Model includes 1+4 dimensions and 40+ metrics. Here we focus on the 4 core technology dimensions. They are:

Technology Size: This dimension assesses the overall scale of a company's technology innovation. It considers factors such as the cumulative count of their patent applications, the growth rate of their patent applications in recent years, and the number of their active inventors.

Technology Quality: In this dimension, we evaluate the value of a company's patents as technology assets. This includes indicators such as the grant rate of invention applications, and the average valuation of each patent (based on Patsnap's own valuation model).

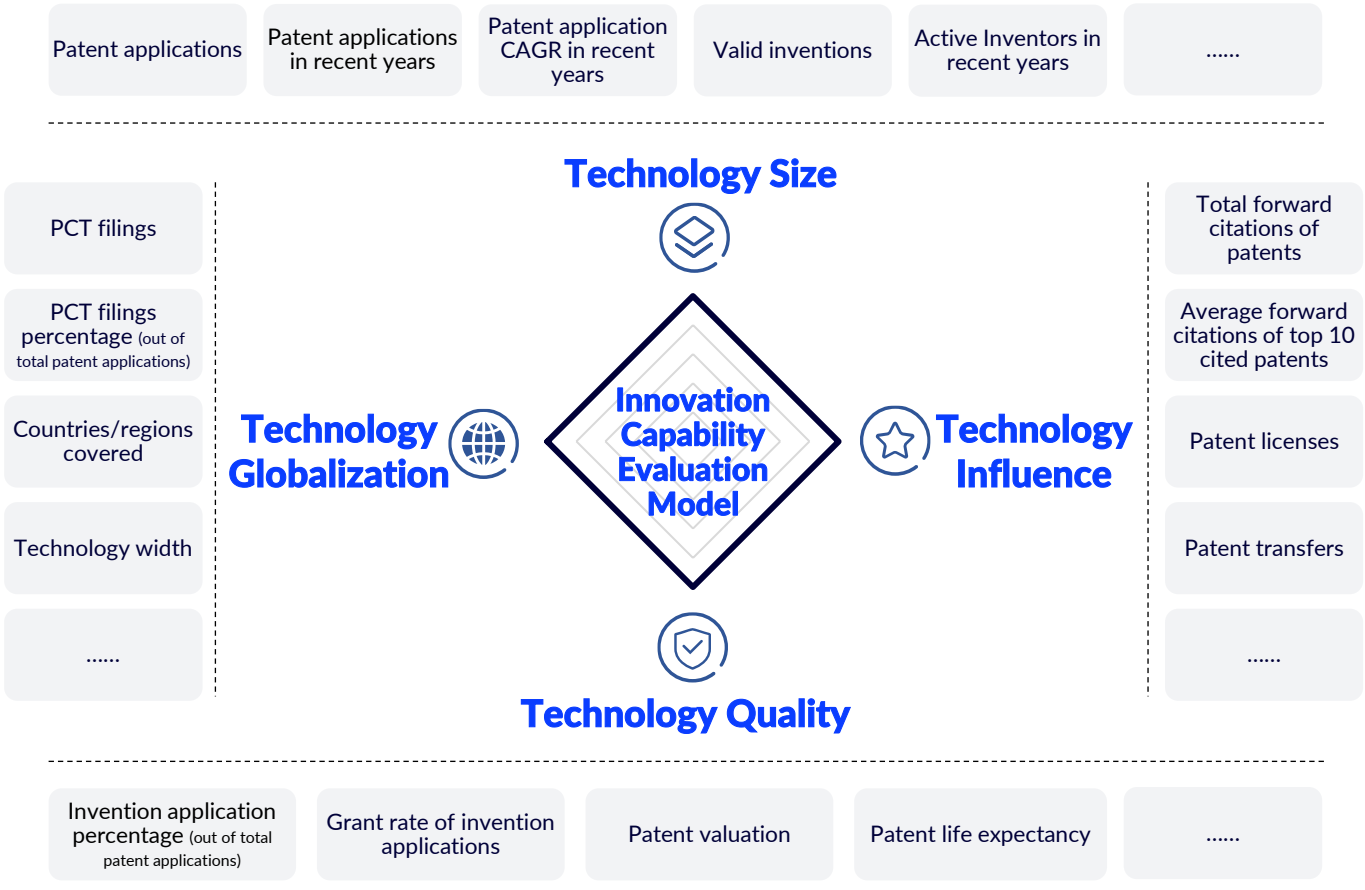
Technology Influence: Here, we measure the impact of a company's technologies in terms of their role in leading and guiding subsequent innovations. This dimension is reflected in various metrics, such as the number of forward citations of the patents, and the count of licensed patents.

Technology Globalization: This dimension quantifies the extent to which a company's technologies have a global footprint, including the total number of PCT filings (filed under the international Patent Cooperation Treaty) and the total number of countries/regions where patents have been filed.

These dimensions collectively provide a comprehensive view of a company's technological innovation capability, allowing us to identify and evaluate innovation players effectively.

Chart 0.1 Patsnap's Innovation Capability Evaluation Model

The chart here illustrates the ***4 technology-related dimensions from the total 1+4 dimensions, with typical metrics.***



How do we identify the top-performing companies?

Using Patsnap's Innovation Capability Evaluation Model, we effectively assess and dissect the innovation capabilities of each of the 100 million technology companies in Patsnap database. We can also make relative comparisons and analysis across all innovation dimensions.

In this report, we identify and demonstrate the 100 top-performing companies as our **"2023 Global Innovation 100",** celebrating excellence in innovation.

We also identify the 50 rapidly growing companies with groundbreaking innovations as our **"2023 Global Disruption 50"**, celebrating disruption in innovation.

Beyond the identification of these companies, we also illustrate some insights into the essence of their innovation. The Global Innovation 100 and Global Disruption 50 are not just 150 individual companies. Each of them represents a small innovation ecosystem as there can be hundreds of subsidiaries within their organizations. Together they represent the dynamic landscape of innovation, shaping the future of technology across a diverse array of industries. By analyzing their comprehensive innovation data, we uncover characteristics, patterns and trends of global innovation. As a result, we also provide a series of innovation observations based on the two lists, aiming to inspire further contemplation and thought.

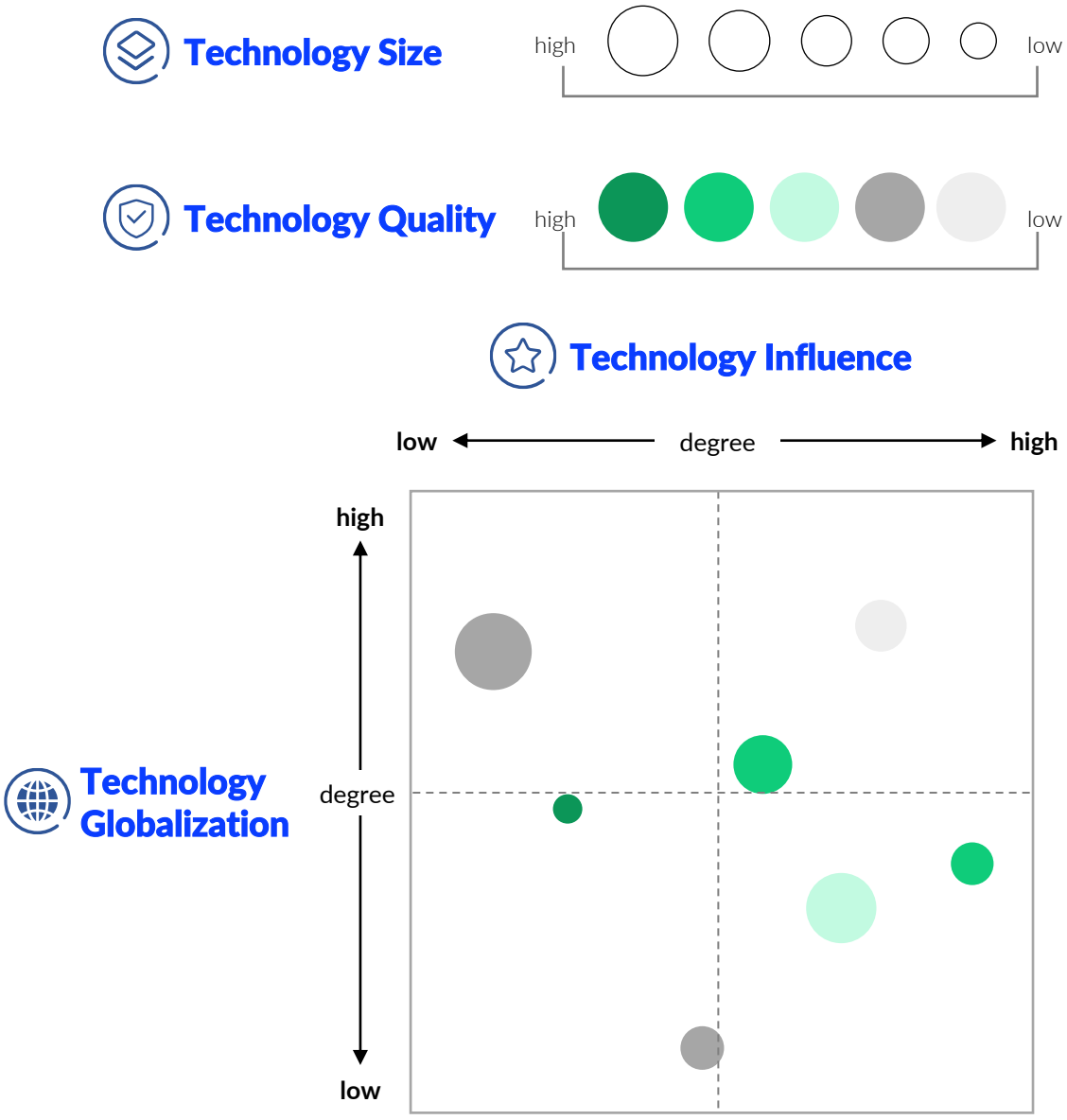
It should be noted that these 2 lists of companies are based on our unique angles of value propositions with the metrics calculated as of today. Therefore, they are by no means exhaustive or static.

How can we effectively showcase a company's technological innovation capabilities?

Utilizing Patsnap's Innovation Capability Evaluation Model, we leverage the four technology dimensions to portray companies in the format of bubble charts on a 2-dimensional map. On this map, each bubble symbolizes a company, with the bubble's size representing the Technology Size, its color denoting Technology Quality, its position on the horizontal axis reflecting Technology Influence, and its placement on the vertical axis signifying Technology Globalization.

This innovative approach allows us to present each organization's performance in four distinct dimensions. Within this framework, each company can be compared with others across each dimension, facilitating a holistic judgment of their innovation capabilities.

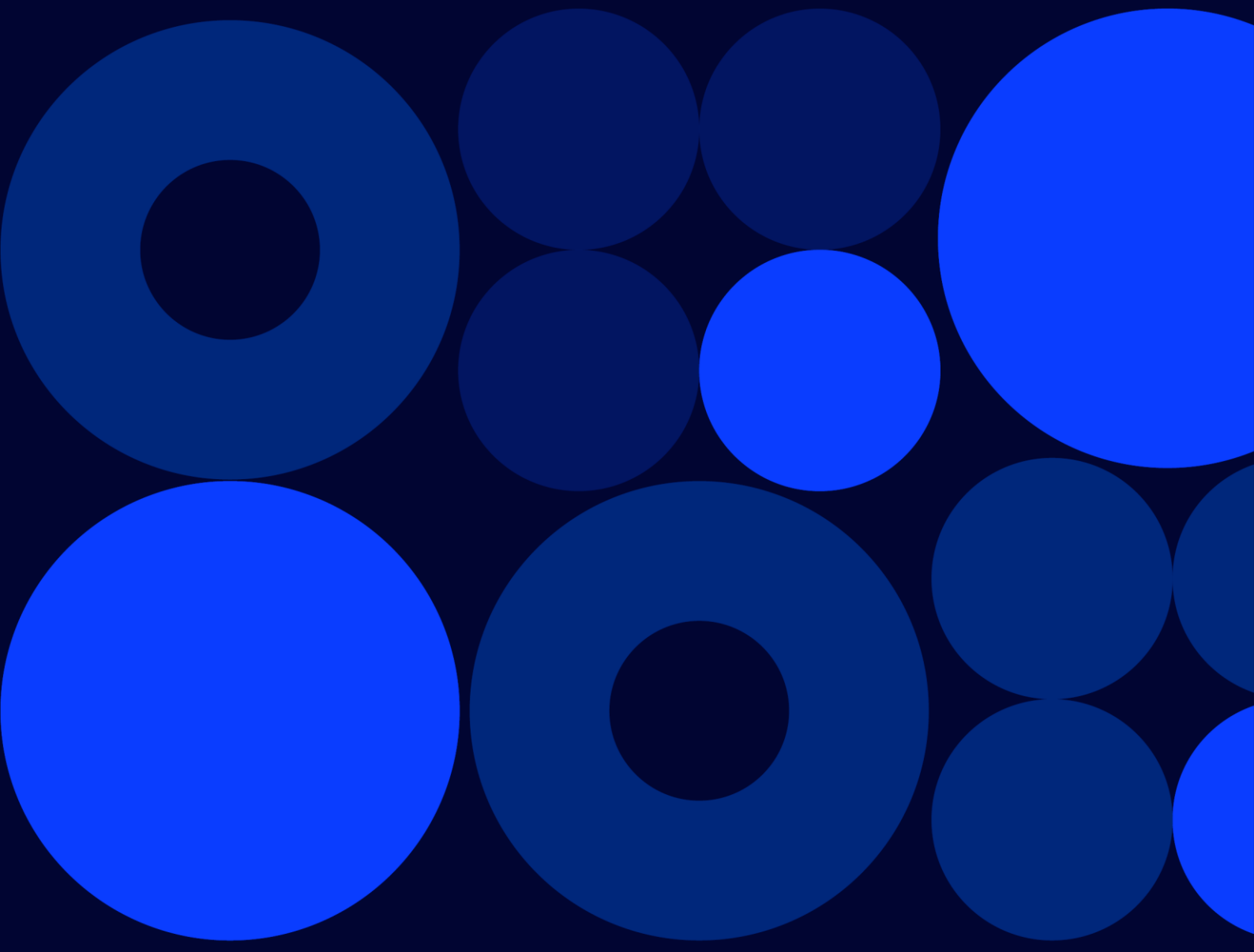
Chart 0.2 Innovation Map for the Global Innovation 100 and Global Disruption 50



GLOBAL INNOVATION 100
2023

Part I

2023 Global Innovation 100



How do we define Global Innovation 100?

The realm of innovation encompasses a wide array of individuals, organizations, and institutions. Yet, it is undeniable that a significant portion of groundbreaking innovations can be attributed to a select group of tech giants. Collectively these entities stand as the forerunners of global innovation, boasting unparalleled technological prowess, exemplary performance, and a remarkable track record of accomplishments.

They are the greatest innovators of this era. Over the years, they have led the world's technology progress, and consistently outperform others in technology innovation.

They are also trailblazers in the innovation ecosystem. Not only do they expand the horizons of innovation through their robust technological capabilities, but they also exert a profound influence on companies both within and beyond their respective industries, propelling the advancement of our times.

We use Patsnap's Innovation Capability Evaluation Model to identify these brilliant innovators. We reveal our list of the top 100 companies, this year's Global Innovation 100, in the following pages.

It should be noted that all the companies listed are independent, not subsidiaries of any other company.

GLOBAL INNOVATION 100
2023

The Greatest innovators of this era,
Leading the world's technology progress

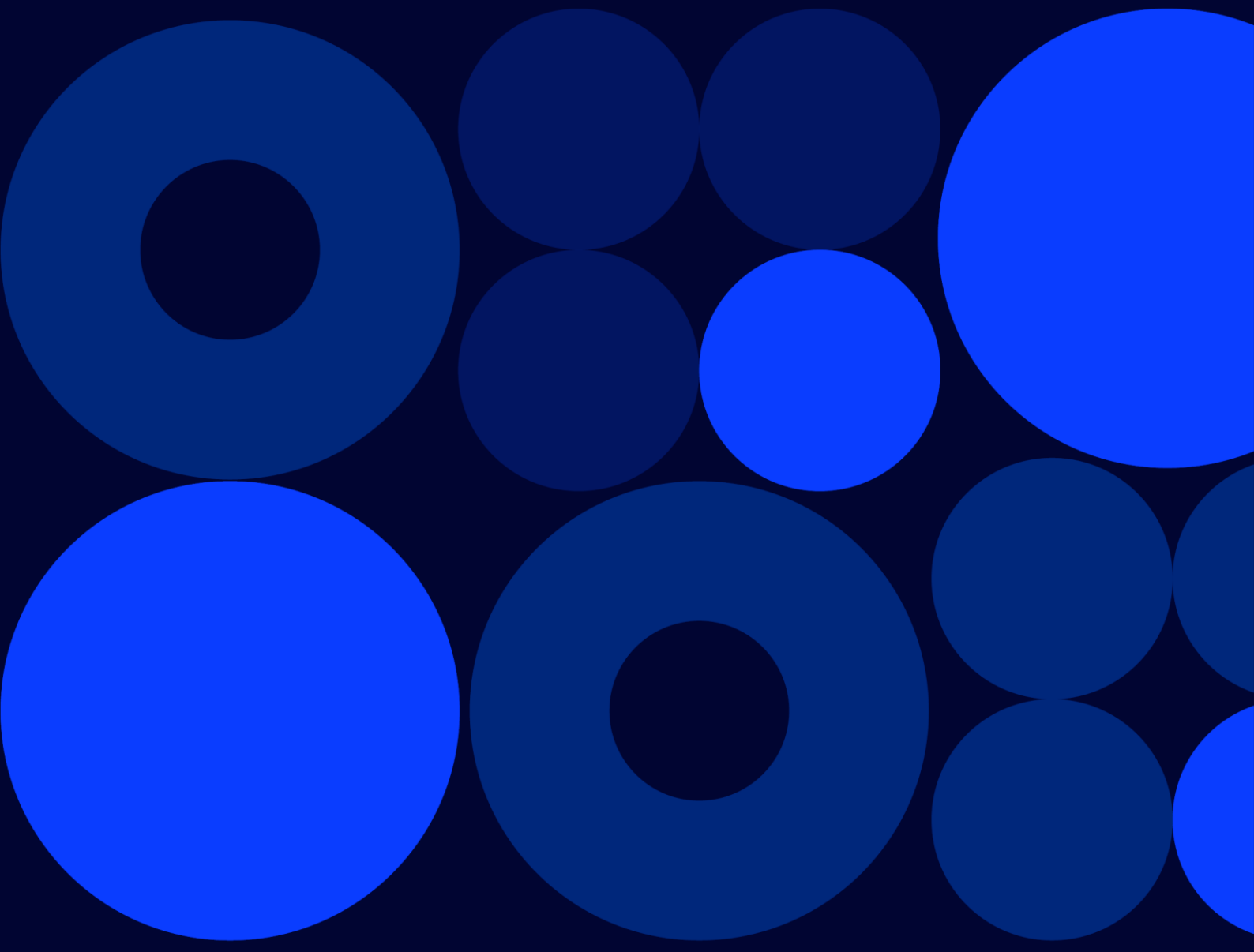
They are rated as:

Excellent **in innovation capability.**

GLOBAL INNOVATION 100
2023

A

Who are they?



GLOBAL INNOVATION 100
2023

The list is sorted alphabetically

Company	Country/Region	Industry
3M	U.S.	Chemicals & Materials
ABB	Switzerland	Machinery & Equipment
Abbott	U.S.	Life Science & Healthcare
AbbVie	U.S.	Life Science & Healthcare
Alphabet	U.S.	Information Technology
Apple	U.S.	Electronics
Applied Materials	U.S.	Semiconductor
Asahi Kasei	Japan	Chemicals & Materials
AstraZeneca	U.K.	Life Science & Healthcare
Baker Hughes	U.S.	Energy & Electrical
BASF	Germany	Chemicals & Materials
Bayer	Germany	Life Science & Healthcare
Becton Dickinson	U.S.	Life Science & Healthcare
Boehringer Ingelheim	Germany	Life Science & Healthcare
Boeing	U.S.	Aerospace & Defense
Bosch	Germany	Machinery & Equipment
Boston Scientific	U.S.	Life Science & Healthcare
Bristol Myers Squibb	U.S.	Life Science & Healthcare
British American Tobacco	U.K.	Consumer Goods
Canon	Japan	Electronics
Continental	Germany	Automotive
Corning	U.S.	Chemicals & Materials
Corteva Agriscience	U.S.	Chemicals & Materials
Danaher	U.S.	Life Science & Healthcare
DENSO	Japan	Automotive

GLOBAL INNOVATION 100
2023

The list is sorted alphabetically

Company	Country/Region	Industry
Dow	U.S.	Chemicals & Materials
Eaton	Ireland	Energy & Electrical
Emerson	U.S.	Machinery & Equipment
Epson	Japan	Electronics
Exxon Mobil	U.S.	Energy & Electrical
FUJIFILM	Japan	Electronics
Fujitsu	Japan	Electronics
GE	U.S.	Machinery & Equipment
General Motors	U.S.	Automotive
Gilead Sciences	U.S.	Life Science & Healthcare
GSK	U.K.	Life Science & Healthcare
Hitachi	Japan	Machinery & Equipment
Honda	Japan	Automotive
Honeywell	U.S.	Machinery & Equipment
Huawei	Chinese Mainland	Telecommunications
IBM	U.S.	Electronics
Intel	U.S.	Semiconductor
InterDigital	U.S.	Information Technology
JFE Steel	Japan	Chemicals & Materials
Johnson & Johnson	U.S.	Life Science & Healthcare
Kyocera	Japan	Electronics
LG Chem	Korea	Chemicals & Materials
LG Electronics	Korea	Electronics
LM Ericsson	Sweden	Telecommunications
Medtronic	U.S.	Life Science & Healthcare

GLOBAL INNOVATION 100
2023

The list is sorted alphabetically

Company	Country/Region	Industry
Merck	Germany	Chemicals & Materials
Merck Sharp & Dohme	U.S.	Life Science & Healthcare
Microsoft	U.S.	Electronics
Mitsubishi Chemical	Japan	Chemicals & Materials
Mitsubishi Electric	Japan	Machinery & Equipment
Mitsubishi Heavy Industries	Japan	Machinery & Equipment
Motorola	U.S.	Electronics
Murata Manufacturing	Japan	Electronics
NEC	Japan	Telecommunications
Nestlé	Switzerland	Consumer Goods
Nippon Steel	Japan	Chemicals & Materials
Nitto Denko	Japan	Chemicals & Materials
Nokia	Finland	Electronics
Novartis	Switzerland	Life Science & Healthcare
Olympus	Japan	Electronics
OPPO	Chinese Mainland	Electronics
Oracle	U.S.	Information Technology
Otsuka Pharmaceutical	Japan	Life Science & Healthcare
P&G	U.S.	Consumer Goods
Panasonic	Japan	Machinery & Equipment
Pfizer	U.S.	Life Science & Healthcare
Philip Morris International	U.S.	Consumer Goods
Philips	Netherlands	Electronics
QUALCOMM	U.S.	Telecommunications
Ricoh	Japan	Electronics

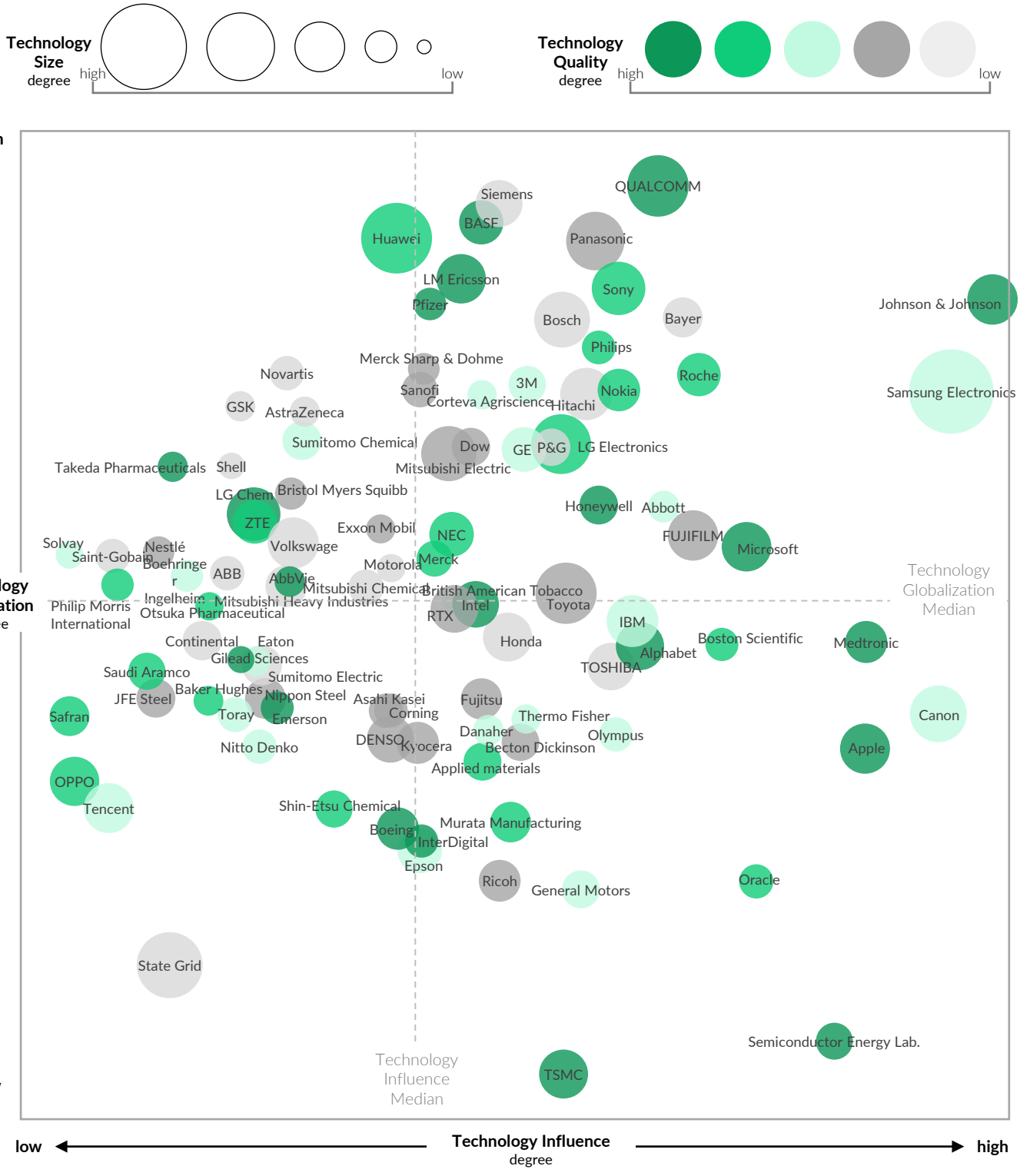
GLOBAL INNOVATION 100
2023

The list is sorted alphabetically

Company	Country/Region	Industry
Roche	Switzerland	Life Science & Healthcare
RTX	U.S.	Aerospace & Defense
Safran	France	Aerospace & Defense
Saint-Gobain	France	Chemicals & Materials
Samsung Electronics	Korea	Electronics
Sanofi	France	Life Science & Healthcare
Saudi Aramco	Saudi Arabia	Energy & Electrical
Semiconductor Energy Lab.	Japan	Semiconductor
Shell	U.K.	Energy & Electrical
Shin-Etsu Chemical	Japan	Chemicals & Materials
Siemens	Germany	Machinery & Equipment
Solvay	Belgium	Chemicals & Materials
Sony	Japan	Electronics
State Grid	Chinese Mainland	Energy & Electrical
Sumitomo Chemical	Japan	Chemicals & Materials
Sumitomo Electric	Japan	Machinery & Equipment
Takeda Pharmaceuticals	Japan	Life Science & Healthcare
Tencent	Chinese Mainland	Information Technology
Thermo Fisher	U.S.	Life Science & Healthcare
Toray	Japan	Chemicals & Materials
TOSHIBA	Japan	Machinery & Equipment
Toyota	Japan	Automotive
TSMC	Taiwan Region	Semiconductor
Volkswagen	Germany	Automotive
ZTE	Chinese Mainland	Telecommunications

GLOBAL INNOVATION 100
2023

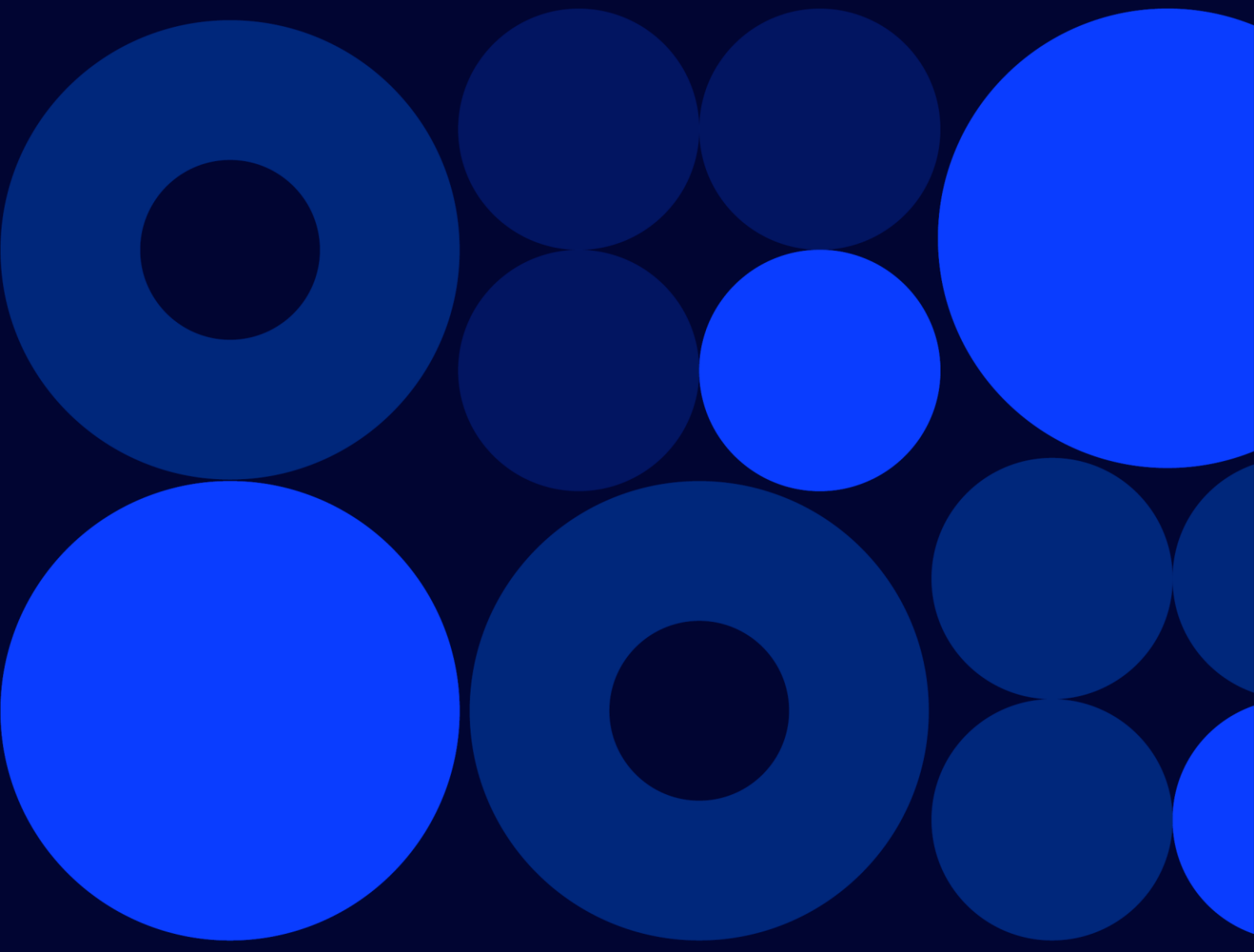
Innovation Map
Patsnap 2023 Global Innovation 100



GLOBAL INNOVATION 100
2023

B

How are they transforming the world?



GLOBAL INNOVATION 100
2023

Insight 1

The Global Innovation 100 contribute to a quarter of the World's technology innovation.

The Global Innovation 100 encompass tens of thousands of "tech subsidiaries". Although accounting for less than 2% of the world's total tech companies, they are responsible for 22% of the world's patented inventions, they generate 27% of total global PCT filings, and even contribute to an impressive 35% of the world's technology inspirations as measured by patent citations.

Insight 2

70% of the Global Innovation 100 come from the sectors of Life Science & Healthcare, Chemicals & Materials, Electronics and Machinery & Equipment.

The Global Innovation 100 are distributed across 11 industries. The majority come from the sectors of Life Science & Healthcare, Chemicals & Materials, Electronics, and Machinery & Equipment, each of which has >10 companies on the list.

Insight 3

The Global Innovation 100 come from 15 countries/regions, while their technology footprints spread across the world.

The Global Innovation 100 companies originate from 15 countries/regions, but their patent applications span over 159 countries/regions. Notably, companies from the U.S. and Japan account for 2 thirds of the total Global Innovation 100.

Insight 4

Europe's and America's Global Innovation 100 participants dominate Life Science & Healthcare sectors, while Asia's are prominent in heavy manufacturing industries.

Different regions show different areas of innovation strength. Asia's Global Innovation 100 excel in Technology Size, North America's enjoy a wider Technology Influence, while Europe's a higher Technology Globalization. In terms of industry, Europe's and North America's Global Innovation 100 dominate the Life Science & Healthcare sector, while Asia's are most prominent in heavy manufacturing industries ranging from materials, equipment and machinery.

Insight 5

Technological collaboration is ubiquitous, with the U.S.-Based Global Innovation 100 participants placing a strong emphasis on overseas cooperation.

The Global Innovation 100 collaborate closely with each other in technology innovation, with a total of 85,000 joint patent applications. America's Global Innovation 100 prefer cooperation with overseas participants in the Global Innovation 100, while Japan's participants focus more on cooperation with domestic players.

Insight 6

The Global Innovation 100 are showing signs of a slowing pace of innovation.

The Global Innovation 100 have an average technology growth rate of -2.3% over recent years, slightly lower than overall global technology growth and economic growth. Only one in five of the 100 companies listed has maintained positive growth.

Insight 7

The Global Innovation 100 are actively pursuing the development of cutting-edge technologies, representing a significant driver of their innovation growth.

The Global Innovation 100 participants also show growth on cutting-edge fields, such as smart grids and biomedical engineering. These "high-growth" tech subsidiaries are mainly concentrated in Asia and the U.S.. Both in-house incubation and external acquisition are used to build their portfolios.

GLOBAL INNOVATION 100 2023 **Insight 1**

The Global Innovation 100 contribute to a quarter of the World's technology innovation.

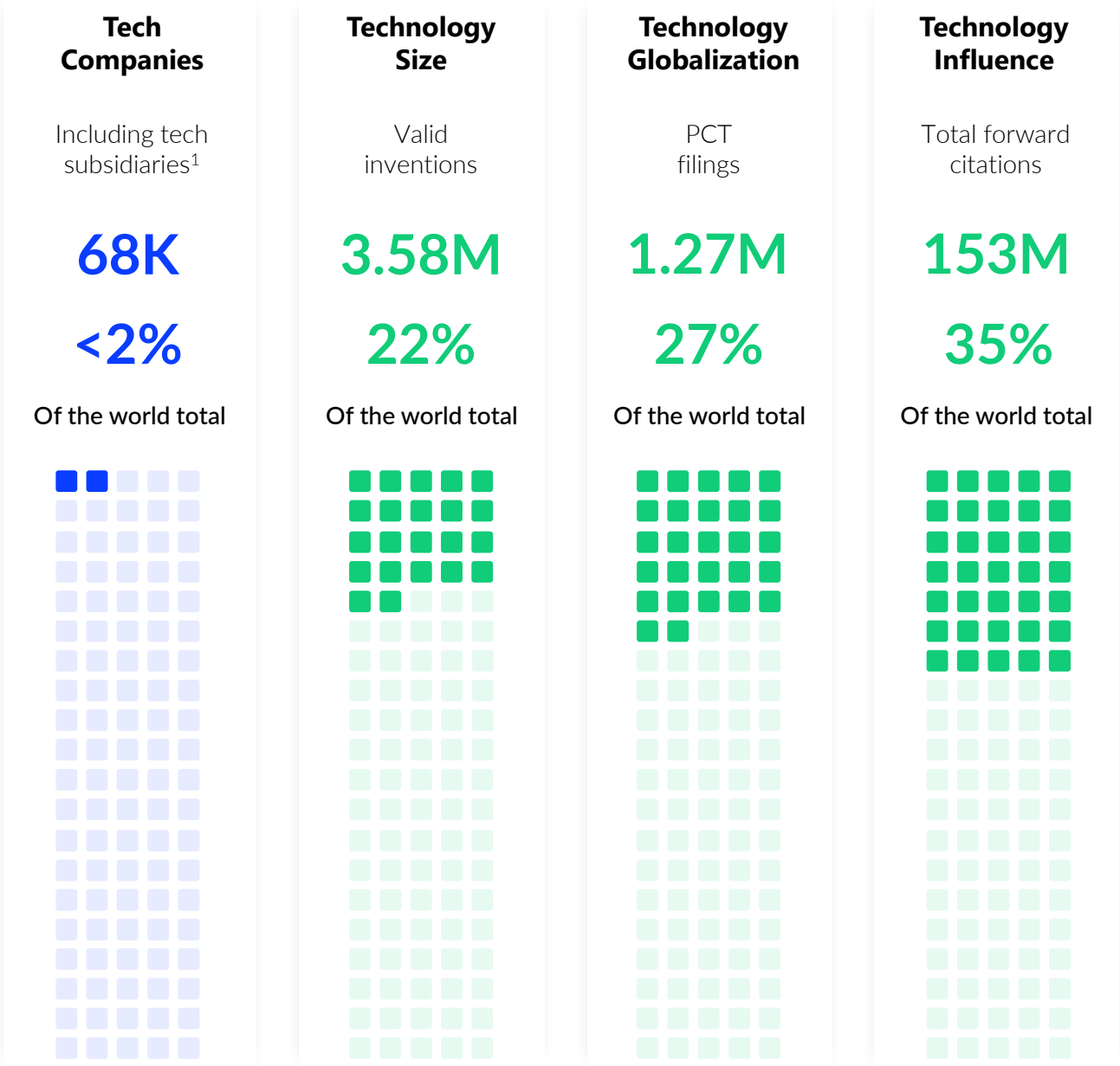
The Global Innovation 100 encompass tens of thousands of "tech subsidiaries". Although accounting for less than 2% of the world's total tech companies, they are responsible for 22% of the world's valid inventions, they generate 27% of total global PCT filings, and even contribute to an impressive 35% of the world's technology inspirations as measured by patent citations. They hold strong leadership in the global technology landscape.

The Global Innovation 100 companies are technology giants including around 68K "tech subsidiaries"[1]. Despite the large number, they account for less than 2% of total global "tech companies".

In contrast, the Global Innovation 100 are responsible for 22% of the world's invention assets, account for 27% of the global technology competition, contribute to an impressive 35% of the world's technology inspirations as measured by patent citations. In terms of size, the 100 companies and their subsidiaries own about 3.58 million valid inventions, accounting for 22% of the world's total. In terms of technology globalization, the 100 tech giants have applied for 1.27 million PCT filings, accounting for 27% of the world's total. With respect to technology influence, the 100 companies' patents have been cited a total of 153 million times, accounting for an impressive 35% of all the world's patent citations.

1 "tech subsidiary" or "tech company" indicates those companies that invest in Research & Development and apply for patents. It does not include manufacturing companies or sales companies which makes the "tech subsidiary" number less than the total subsidiaries of the Global Innovation 100 group. Data is from the Patsnap Discovery Database.

Chart 1.1 Contribution of the 2023 Global Innovation 100 to the World's Innovation



1 "tech subsidiary" or "tech company" indicates those companies that invest in Research & Development and apply for patents. It does not include manufacturing companies or sales companies which makes the "tech subsidiary" number less than the total subsidiaries of the Global Innovation 100 group. Data is from the Patsnap Discovery Database.

The 2023 Global Innovation 100 are not necessarily the largest companies in terms of revenue size nor the most pioneering companies in technological exploration. However, they represent the world's strongest innovation capabilities up to 2023. They are the trailblazers that constantly drive forward the world's innovation progress.

In terms of a typical innovation profile, the 100 tech giants have advantages in four dimensions: huge technology size, outstanding technology quality, profound technology influence and a relatively high level of technology globalization.

Huge technology size. On average the Global Innovation 100 have filed around 210K patent applications, outnumbering the total patent applications received by the German Patent Office in a single year. The total number of valid inventions of each tech giant averages 36K, which means that each tech giant exclusively holds and is able to utilize a large portfolio of core technology assets to empower its business.

Outstanding technology quality. The Global Innovation 100's average invention application percentage is around 93%, while design patents and utility models typically account for less than 10%. The 93% invention application percentage is well above the world's average level of 62%.

Profound technology influence. On average for each Global Innovation 100 participant, its collective patents are cited 1.8M times by subsequent patents, which indicates 1.8M times they have been used as technology inspirations for other companies and institutes. Typically for the Global Innovation 100 each of their patents is cited 8.6 times.

High level of technology globalization. On average, a typical Global Innovation 100 company has patent applications in 81 countries/regions around the world. The average number of PCT filings held by a Global Innovation 100 company is 12k.

Chart 1.2 2023 Global Innovation 100's Innovation Profile (with selected key indicators)

Average number for each company

Technology Size

Patent applications	210K
Valid inventions	36K

Technology Quality

Invention application percentage out of total patent applications	93%

Technology Influence

Total forward citations	1.8M

Technology Globalization

Countries/regions covered	81
PCT filings	12K

GLOBAL INNOVATION 100 2023 **Insight 2**

70% of the Global Innovation 100 come from the sectors of Life Science & Healthcare, Chemicals & Materials, Electronics and Machinery & Equipment.

The Global Innovation 100 are distributed across 11 industries. The majority come from the sectors of Life Science & Healthcare, Chemicals & Materials, Electronics, and Machinery & Equipment, each of which has >10 companies on the list.

The 2023 Global Innovation 100 are distributed across 11 industries, including Life Science & Healthcare, Chemicals & Materials, Electronics, Machinery & Equipment, Energy & Electrical, Automotive, Telecommunications, Semiconductor, Information Technology, Consumer Goods, and Aerospace & Defense.

Among them, Life Science and Healthcare, Chemicals & Materials, Electronics and Machinery & Equipment are the top 4 areas of focus, each encompassing 10+ Global Innovation 100 participants, which together account for almost 70% of the total 100 companies.
Machinery & Equipment includes 13 conglomerates, including ABB, Bosch, General Electric, Panasonic, Toshiba, Kyocera, etc.
Most of them are established names originating from Japan, Germany and the U.S. They grew up with the development of nationalized industries, and thus cover a wide range of diversified manufacturing fields.

Chart 1.3 Industry Distribution of the 2023 Global Innovation 100

Life Science & Healthcare

In total, there are 22 participants from the Global Innovation 100. Most of them are pharmaceutical companies, such as AstraZeneca, Bayer and Merck, there a few medical device companies, such as Medtronic and Boston Scientific, and several Contract Manufacturing (CMO) companies, e.g. Boehringer Ingelheim.

The 22 Global Innovation 100 participants from the Life Science & Healthcare sector are concentrated in the upper part of the map shown in Chart 1.4, indicating relatively small technology size, high technology quality, varied technology influence, and comprehensively outperforming capabilities in technology globalization.

In terms of technology globalization, most of the Global Innovation 100 in the Life Science & Healthcare sector exceed the average level of the Global Innovation 100, making the sector the most globalized one. 16 out of 22 companies have expanded their technologies to more than 100 countries/regions, and all the 8 companies that have expanded their technologies to more than 120 countries/regions are from the Life Science & Healthcare sector. Pfizer has applied for patents in 138 countries/regions, top among the Global Innovation 100.

Technology influence varies greatly, with Johnson & Johnson and Medtronic leading the 100 companies. Johnson & Johnson shows the strongest capabilities in technology influence among the Global Innovation 100, with its patents cited a total of 6.6M times, far outpacing the others. Medtronic excels in the influence of one single technology. Each of its patents gains, on average, 49 citations from other companies or organizations, 7 times the average level of the Global Innovation 100.

Pfizer

Patents applied for in **138** countries/regions

Ranking **1st** among the Global Innovation 100

Johnson & Johnson

Patents are cited **6.6M** times

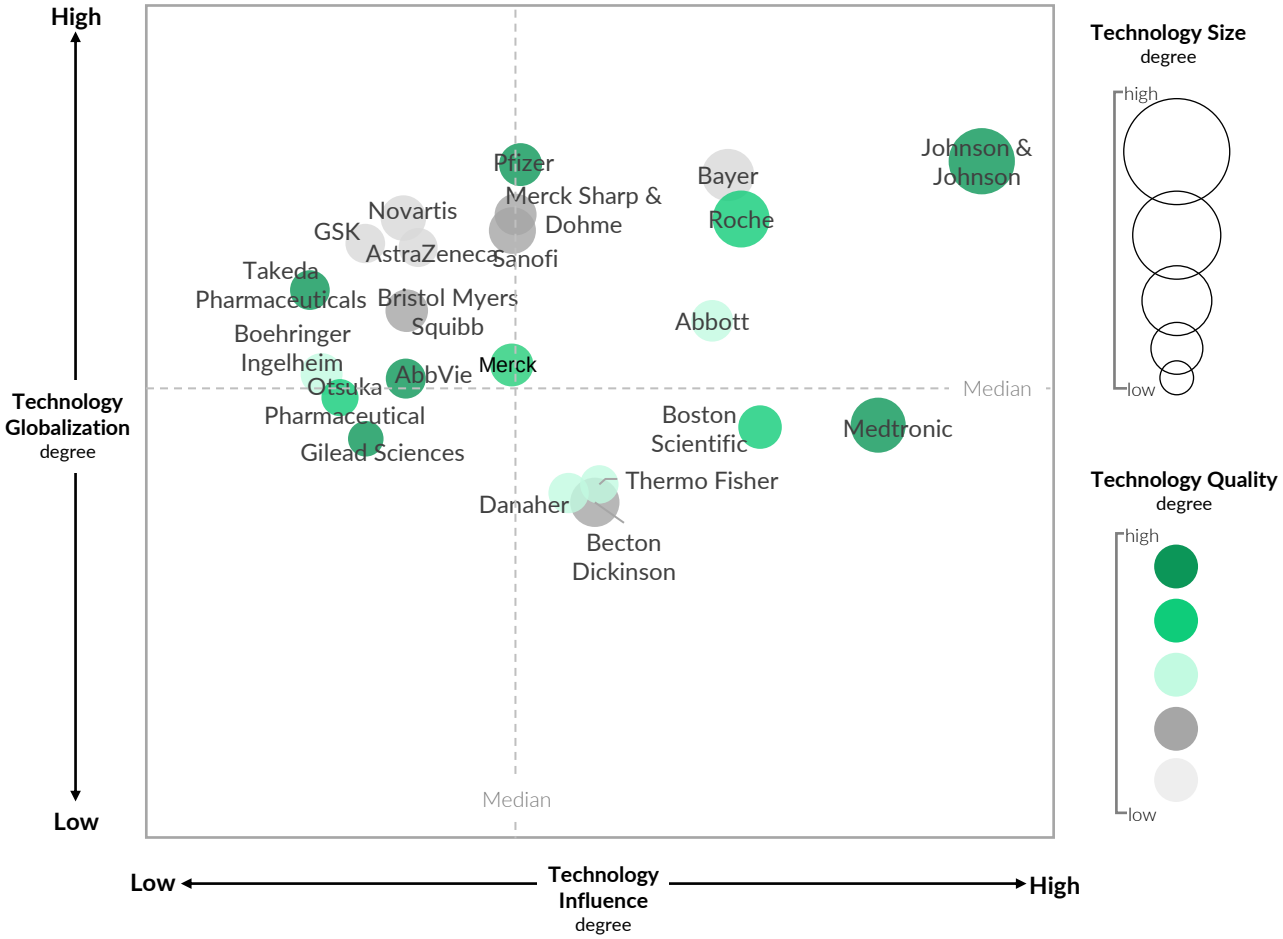
Ranking **1st** among the Global Innovation 100

Medtronic

Each patent on average is cited **49** times

7X more than the Global Innovation 100's average level

Chart 1.4 Innovation profile of 2023 Global Innovation 100 in Life Science & Healthcare sector



Chemicals & Materials

In total, there are 16 Global Innovation 100 participants, covering all the 3 major categories in the field of materials. The majority of them are organic polymer materials/chemicals companies, such as 3M, BASF, LG Chem, and Sumitomo Chemical. There are also companies focused on metals, such as Nippon Steel and JFE, and a few inorganic non-metal materials companies, such as Corning Glass.

The 16 Global Innovation 100 participants in the Chemicals & Materials sector are concentrated in the upper left corner of the map shown in Chart 1.5, indicating relatively small technology size, relatively low technology influence, and strong capabilities in technology globalization.

Most of the Global Innovation 100 in the Chemicals & Materials sector have a high level of technology globalization. on average, they have expanded their technologies to 89 countries/regions, outnumbering the average level of the Global Innovation 100. Among them, BASF has patent applications filed in 120 countries/regions, only second to a few Life Science & Healthcare companies. LG Chem excels in the depth of globalization, with its PCT filings accounting for 12% of all its patents, twice as many as the Global Innovation 100' average.

BASF

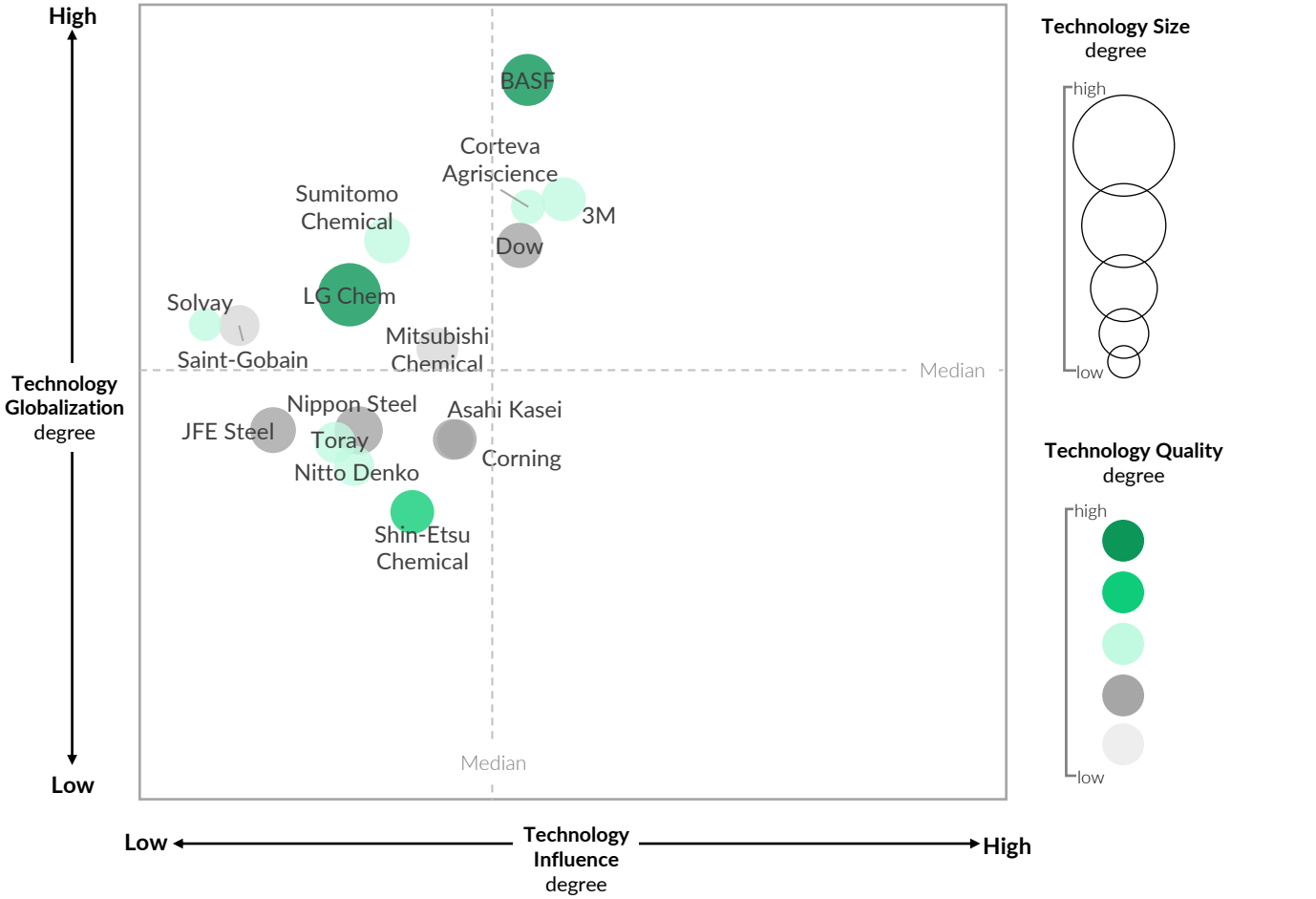
120 countries/regions with patent applications

LG Chemical

percentage of PCT filings: **12%**

2X that of the Global Innovation 100's average

Chart 1.5 Innovation profile of the 2023 Global Innovation 100 in Chemicals & Materials sector



Electronics

In total, there are 16 Global Innovation 100 participants in the Electronics sector. Most of them are manufacturers of consumer electronics such as smartphones, computers and home appliances, including Apple, IBM, Sony, OPPO and LG Electronics.

Most of the Global Innovation 100 in the Electronics sector are clustered in the upper right of the chart shown in Chart 1.6, implying large technology size and outstanding technology influence.

The Global Innovation 100 in the Electronics sector have a larger technology size than counterparts in other sectors. On average, a typical Electronics company has a total number of 330K patent applications. Samsung Electronics ranks second among the Global Innovation 100 for its 884K patent applications. In addition, both Canon and Sony have a total of over 500K patent applications, far outnumbering other Global Innovation 100 participants.

The Global Innovation 100 in the Electronics sector have generally established a strong technology influence, bringing about substantial references and inspirations to the industry's technology development. On average, each Electronics company's patents have been cited a total of 2.67M times, outnumbering the average level of all other sectors, with Samsung, IBM and Canon reaching 5.6, 4.8 and 4.3 million citations, respectively. In terms of average citations, each of Microsoft's individual patents has been cited 20 times, the highest among the 16 companies.

Samsung Electronics

884K patent applications in total

Ranking **2nd** among the Global Innovation 100

IBM

Patents are cited **4.8M** times

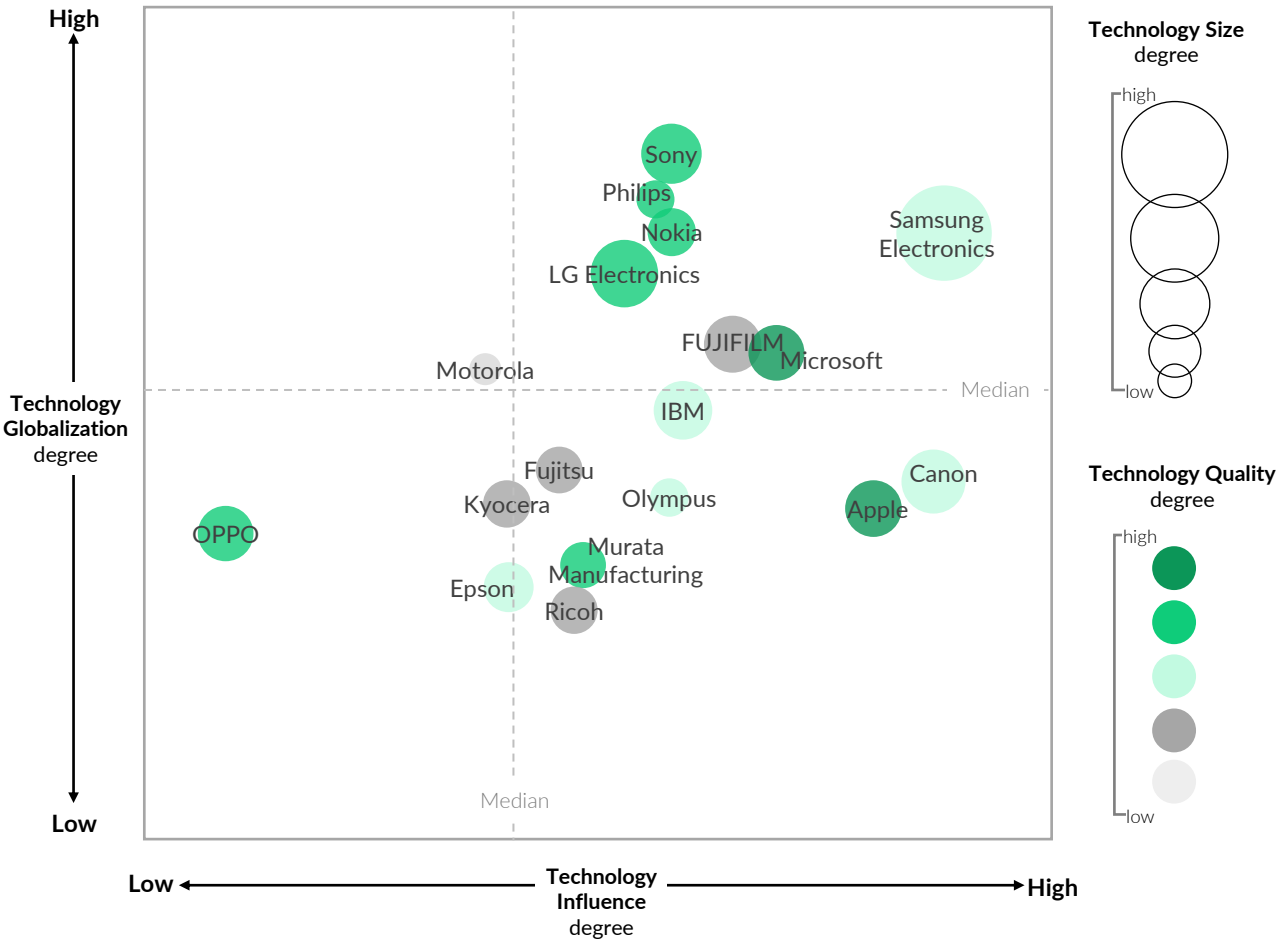
3X the Global Innovation 100's average

Microsoft

Each patent is cited on average **20** times

3X that of the Global Innovation 100's average

Chart 1.6 Innovation profile of 2023 Global Innovation 100 in Electronics sector



Insight 3

The Global Innovation 100 come from 15 countries/regions, while their technology footprints spread across the world.

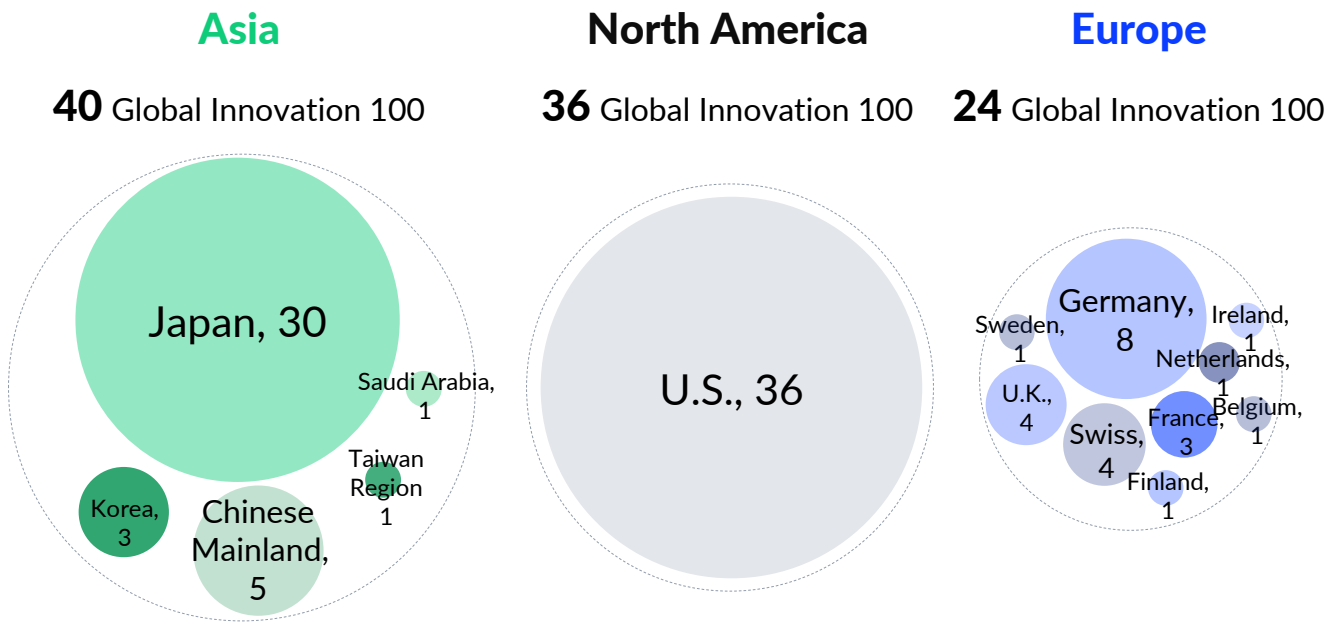
The Global Innovation 100 companies originate from 15 countries/regions, but their patent applications span over 159 countries/regions. Notably, companies from the U.S. and Japan account for 2 thirds of the total Global Innovation 100.

The headquarters of the 2023 Global Innovation 100 are located in 15 countries/regions, including the U.S., Japan, Germany, Chinese Mainland, Switzerland, the United Kingdom, South Korea, France, Netherlands, Ireland, Finland, Sweden, India, Taiwan Region, Belgium and Saudi Arabia. Almost 2/3 of them are from the U.S. and Japan - 36 in the U.S. and 30 in Japan.

At the continental level, this year's Global Innovation 100 are evenly distributed across Asia, North America and Europe. Asia accounts for the largest proportion of 40%, with Japan dominating the list. North America has all their Global Innovation 100 in the U.S. Europe has a balanced distribution, with Germany, the United Kingdom, Switzerland and France the main countries.

In total, the Global Innovation 100 comprise 68K "tech subsidiaries"[2] with a broad global business footprint. They are headquartered in 181 countries/regions around the world, far more than the 15 countries/regions of the overall HQ's. In terms of patent coverage, these 100 companies, along with their "tech subsidiaries", have filed a total of 20.8 million patent applications in more than 159 countries/regions around the world.

Chart 1.7 Headquarter distribution of the 2023 Global Innovation 100



2 "tech subsidiary" or "tech company" indicates those companies that invest in Research & Development and apply for patents. It does not include manufacturing companies or sales companies which makes the "tech subsidiary" number less than the total subsidiaries of the Global Innovation 100 group. Data is from the Patsnap Discovery Database.

GLOBAL INNOVATION 100 2023 **Insight 4**

Europe's and America's Global Innovation 100 participants dominate Life Science & Healthcare sectors, while Asia's are prominent in heavy manufacturing industries.

Different regions show different areas of innovation strength. Asia's Global Innovation 100 excel in Technology Size, North America's enjoy a wider Technology Influence, while Europe's a higher Technology Globalization. In terms of industry, Europe's and North America's Global Innovation 100 dominate the Life Science & Healthcare sector, while Asia's are most prominent in heavy manufacturing industries ranging from materials, equipment and machinery.

in Asia, the 40 participants are shown as relatively large bubbles and appear in the lower left part of the chart shown in Chart 1.8, representing large technology size, relatively weak technology influence and a relatively low level of globalization.

In terms of technology size, these Asia-based Global Innovation 100 participant, on average, have filed a total of 280K patent applications each, much larger than the 100 average. This might be related with the industry focuses of these companies, which are mostly Electronics, Chemicals & Materials, Machineries & Equipment. Among them, Panasonic, Samsung Electronics and Hitachi are the top 3 companies with the largest number of patent applications, with 1.06M, 880K and 730K respectively.

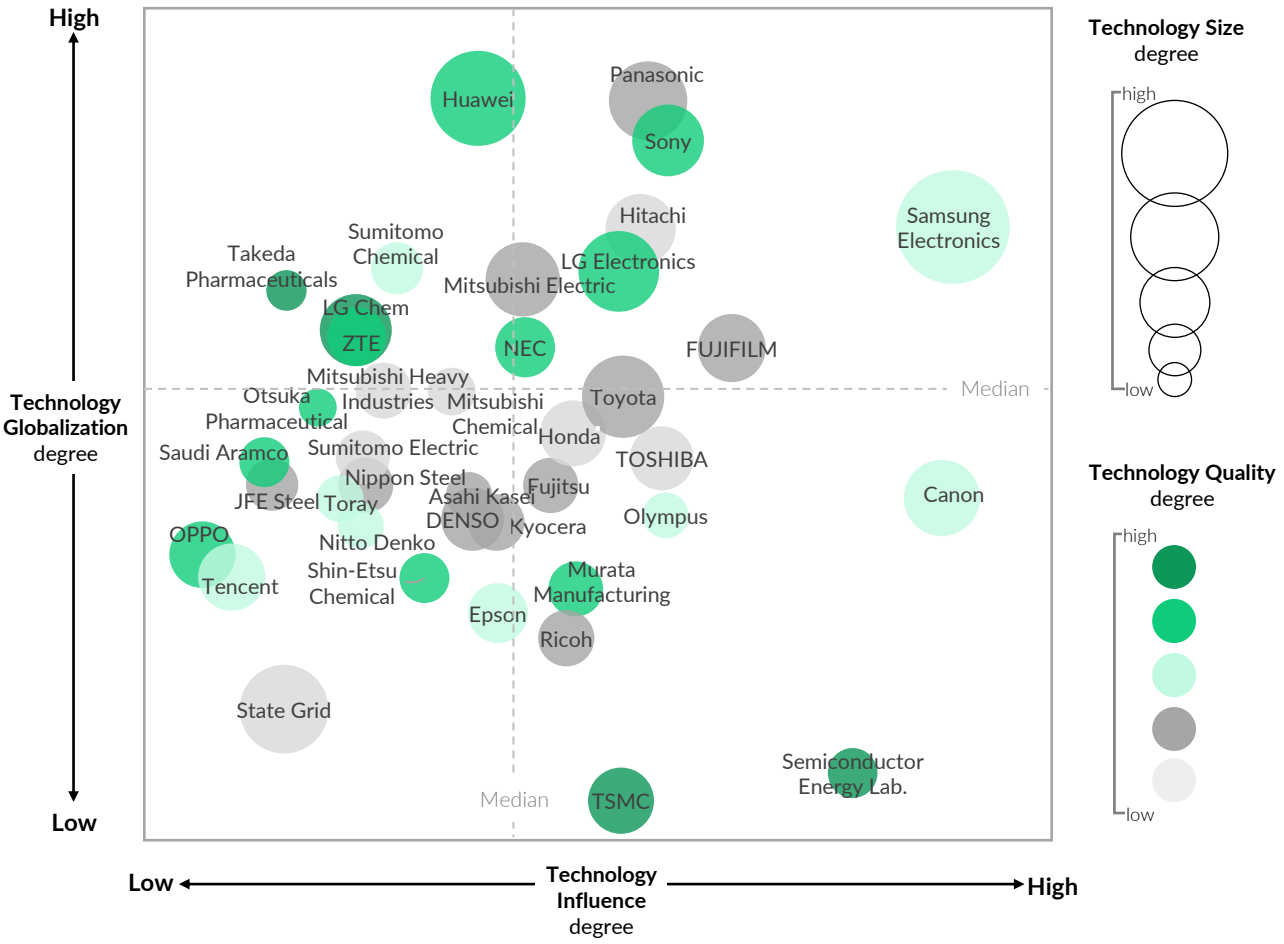
As for technology globalization, Asia's Global Innovation 100 have an average PCT filings percentage of 5.0% and have expanded their technologies to 67 countries/regions on average. Both of these numbers are significantly lower than those of the Global Innovation 100 in America and Europe.

Asia's Global Innovation 100 excel in technology size

Number of patent applications per company:

280K

Chart 1.8 Innovation profile of 2023 Global Innovation 100 from Asia



The 36 companies from North America (all located in the U.S.) are shown in a darker bubble and appear in the upper-right part of the chart shown in Chart 1.9, representing higher technology quality, far-reaching technology influence and outstanding technology globalization.

In terms of technology influence, a typical Global Innovation 100 participant from the U.S. has its patents cited 169K times, almost the same as the average level of the Global Innovation 100 from Asia. However, they are far ahead in terms of the average forward citations of each patent, which reaches 12.6 times per patent, more than double that of Global Innovation 100 from Europe and Asia. Though this may reflect the U.S. IDS requirements.

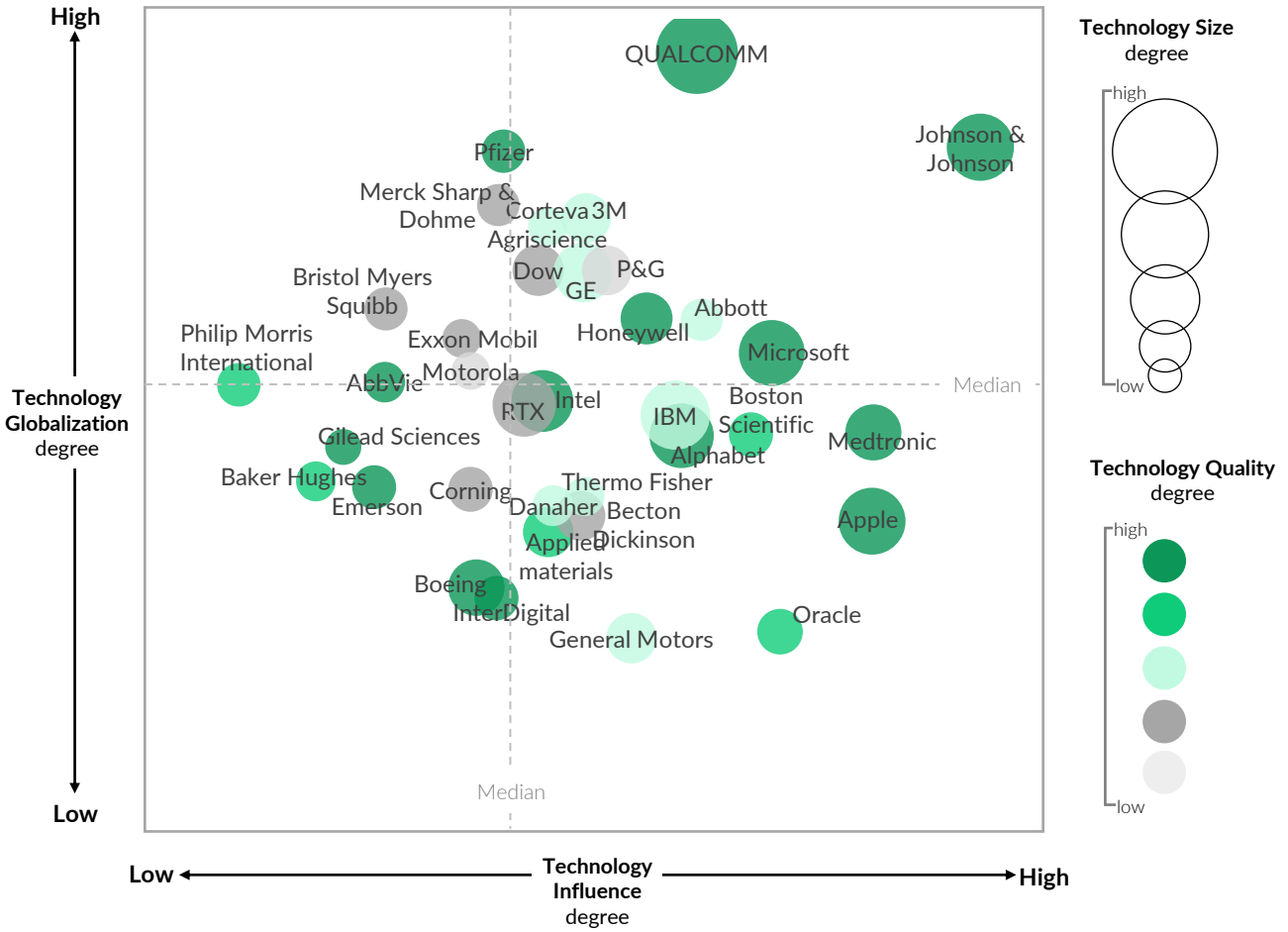
Among all the100 companies, 9 companies have each of their patents cited more than 15 times on average and all of them are from the U.S.. Medtronic, Oracle and Boston Scientific rank as the top 3, with their patents averagely cited 49 times, 30 times and 30 times, respectively.

In terms of technology globalization, a typical Global Innovation 100 participant from the U.S. has an average PCT filings percentage of 7.4%, exceeding the average level of the Global Innovation 100 from Asia and Europe.

U.S.'s Global Innovation 100 have a particularly high technology influence

Each patent is cited **12.6** times on average

Chart 1.9 Innovation profile of the 2023 Global Innovation 100 from North America



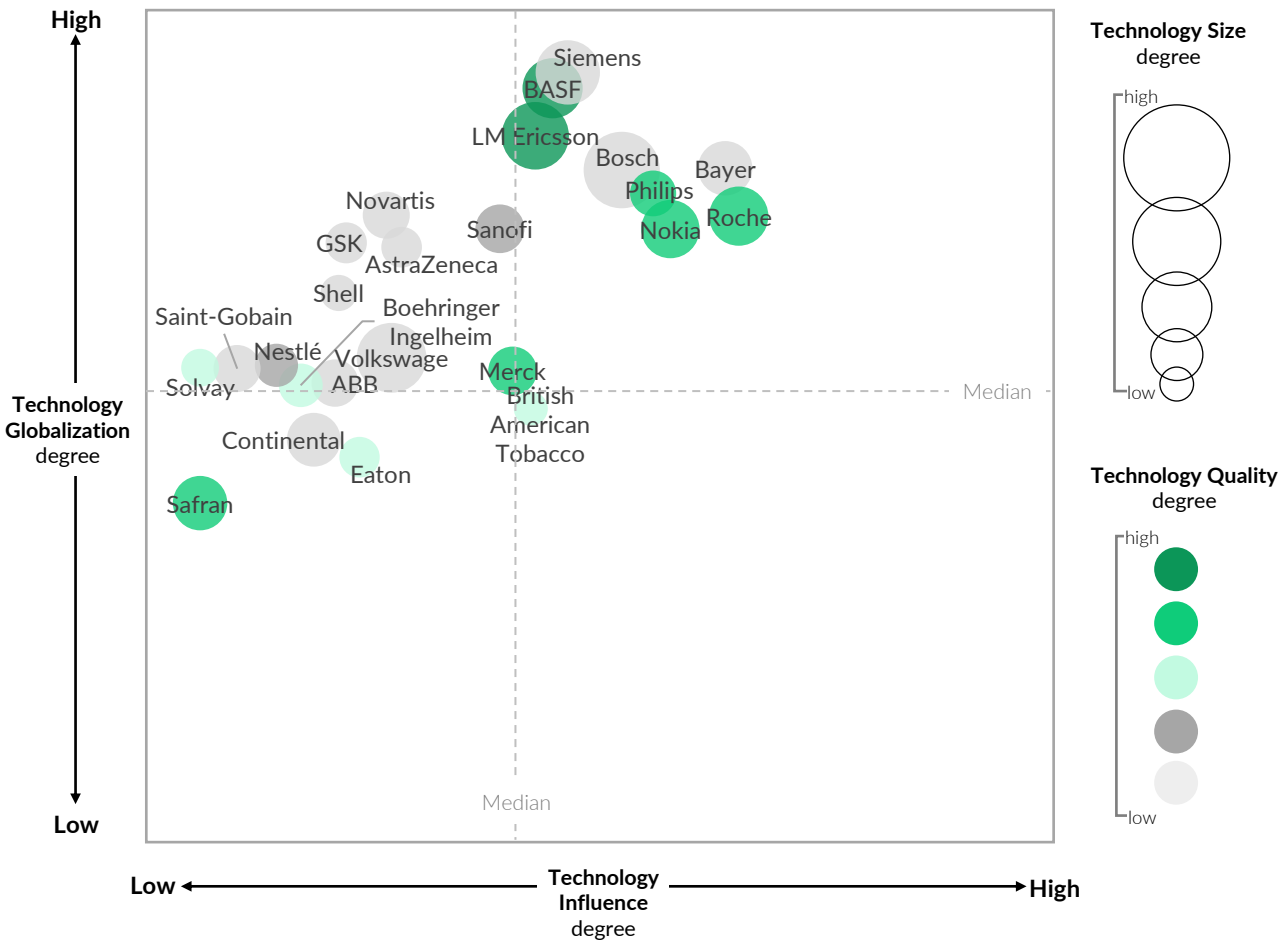
The 24 companies from Europe are shown in relatively smaller and lighter bubbles, and mostly appear in the upper-left quadrant of the chart, representing relatively smaller technology size, outstanding technology globalization and relatively weak technology influence.

In terms of technology globalization, each Global Innovation 100 participant from Europe has 14K PCT filings on average, and a PCT filings percentage of 7.1%. In addition, each Global Innovation 100 participant from Europe has applied for patents in 101 countries/regions on average, far exceeding that of their counterparts in any other continent. Furthermore, out of the total 10 Global Innovation 100 with patent filings in more than 120 countries/regions, 6 are from Europe, namely AstraZeneca, Novartis, Bayer, Sanofi, BASF, and Shell.

Europe's Global Innovation 100 have strong performance in technology globalization

On average, each participant has applied for patents in **101** countries/regions

Chart 1.10 Innovation profile of the 2023 Global Innovation 100 from Europe



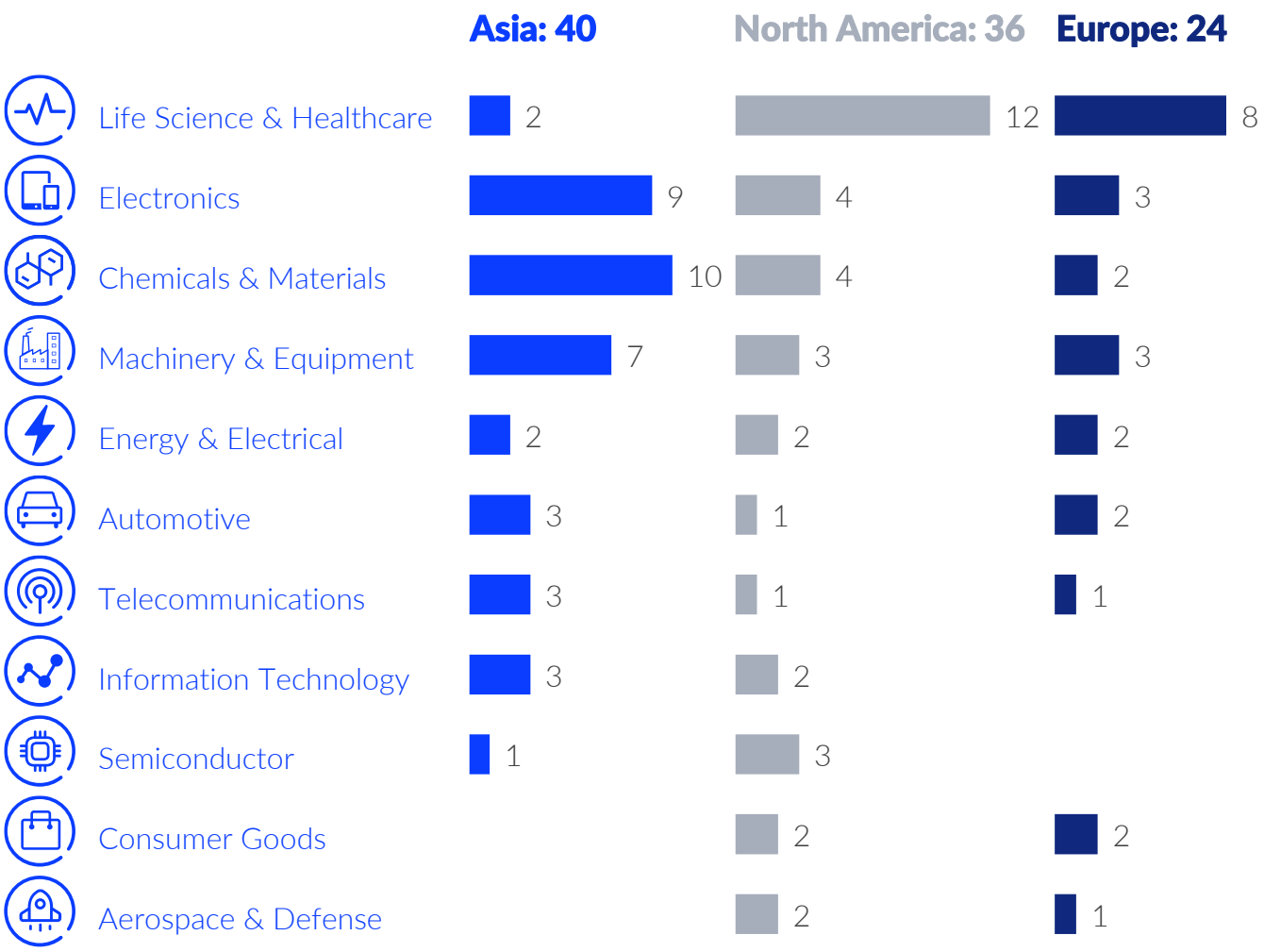
There are significant differences in the industry distribution of the Global Innovation 100 participants across the three continents.

America and Europe have the highest concentration of the Global Innovation 100 in the Life Science & Healthcare sector, with 12 and 8 Global Innovation 100 participants respectively, accounting for 50% and 40% of the industry total.

Asia has the highest concentration of Global Innovation 100 participants in the sectors of Electronics, Machinery & Equipment and Chemicals & Materials, with 9, 7, and 10 of the Global Innovation 100 respectively, accounting for more than half the participants of each of these industries.

In addition, the Global Innovation 100 are evenly distributed in the sectors of Energy & Electrical, Automotive and Telecommunications. In the sectors of Information Technology and Semiconductors, the Global Innovation 100 only come from Asia and America, but none are based in Europe. In the sectors of Consumer Goods and Aerospace & Defense, the Global Innovation 100 only come from America and Europe, but none are based in Asia.

Chart 1.11 Industry Distribution of the 2023 Global Innovation 100 from different continents



GLOBAL INNOVATION 100 2023 **Insight 5**

Technological collaboration is ubiquitous, with the U.S.-based Global Innovation 100 participants placing a strong emphasis on overseas collaboration.

The Global Innovation 100 collaborate closely with each other in technology innovation, with a total of 85,000 joint patent applications. America's Global Innovation 100 prefer cooperation with overseas participants in the Global Innovation 100, while Japan's participants focus more on cooperation with domestic players.

The adoption of open innovation or collaboration is prevalent among the world's top innovators.

The Global Innovation 100 have active and close collaboration in technology innovation with each other. 99 of the Global Innovation 100 participants have had technological cooperation with others on the list. On average, each Global Innovation 100 participant has 26 Global Innovation 100 partners. Such cooperation may exist between parent companies or between their subsidiaries. Those who are most active are Panasonic, Siemens and Hitachi, each with around 50 partners from the list.

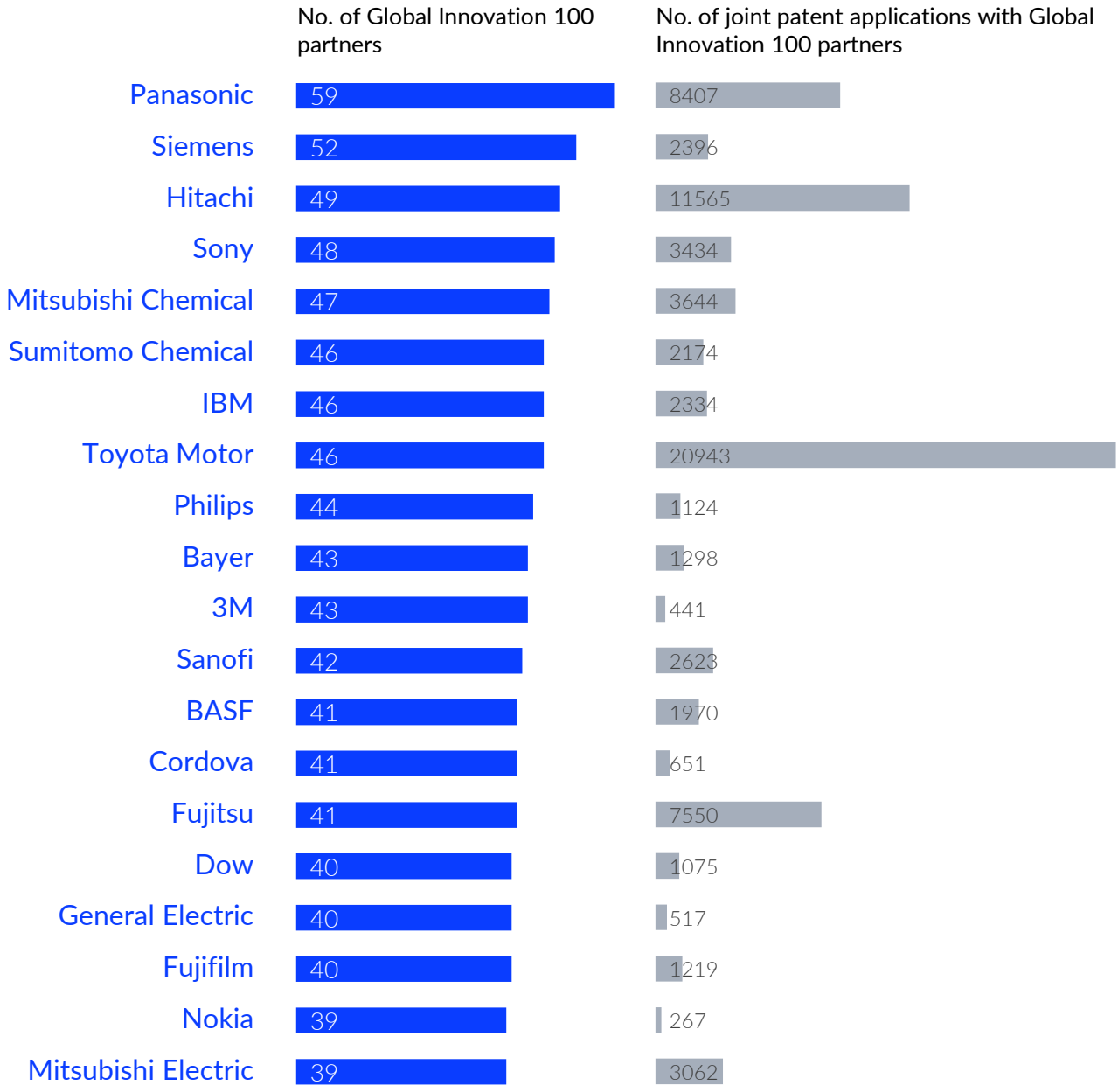
In terms of collaborated technologies, there are a staggering 85K patents co-invented by these partner companies. Those with the most joint patent applications are Toyota, Denso and Hitachi, each with more than 10K joint patent applications.

99/100
Of the Global Innovation 100 have collaborated with others on the list

On average, each of them has
26 Global Innovation 100 partners

The Global Innovation 100 jointly filed a staggering
85K patents

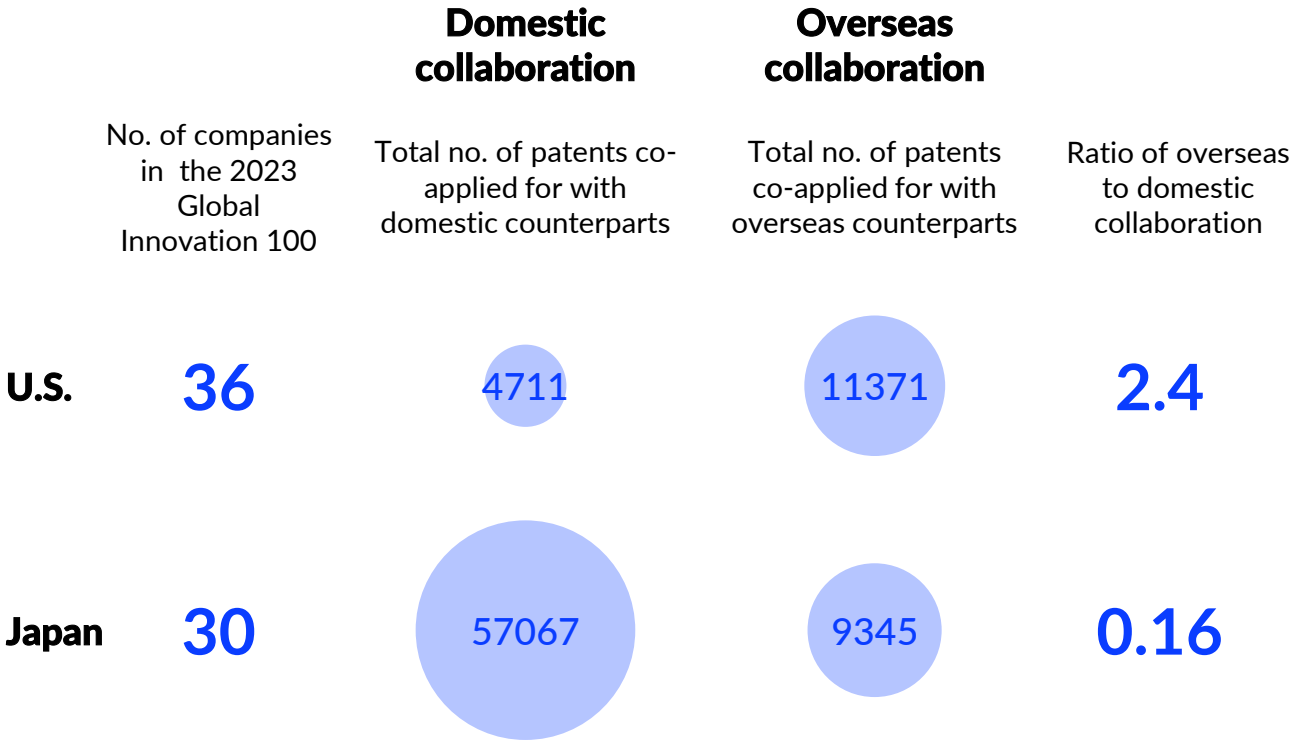
Chart 1.12 Top20 Global Innovation 100 companies with the most Global Innovation 100 partners



Global Innovation 100 participants from different countries show different preferences in their innovation cooperation patterns. For example, the U.S. and Japan, the two countries with the most Global Innovation 100 participants, show markedly different approaches. Global Innovation 100 participants from the U.S are more inclined to jointly file patent applications with overseas counterparts. The U.S. Global Innovation 100 participant's joint patent applications with overseas counterparts are 2.4 times the number of those with domestic counterparts. By contrast, Japan's Global Innovation 100 participants tend to prefer cooperating with domestic counterparts. Their joint patent applications with overseas counterparts are only 1/6 of those with domestic partners.

Similar patterns can be identified if we take a closer look at the top 10 innovation partners with the most joint patent applications. Almost all of the top 10 pairs with the most joint patent applications reflect domestic tech cooperation between the Global Innovation 100 participants from Japan. Toyota Motor and Denso have jointly filed the most patent applications. Denso, a former subsidiary of Toyota, continues to technologically cooperate with Toyota after its independence. The 2 companies have jointly filed 13K patent applications with each other, much larger than any other innovation partners. Similarly, Toyota Motor and Sumitomo Electric have more than 2K joint parent applications, as do NEC and Fujitsu. Among the top 10 pairs, only one pair is outside Japan. They are Abbott and AbbVie in the U.S., who have jointly filed 1.2K patent applications.

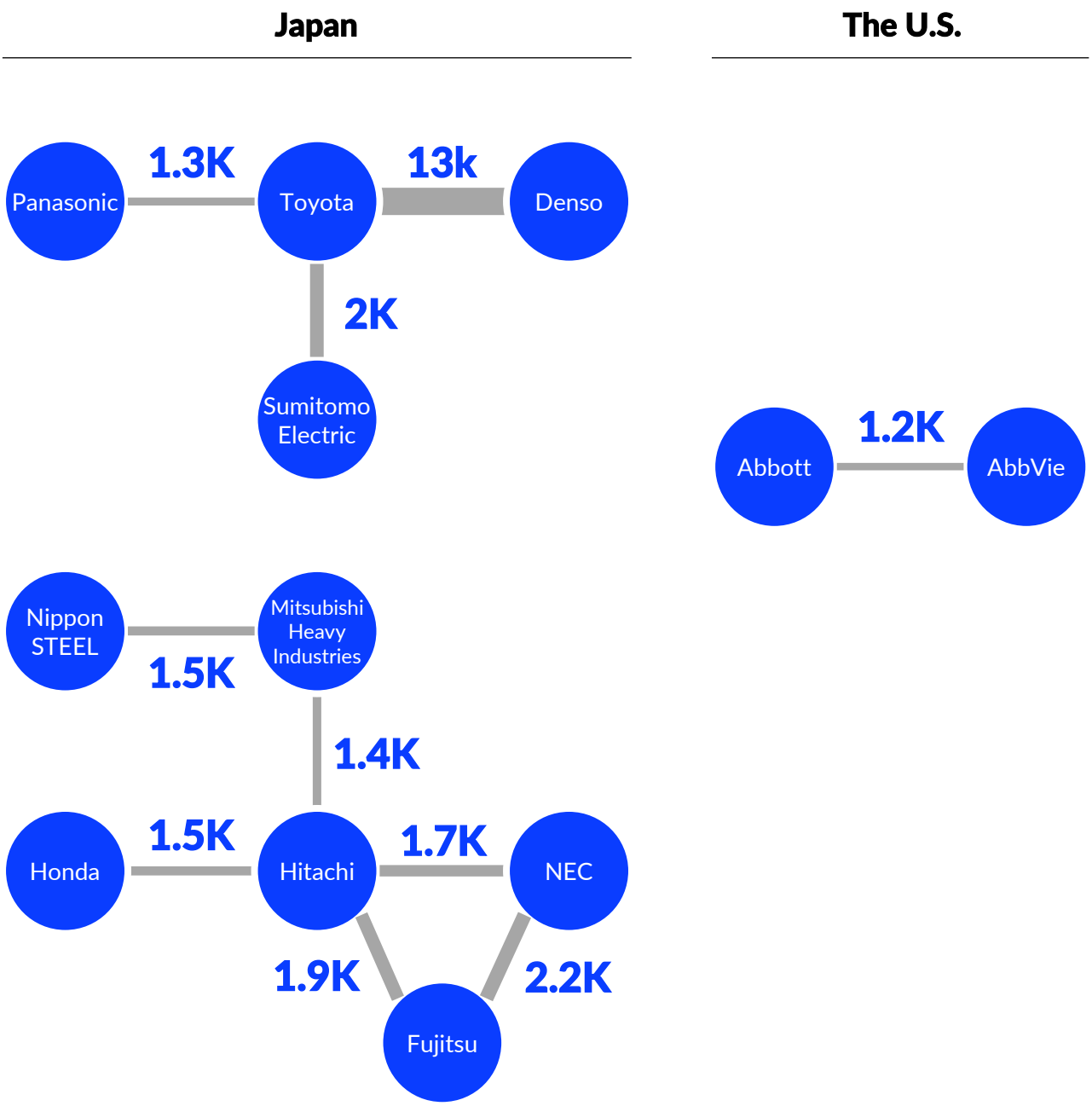
Chart 1.13 Innovation collaboration patterns of Global Innovation 100 participants from the U.S. and Japan



Data Description: All cooperation includes those between parent companies and subsidiaries, and the number of partners shall still be summarized and counted according to the number of groups.

Chart 1.14 TOP 10 innovation partners with the most joint patent applications

Based on the number of joint patent applications



Data Description: All collaborations include those between parent companies and subsidiaries

Insight 6

The Global Innovation 100 are showing signs of a slowing pace of innovation.

The Global Innovation 100 have an average technology growth rate of -2.3% over recent years, slightly lower than overall global technology growth and economic growth. Only one in five of the 100 companies listed has maintained positive growth in their patent applications. Two thirds of the growth we saw took place in Asia.

The Global Innovation 100 are showing signs of a slowdown in their pace of innovation. Their technology growth is slower than global technology growth and economic growth. In the post Covid-19 era, the global economy is recovering, with 2019-2022 GDP CAGR hitting a historically low of 1.9%. Compared to economic growth, technology growth as measured by patent applications has slowed down. In 2022, a total of 7.91M patent applications were filed throughout the year, with a 3-year CAGR of 1.5%. In the same year, the Global Innovation 100 companies contributed to nearly 1M patent applications, showing a slight downward trend, with a CAGR of -2.3% over the same period.

The Global Innovation 100 participants showed diversified growth trends: only one fifth of them still maintaining growth in patent applications, with any positive growth mainly occurring in Asia. Among the Global Innovation 100, only 19 participants maintained positive growth, with 12 from Asia and the remaining 7 from the U.S. All the Global Innovation 100 participants from Europe delivered negative growth. Among the 12 Global Innovation 100 participants from Asia, 5 are from Japan, 4 from Chinese Mainland, 2 from South Korea, and 1 from Taiwan Region. In the past 3 years, only Tencent and TSMC maintained ~20% growth in their technology development.

Chart 1.15 Comparison between the 2023 Global Innovation 100's technology growth and global technology and economic growth

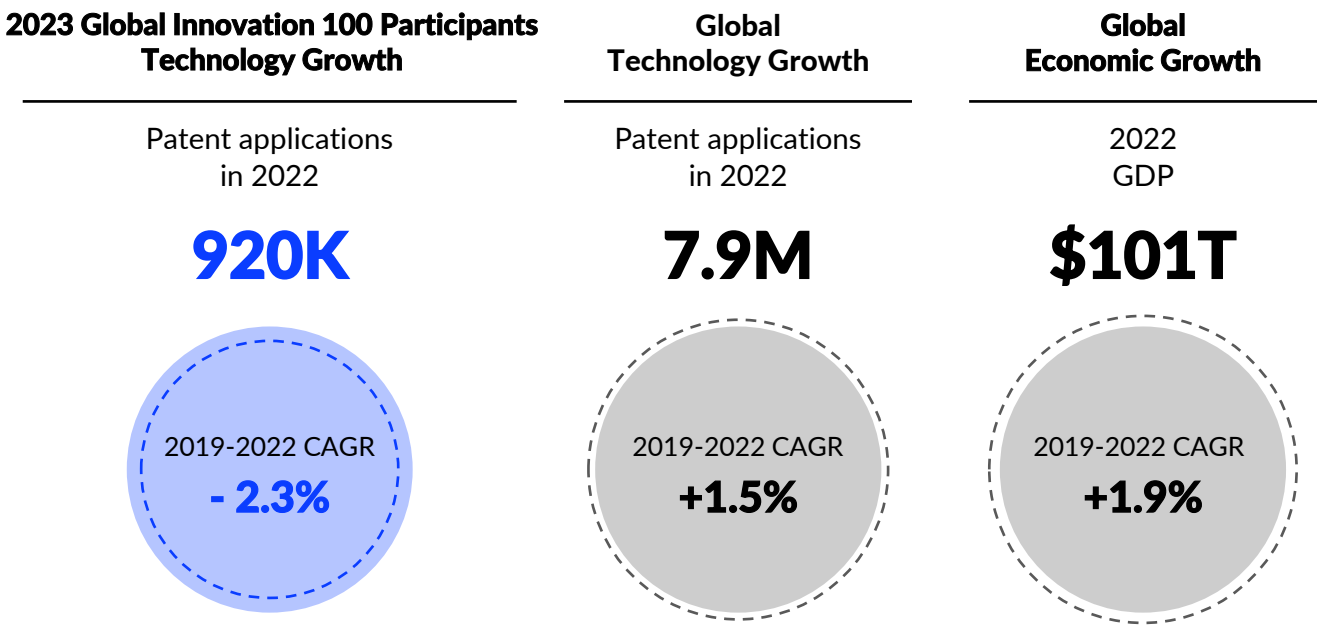


Chart 1.16 The Global Innovation 100 with positive and negative 2019-2022 CAGR

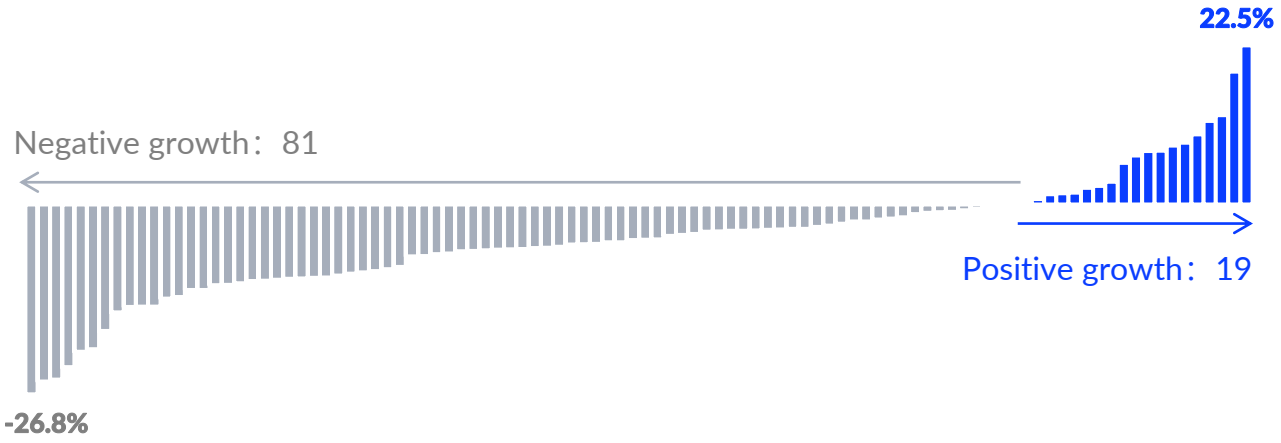


Chart 1.17 19 Global Innovation 100 that have positive 2019-2022 CAGRs

Company	Countries/ regions	Industry	Patent applications in 2022 (10k)	2019-2022 CAGR
Tencent	Chinese Mainland	Information Technology	1.86	22.5%
TSMC	Taiwan Region	Semiconductor	1.46	18.8%
Applied Materials	U.S.	Chemicals & Materials	0.77	12.6%
Becton Dickinson	U.S.	Life Science & Healthcare	0.67	11.8%
State Grid	Chinese Mainland	Energy & Electrical	3.80	9.9%
Huawei	Chinese Mainland	Telecommunications	5.15	8.8%
LG Chemical	Korea	Chemicals & Materials	1.94	8.3%
Nitto Denko	Japan	Chemicals & Materials	0.49	7.6%
Samsung Electronics	Korea	Electronics	6.88	7.6%
Danaher	U.S.	Life Science & Healthcare	0.29	6.9%
Apple	U.S.	Electronics	1.31	5.9%
QUALCOMM	U.S.	Telecommunications	2.95	3.2%
Murata Manufacturing	Japan	Electronics	0.70	2.6%
InterDigital	U.S.	Information Technology	0.33	2.4%
Gilead Sciences	U.S.	Life Science & Healthcare	0.17	1.7%
OPPO	Chinese Mainland	Electronics	1.85	1.6%
NEC	Japan	Telecommunications	1.02	1.5%
Shin-Etsu Chemical	Japan	Chemicals & Materials	0.45	0.8%
JFE	Japan	Chemicals & Materials	0.57	0.4%

GLOBAL INNOVATION 100 2023 **Insight 7**

The Global Innovation 100 are actively pursuing the development of cutting-edge technologies, representing a significant driver of their innovation growth.

The Global Innovation 100 participants also show growth on cutting-edge fields, such as smart grids and biomedical engineering. These "high-growth" tech subsidiaries are mainly concentrated in Asia and the U.S.. Both in-house incubation and external acquisition are used to build their portfolios.

When further investigating the growth of >68K “tech subsidiaries“ of the Global Innovation 100, we examined the key technological fields where Global Innovation 100 participants were developing technologies. We selected ”high-growth” tech subsidiaries based on two criteria: 1) the number of patent applications in 2022 is greater than 20; and 2) their 2019-2022 patent application CAGR>20%. Based on these criteria, we identified a total of 336 "high-growth" tech subsidiaries.

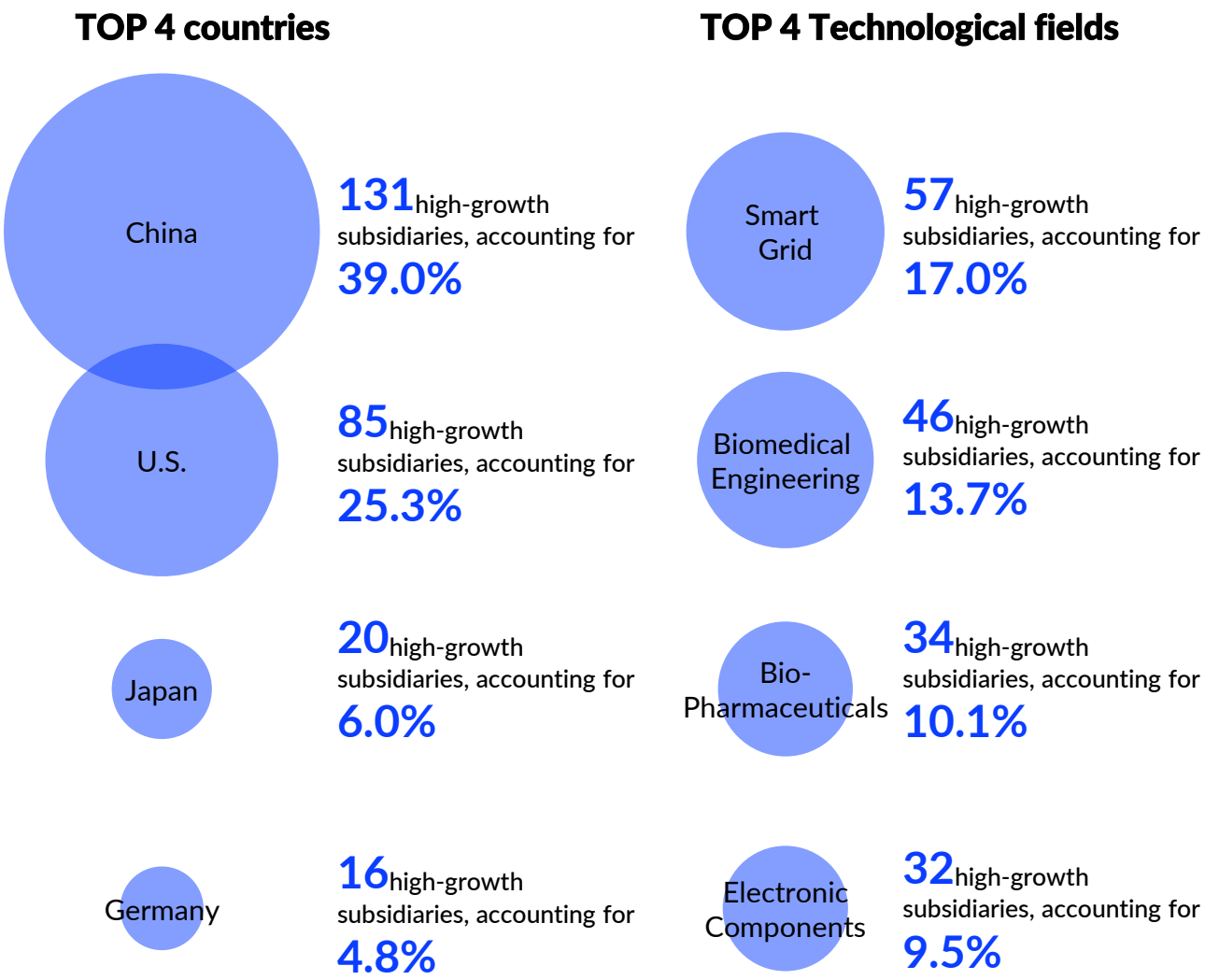
In terms of regional distribution, these 336 "high-growth" tech subsidiaries are concentrated in China and the U.S. China is in a leading position with 131 "high-growth" tech subsidiaries, accounting for nearly 40% of the total, while the U.S. is home to 85, followed by Japan and Germany. It should be noted that the region where a subsidiary is located is not always equivalent to the region where its parent company is located.

In terms of technology fields, the TOP 4 technological fields selected by these 336 "high-growth" tech subsidiaries are smart grids, biomedical engineering, biopharmaceuticals, and electronic components. The top 4 technological fields account for 50% of all the fields chosen by these “high-growth” subsidiaries.

These high-growth tech subsidiaries are developing technologies through both internal incubation and external acquisitions. For example, Honeywell, a traditional Machinery & Equipment group focused on heavy industry, is exploring integrated solutions of quantum computing software and hardware through both internal incubation and external mergers and acquisitions. Takeda Pharmaceutical is developing cutting-edge immunotherapy technologies through the acquisition of GammaDelta. Huawei has incubated Huawei Digital Power to better focus on the fields of new energy and smart grids.

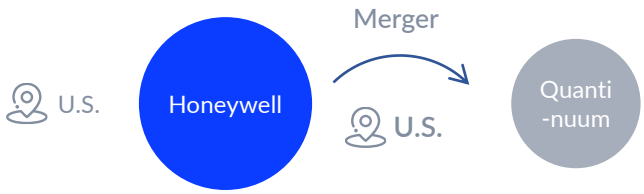
Chart 1.18 Major countries and technological fields of the Global Innovation 100's high-growth subsidiaries

We define "high-growth" as: number of patent applications in 2022 >20 and 2019-2022 CAGR >20%



Source: Patsnap
Note: All statistics up to 2023.07.31; all statistics based on publication date

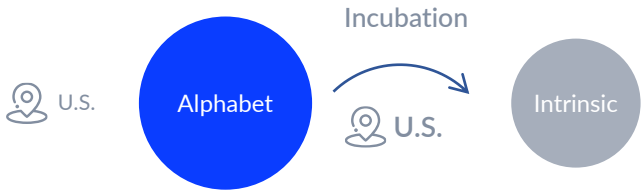
Chart 1.19 Representative high-growth subsidiaries of the Global Innovation 100



A merger by Honeywell Quantum Solutions, Honeywell's quantum computing division, and Cambridge Quantum in 2021, Quantinuum has become the world's leading integrated quantum computing hardware and software company

39 patent applications in 2022

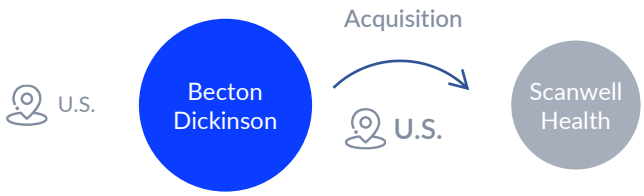
YOY growth rate **117%**



Incubated from Alphabet's Research Department X in 2021, Intrinsic is dedicated to software that trains industrial robots with AI technology

142 patent applications in 2022

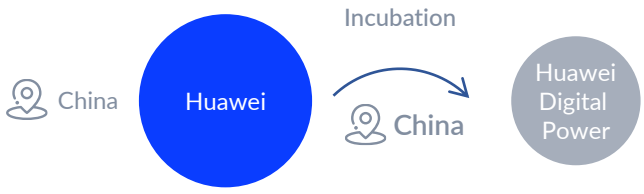
CAGR **37%**



Founded in 2018 and acquired by BD in 2021, Scanwell Health is dedicated to providing convenient and accessible home testing reagents and mobile phone-based testing and diagnostic solutions

29 patent applications in 2022

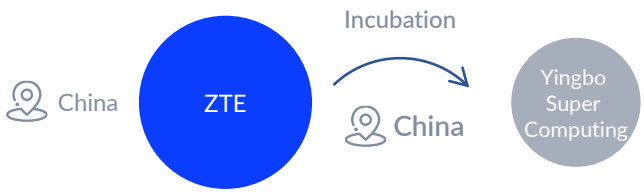
CAGR **73%**



Founded in 2021, Huawei Digital Power is dedicated to creating digital energy products and solutions based on digital technologies and power electrics

1816 patent applications in 2022

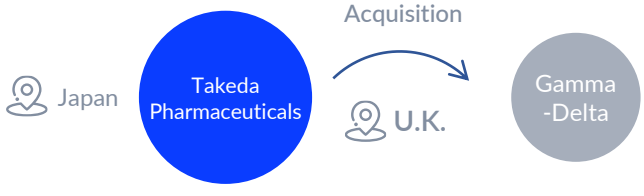
CAGR **230%**



Founded in 2018, Yingbo Super Computing is dedicated to developing full-stack technology for autonomous driving systems, and serving as a hardware and software provider of domain controllers, in-vehicle real-time operating systems, V2X, etc.

78 patent applications in 2022

Patent application CAGR **87%**



Founded in 2016 and acquired by Takeda Pharmaceutical in 2021, Gamma-Delta is dedicated to γδ T-cell-based immunotherapy, the world's latest hot area in cancer treatment

93 patent applications in 2022

3-year CAGR **104%**

Source: Patsnap

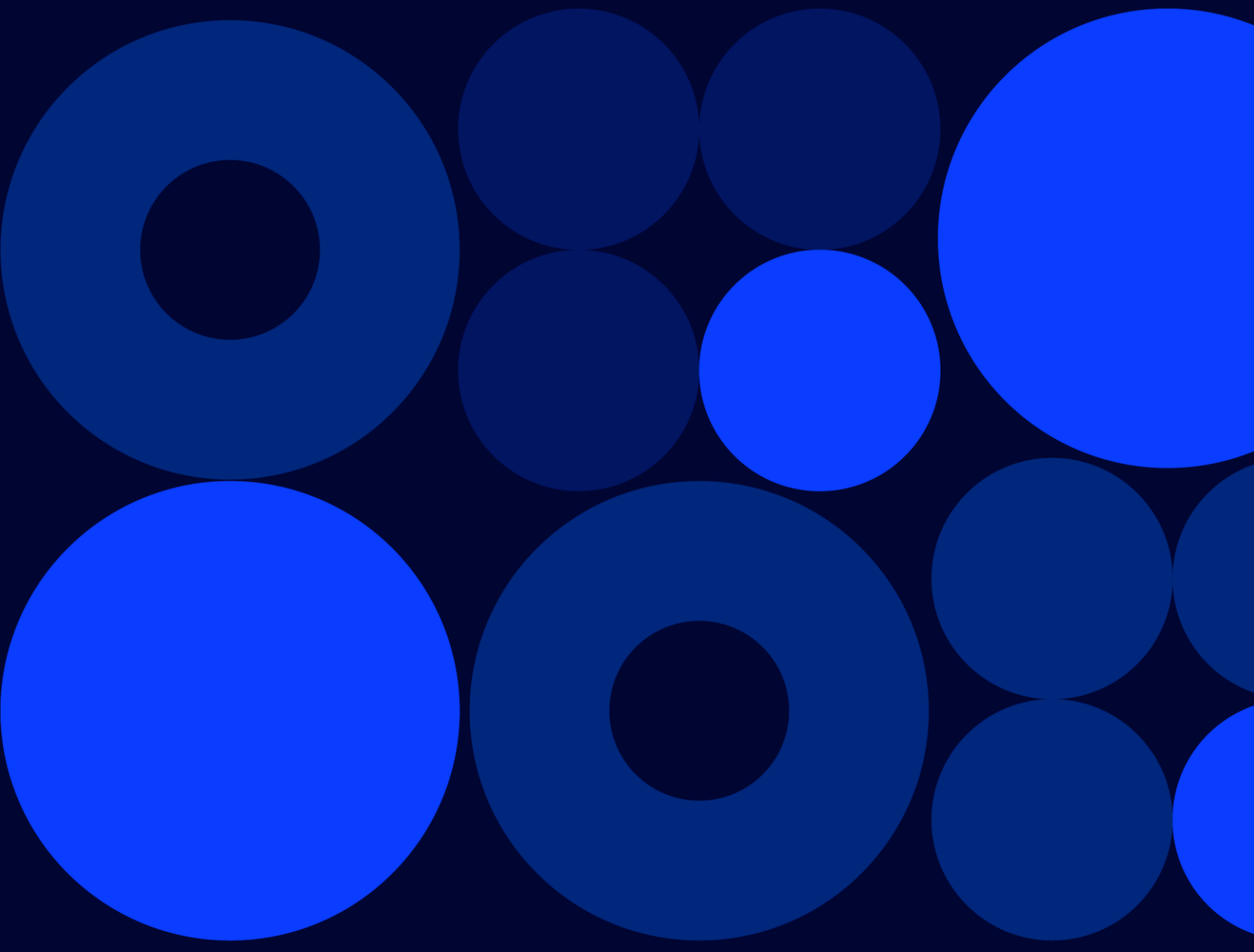
Note: All statistics as of 2023.07.31; all statistics based on publication day

GLOBAL INNOVATION 100
2023

C

What are they innovating?

(Illustrating the innovation capabilities of 10 selected participants)



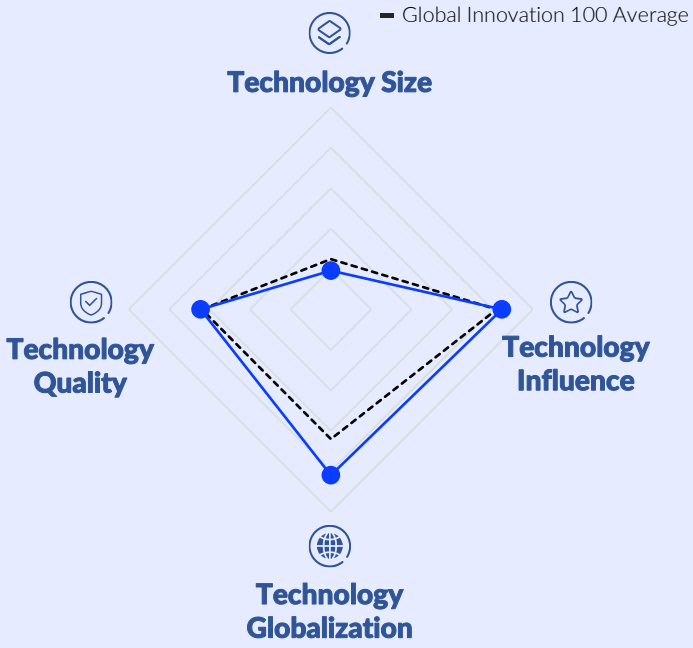
3M

U.S. Chemicals & Materials

GLOBAL INNOVATION 100 2023

3M is a pioneering company committed to revolutionizing material technology. It has established a competitive portfolio of material products and technologies that can be utilized across various sectors, including healthcare, automotive, energy, home, and communications. Its technologies have a global presence, serving up to 99 countries/regions worldwide.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)

21

36

Invention application percentage (%)

92.9%

93.7%

Average forward citations per patent

10

8.6

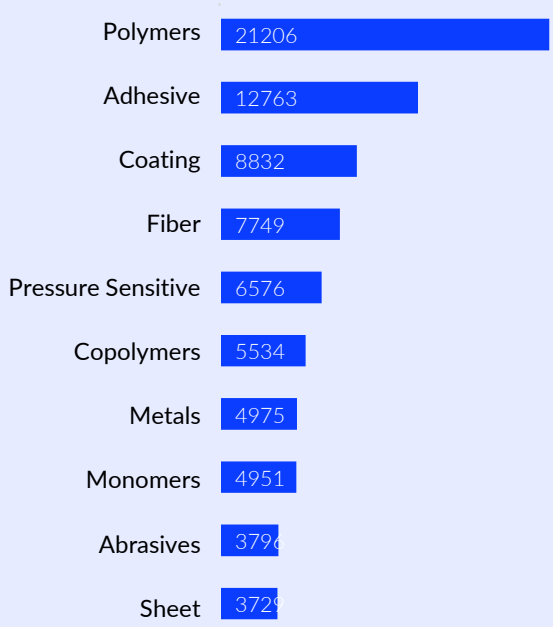
Countries/regions covered

99

81

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

Technology topics with the fastest growing patent applications

Adhesive dressings

921 patent applications in the past 3 years

CAGR **40.2%**

Additive manufacturing

424 patent applications in the past 3 years

CAGR **81.2%**

orthodontics

388 patent applications in the past 3 years

CAGR **15.8%**

Source: Patsnap

Note: All statistics up to 2023.07.31; all statistics based on publication day

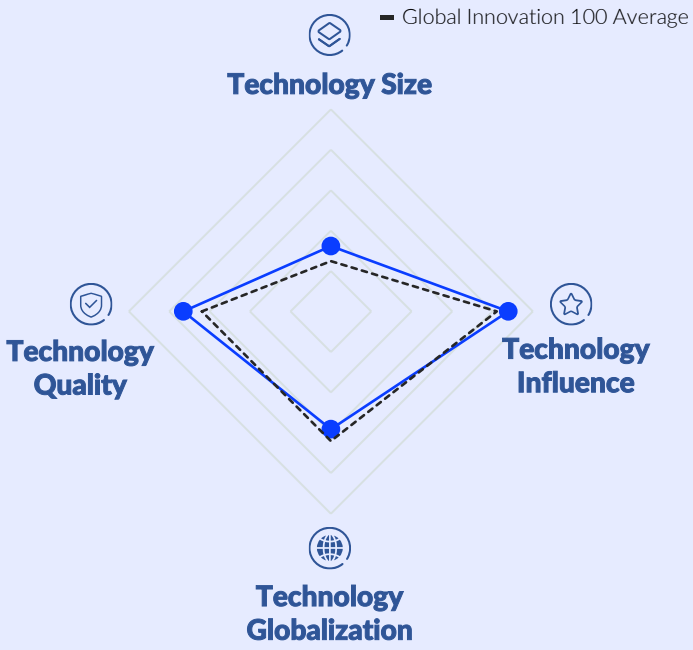
ALPHABET Alphabet

GLOBAL INNOVATION 100 2023

U.S. Information Technology

Alphabet is a worldwide tech powerhouse with a presence in multiple IT domains, including internet search, cloud computing, AI, and more. The company wields a significant impact on the global internet landscape, with its patents collectively cited over 1.5 million times. Currently, Alphabet is actively engaged in the exploration of AI technologies for applications such as autonomous driving, smart cities and industrial connectivity.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)
49
36

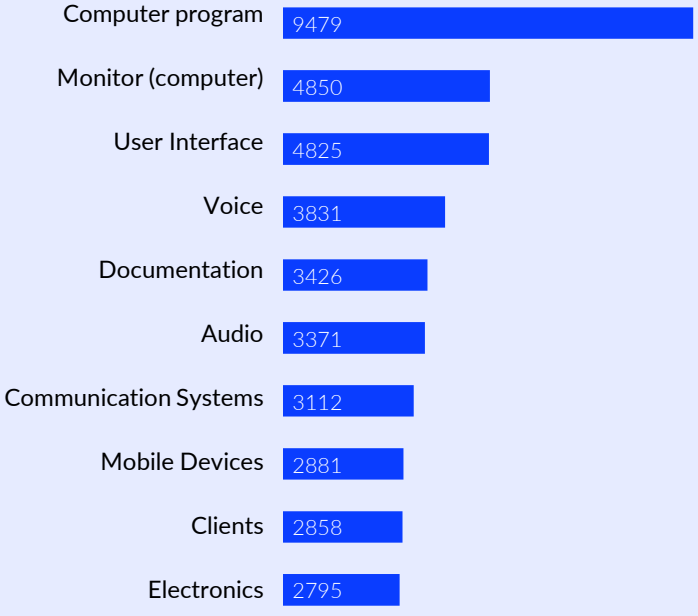
Grant rate of invention applications (%)
45.3%
22.2%

Average forward citations of top 10 patents
1063
791

PCT filings (k)
11
12

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Intrinsic

Incubated in 2021, dedicated to the software that trains industrial robots with AI technology

142 patent applications in 2022

CAGR73%

Raxium

Founded in 2017, acquired in 2022, dedicated to the development of monolithic integrated Micro LEDs

29 patent applications in 2022

3-year CAGR **54%**

Sidewalk Labs LLC

Founded in 2014, a smart city practitioner who once pioneered the construction of the Toronto Waterfront project

37 patent applications in 2022

4-year CAGR **74%**

Source: Patsnap

Note: All statistics up to 2023.07.31; all statistics based on publication day

Saudi Aramco

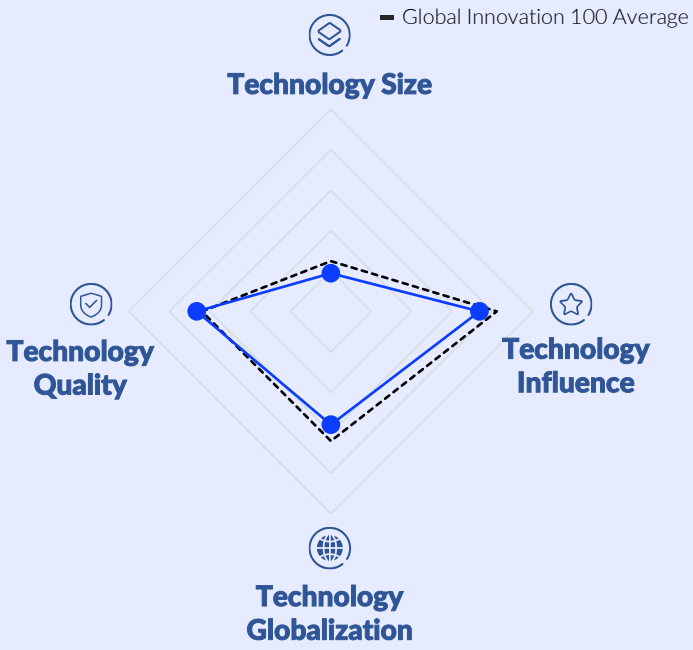
aramco

GLOBAL INNOVATION 100 2023

Saudi Arabia Energy & Electrical

Saudi Aramco, the sole representative from the Middle East in the Global Innovation 100 list, has meticulously developed a comprehensive technology ecosystem from gas exploration and extraction to processing. The company is steadfast in its pursuit of pioneering research and development initiatives aimed at harnessing sustainable energy resources.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)
19
36

Grant rate of invention applications (%)
37.3%
22.2%

Average forward citations per patent
4
8.6

PCT filings (k)
8
12

Technology Characteristics

Top10 Technology Topics (Unit: pcs)

Innovation Trends

Technology topics with the fastest growing patent applications

bisphenol
43 patent applications in 2022
3-year CAGR **23.2%**

aralkyl group
53 patent applications in 2022
3-year CAGR **15.2%**

siloxane
67 patent applications in 2022
3-year CAGR **12.5%**

Source: Patsnap
Note: all statistics up to 2023.07.31; all statistics based on publication day

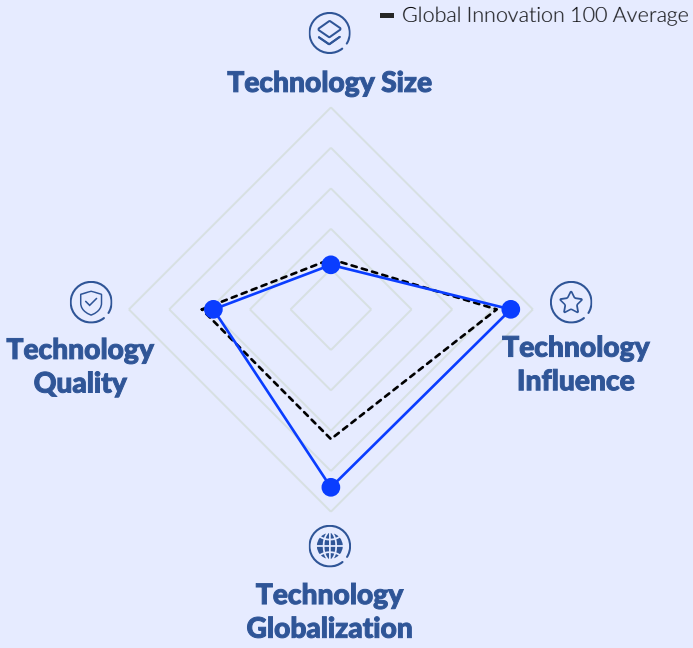
Bayer

Germany Life Science & Healthcare

GLOBAL INNOVATION 100 2023

Bayer is a prominent global innovator in the Life Science & Healthcare sector, boasting a wide-reaching presence across 126 countries/regions and a significant technological impact, as evidenced by its patents being cited 1.7 million times. The company is strategically broadening its technological footprint through frequent acquisitions, entering emerging domains such as gene therapy, cell therapy, and women's healthcare.

Innovation Capability



Key Indicators

Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Patent applications (k)

357

208

Invention application percentage (%)

97.6%

93.7%

Total forward citations (m)

2.0

1.8

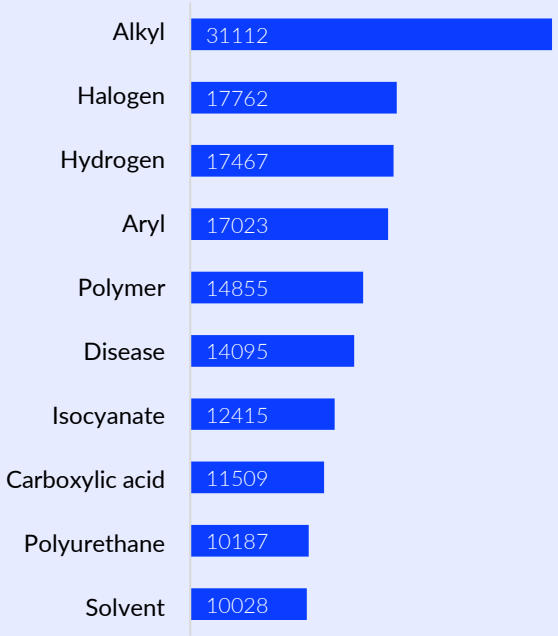
Countries/regions covered

126

81

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Asklepios

Acquired in 2020 to broaden Bayer's innovation base in cell and gene therapy

68 patent applications in 2022

3-year CAGR **125%**

KaNDy

Acquired in 2020 to expand Bayer's drug development pipeline in women's healthcare

20 patent applications in 2022

3-year CAGR **49%**

BlueRock

Acquired in 2019 to build Bayer's leading position in cell therapy

23 patent applications in 2022

Source: Patsnap

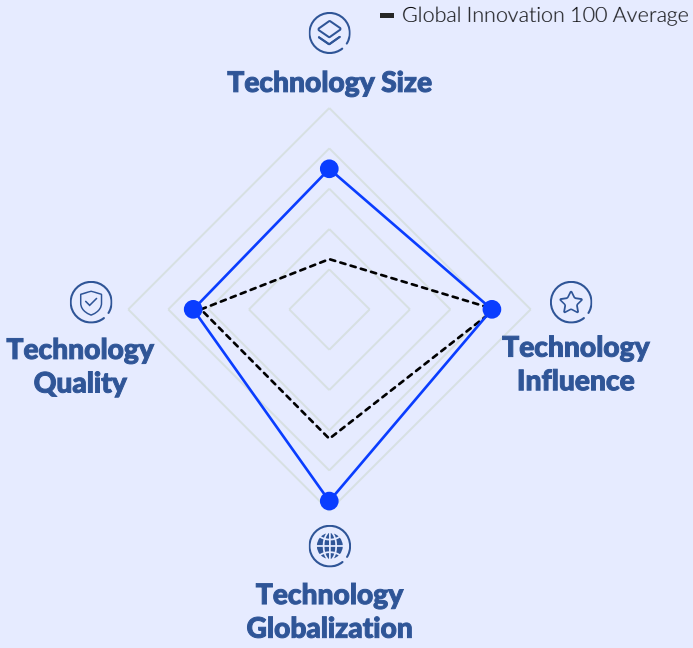
Note: All statistics up to 2023.07.31; all statistics based on publication day

Huawei

Chinese Mainland Telecommunications

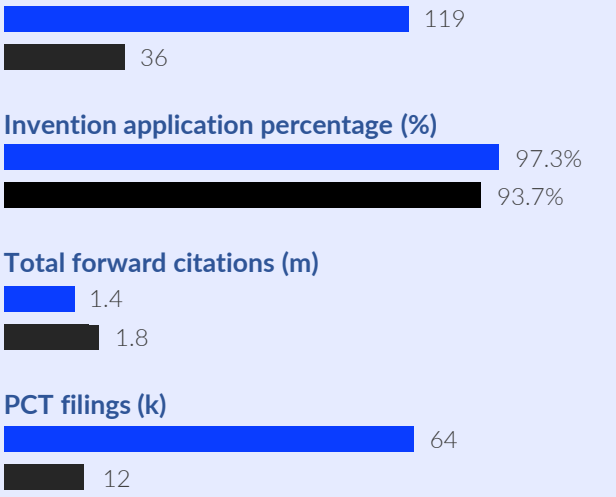
Huawei is one of the world's largest R&D entities. It has become the "Quadrilateral Warrior" of innovation in the Telecommunications sector with its global presence in 65 countries/regions and over 1M forward citations. The company is gradually incubating new technologies such as cloud computing, digitalized use of renewable energy, electric vehicles, and so forth.

Innovation Capability



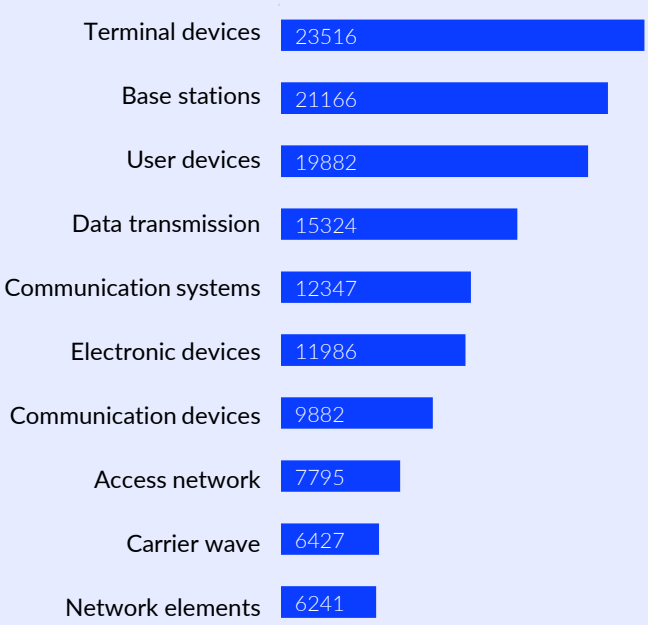
Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages



Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Huawei Cloud Computing

Founded in 2019

679 patent applications in 2022

3-year CAGR of **509%**

Huawei Digital Power

Founded in 2021

1688 patent applications in 2022

3-year CAGR of **726%**

Source: Patsnap

Note: All statistics up to 2023.07.31; all statistics based on publication day

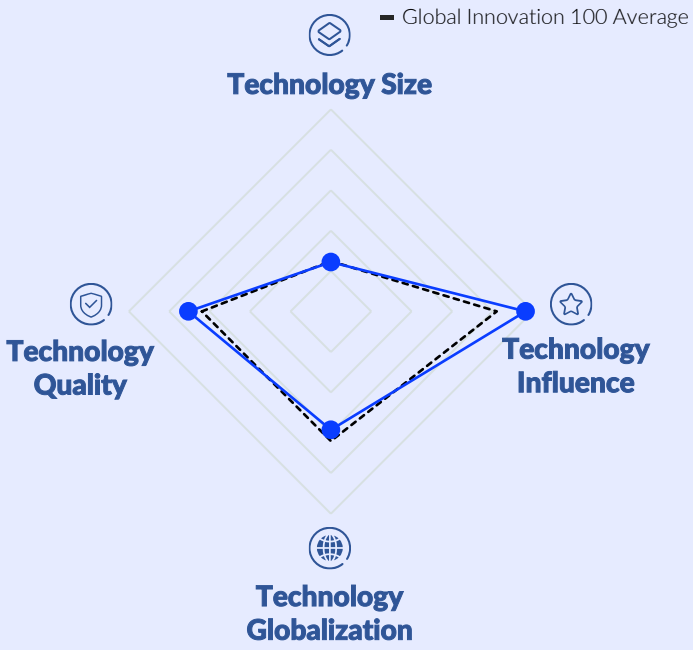
Medtronic Medtronic

GLOBAL INNOVATION 100 2023

U.S. Life Science & Healthcare

Medtronic is a prominent medical device conglomerate known for its diverse range of products, relentless commitment to innovation, and global footprint. It has established a significant technological influence in the realm of Life Science & Healthcare, with an average of 49 forward citations for each of its patents. In recent years, it has been strengthening technological competitiveness in emerging medical devices through proactive acquisitions.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)

36
36

Invention application percentage (%)

97.6%
93.7%

Total forward citations (m)

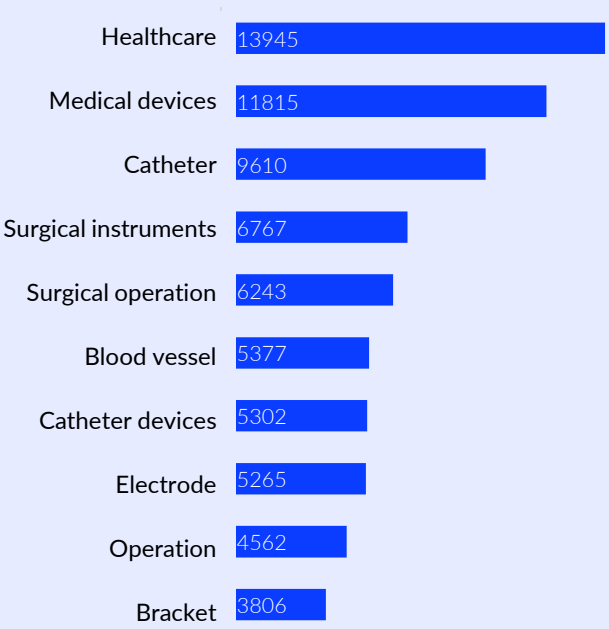
6.2
1.8

Countries/regions covered

64
81

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Mazor Robotics

Founded in Israel in 2010 as a surgical robot startup, acquired in 2018

142 patent applications in 2022

3-year CAGR **83%**

EOFlow

Founded in South Korea in 2021, acquired in 2023, dedicated to the wearable insulin delivery device

101 patent applications in 2022

3-year CAGR of **143%**

Intersect ENT

Founded in the U.S. in 2003, acquired in 2021, the first sinus implant device with FDA approval

257 patent applications in total

Source: Patsnap

Note: All statistics up to 2023.07.31; all statistics based on publication day

Samsung Electronics

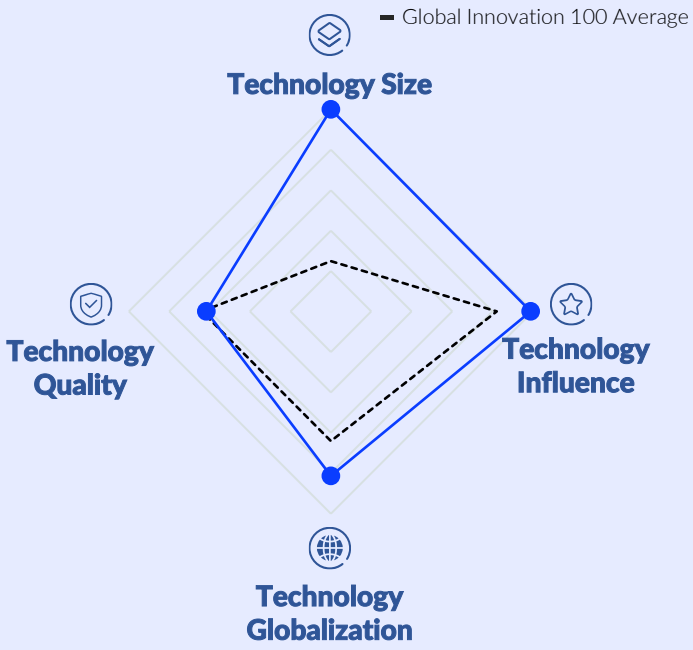
SAMSUNG

GLOBAL INNOVATION 100 2023

Korea Electronics

Samsung Electronics is a global electronics giant with a large technology volume, which centers on diversified electronic products as well as strong technology capabilities in semiconductors and telecommunications. The company has built up a global technology influence for having its patents cited 5.59 million times. In recent years, it is also maintaining an active technology growth.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid patents in the past 5 years (k)

149

19

Grant rate of invention applications (%)

29.5%

22.2%

Total forward citations (m)

5.8

1.8

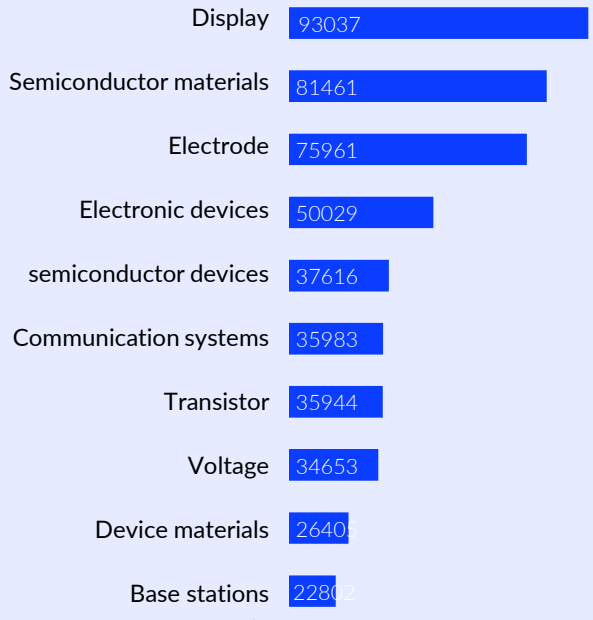
PCT filings (k)

35

12

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

Technology topics with the fastest growing patent applications

Electrosolid devices

11,855 patent applications in 2022

3-year CAGR **21.2%**

Connection management

1,891 patent applications in 2022

3-year CAGR **18.7%**

Computational model

2,203 patent applications in the past 3 years

CAGR **27.6%**

Source: Patsnap

Note: All statistics up to 2023.07.31; all statistics based on publication day

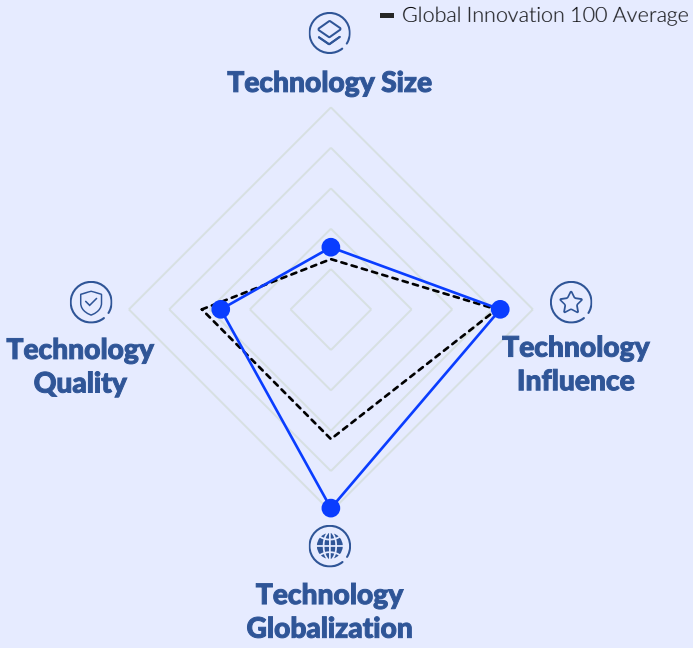
Siemens SIEMENS

GLOBAL INNOVATION 100 2023

Germany Machinery & Equipment

Siemens is a major player in the Machinery & Equipment sector, with an expansive portfolio of diverse business segments, including energy, healthcare, home and electrical devices. It boasts a significant global technology presence, with patent filings in over 100 countries/regions. In recent years, Siemens has intensified its focus on integrating hardware and software, delving into areas like digitalization, industrial internet, and smart infrastructure.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)

47

36

Invention application percentage (%)

93.3%

93.7%

Total forward citations (m)

2.4

1.8

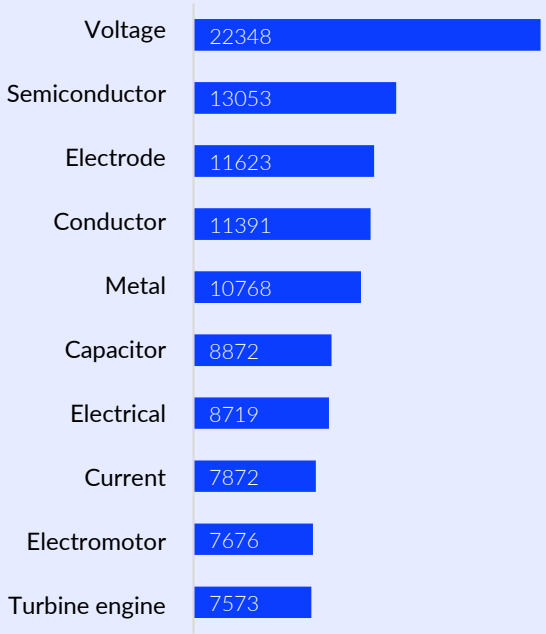
Countries/regions covered

101

81

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Wattsense

Founded in France in **2017** as a provider of plug-and-play IoT management system

Acquired by Siemens in **2021**

SenseEye

Founded in the UK in **2014** as a provider of mechanical diagnostic tool

Acquired by Siemens in **2022**

21 patent applications in total

Avatar Integrated Systems

Founded in the U.S. in **2017** as a developer of IC layout and wiring software

acquired by Siemens in **2020** to expand Siemens EDA's business

Source: PatSnap

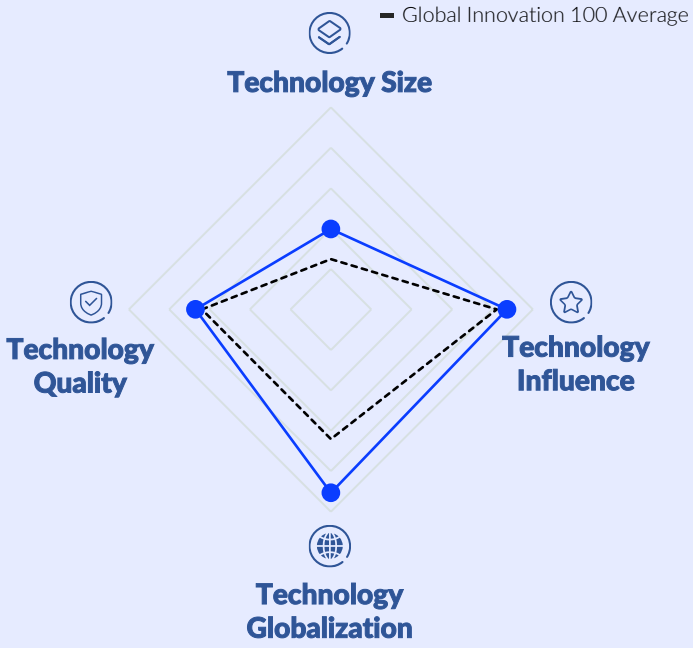
Note: All statistics up to 2023.07.31; all statistics based on publication day

Sony

Japan Electronics

Sony is a Japanese electronics powerhouse renowned for its state-of-the-art technology. Its 500,000 patent applications to date secure the company the 8th place among the Global Innovation 100. With a robust reservoir of technological expertise spanning the realms of graphics, video, audio, and entertainment, the company has successfully extended its technological footprint to an extensive network of 94 countries/regions worldwide.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Valid inventions (k)

65
36

Invention application percentage (%)

90.3%
93.7%

Average forward citations per patent

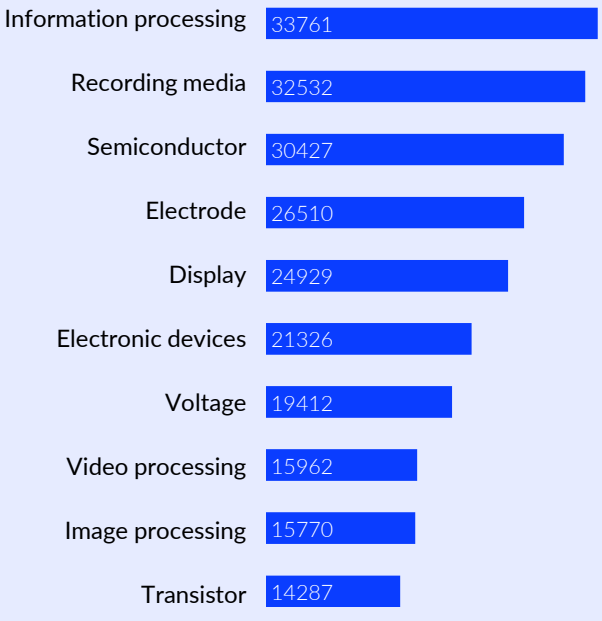
8.5
8.6

Countries/regions covered

94
81

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

Technology topics with the fastest growing patent applications

Photoelectric conversion

976 patent applications in 2022
3-year CAGR **18.3%**

Audio signal

97 patent applications in 2022
3-year CAGR **15.5%**

Control circuit

101 patent applications in 2022
3-year CAGR **14.1%**

Source: PatSnap
Note: All statistics up to 2023.07.31; all statistics based on publication day

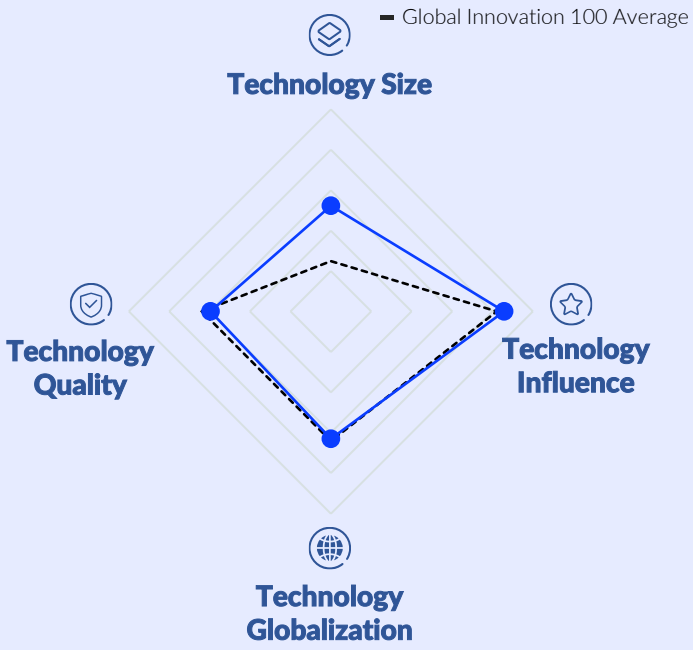
Toyota

Japan Automotive

GLOBAL INNOVATION 100 2023

Toyota, a century-old Japanese automotive group, is known for its pioneering manufacturing principles and a wide range of diversified products. It has accumulated a total of 460K patent applications, establishing itself as a global leader, particularly in hybrid power and hydrogen energy technologies fields. In response to the evolving electric vehicle (EV) industry, Toyota is proactively collaborating with smart vehicle companies in both the U.S. and China.

Innovation Capability



Key Indicators Global Innovation 100 Average

selected metrics in each dimension to illustrate advantages

Patent applications (k)
462
208

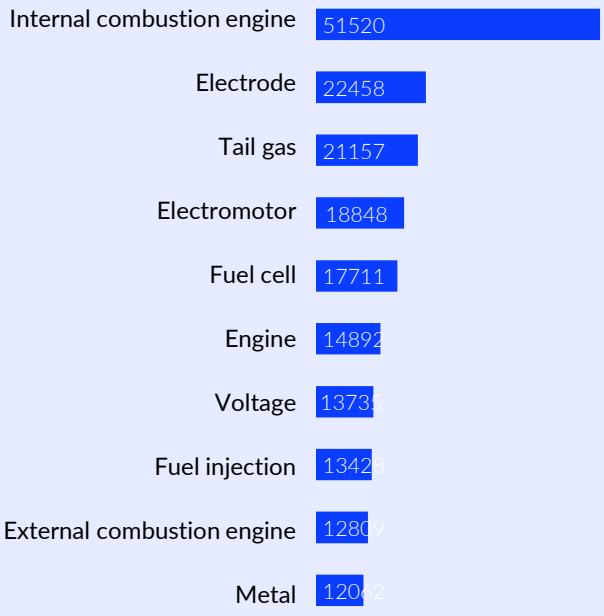
Grant rate of invention applications (%)
26.3%
22.2%

Average forward citations of top 10 patents
602
791

PCT filings (k)
17
12

Technology Characteristics

Top10 Technology Topics (Unit: pcs)



Innovation Trends

New tech subsidiaries with rapid technological growth

Toyota SinoHytec Fuel Cell

Founded in 2021 as a joint venture with SinoHytec

8 patent applications in 2022

3-year CAGR **726%**

Renovo

Founded in the U.S. in 2010 as a developer of automotive operating systems

Acquired by Toyota in 2021

13 patent applications in total

Carmera

Founded in the U.S. in 2015 as a high-precision automotive mapping company

Acquired by Toyota in **2021**

Source: PatSnap

Note: all statistics as of 2023.07.31; all statistics based on publication day

GLOBAL DISRUPTION 50
2023

Part II

2023 Global Disruption 50

How do we define Patsnap's Global Disruption 50?

In addition to the well-established tech achievers, global innovation is also driven by a multitude of fresh ideas, newfound passions, and unyielding determination. These often lead to awe-inspiring breakthroughs and bring about disruptive changes in the established world, inspiring new possibilities.

They are highly ambitious companies that demonstrate disruptive innovation capabilities and keep growing fast. They have the potential to become future Global Innovation 100 members.

To locate these brilliant disruptors, we again use our Innovation Capability Evaluation Model but set some important restrictions. By establishing criteria of "excellent", "active" and "young", we have compiled a list of 50 companies, this year's Global Disruption 50, who are revealed on the following pages.

Similar to the Global Innovation 100, all the Global Disruption 50 companies are independent and not subsidiaries of any other company.

GLOBAL DISRUPTION 50
2023

Rising stars of innovation,
Bringing disruptive technologies to the established world.

They are rated as:

EXCELLENT... while **ACTIVELY growing...** and **YOUNG.**

In their innovation capability
(as measured by Patsnap's Innovation Capability Evaluation Model)

>10% CAGR
of patent applications in the past 3 years

<15 years
since founding

GLOBAL DISRUPTION 50
2023

A

Who are they?

GLOBAL DISRUPTION 50
2023

The list is sorted alphabetically

Company	Country/Region	Industry
10X Genomics	U.S.	Life Science & Healthcare
Advansix	U.S.	Chemicals & Materials
Aeva Technologies	U.S.	Automotive
Akoustis Technologies	U.S.	Telecommunications
Apeel Technology	U.S.	Chemicals & Materials
Arvinas	U.S.	Life Science & Healthcare
Aulton	China	Automotive
Axsome Therapeutics	U.S.	Life Science & Healthcare
BeiGene	China	Life Science & Healthcare
Beijing Horizon Information Technology	China	Automotive
Blueprint Medicines	U.S.	Life Science & Healthcare
Broncus	China	Life Science & Healthcare
CATL	China	Energy & Electrical
Cerence	U.S.	Automotive
ChangXin Memory Technologies	China	Semiconductor
Cloudflare	U.S.	Information Technology
Dataa Robotics	China	Facilities & Equipment
DoorDash	U.S.	Information Technology
Hyperchain Technology	China	Information Technology
Inscripta	U.S.	Life Science & Healthcare
Joby Aviation	U.S.	Aerospace & Defense
KalVista Pharmaceuticals	U.S.	Life Science & Healthcare
KIOXIA	Japan	Semiconductor
Lyft	U.S.	Information Technology
Netskope	U.S.	Information Technology

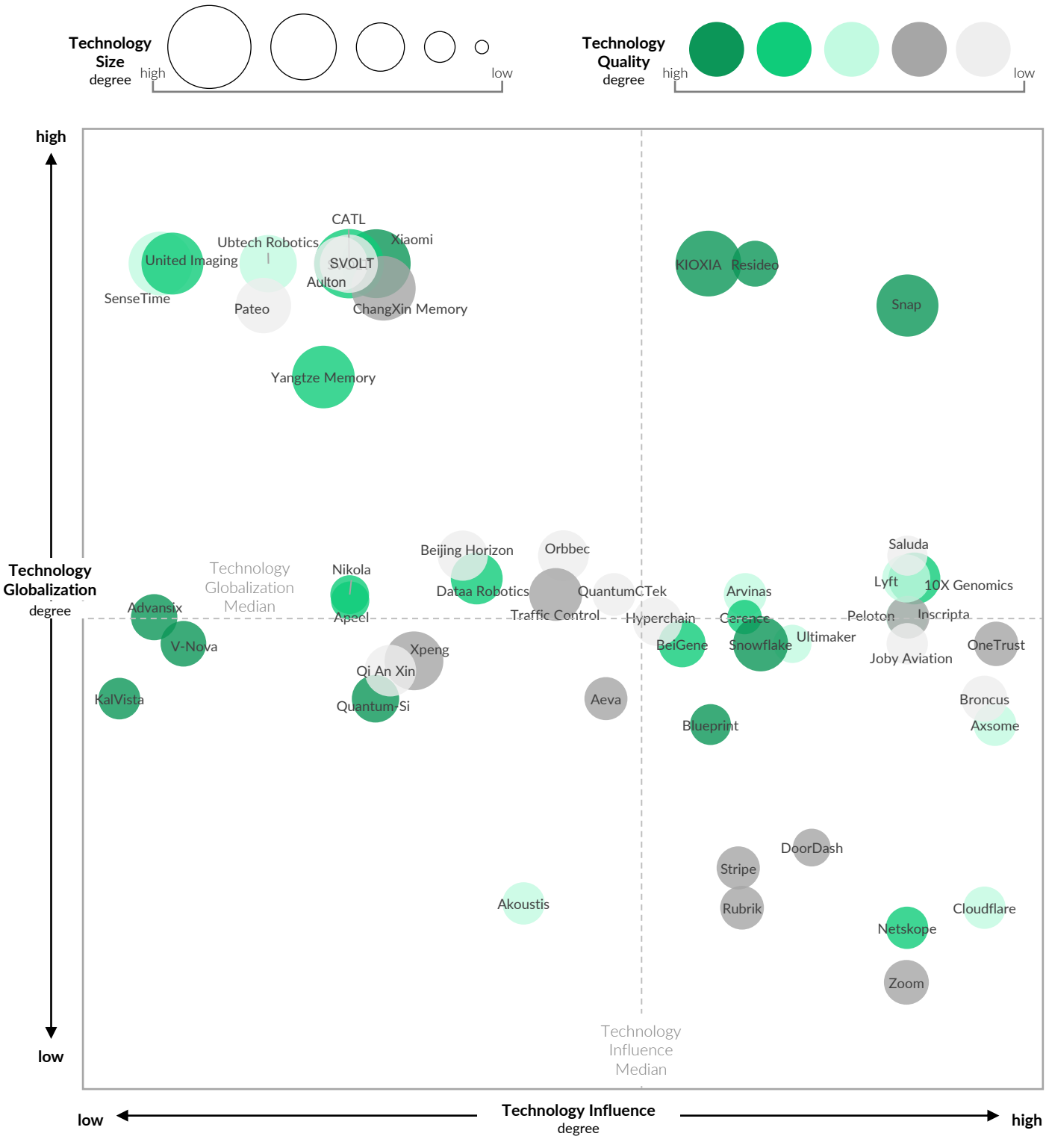
GLOBAL DISRUPTION 50
2023

The list is sorted alphabetically

Company	Country/Region	Industry
Nikola	U.S.	Automotive
OneTrust	U.S.	Information Technology
Orbbec	China	Facilities & Equipment
Pateo	China	Automotive
Peloton Interactive	U.S.	Facilities & Equipment
Qi An Xin Technology	China	Information Technology
QuantumCTek	China	Facilities & Equipment
Quantum-Si	U.S.	Life Science & Healthcare
Resideo Technologies	U.S.	Electronics
Rubrik	U.S.	Information Technology
Saluda Medical	Australia	Life Science & Healthcare
SenseTime	China	Information Technology
Snap	U.S.	Information Technology
Snowflake	U.S.	Information Technology
Stripe	Ireland	Information Technology
SVOLT	China	Energy & Electrical
Traffic Control Technology (TCT)	China	Facilities & Equipment
Ubtech Robotics	China	Facilities & Equipment
Ultimaker	Netherlands	Facilities & Equipment
United Imaging	China	Life Science & Healthcare
V-Nova International	U.K.	Information Technology
Xiaomi	China	Electronics
Xpeng	China	Automotive
Yangtze Memory Technologies	China	Semiconductor
Zoom Video Communications	U.S.	Information Technology

GLOBAL DISRUPTION 50
2023

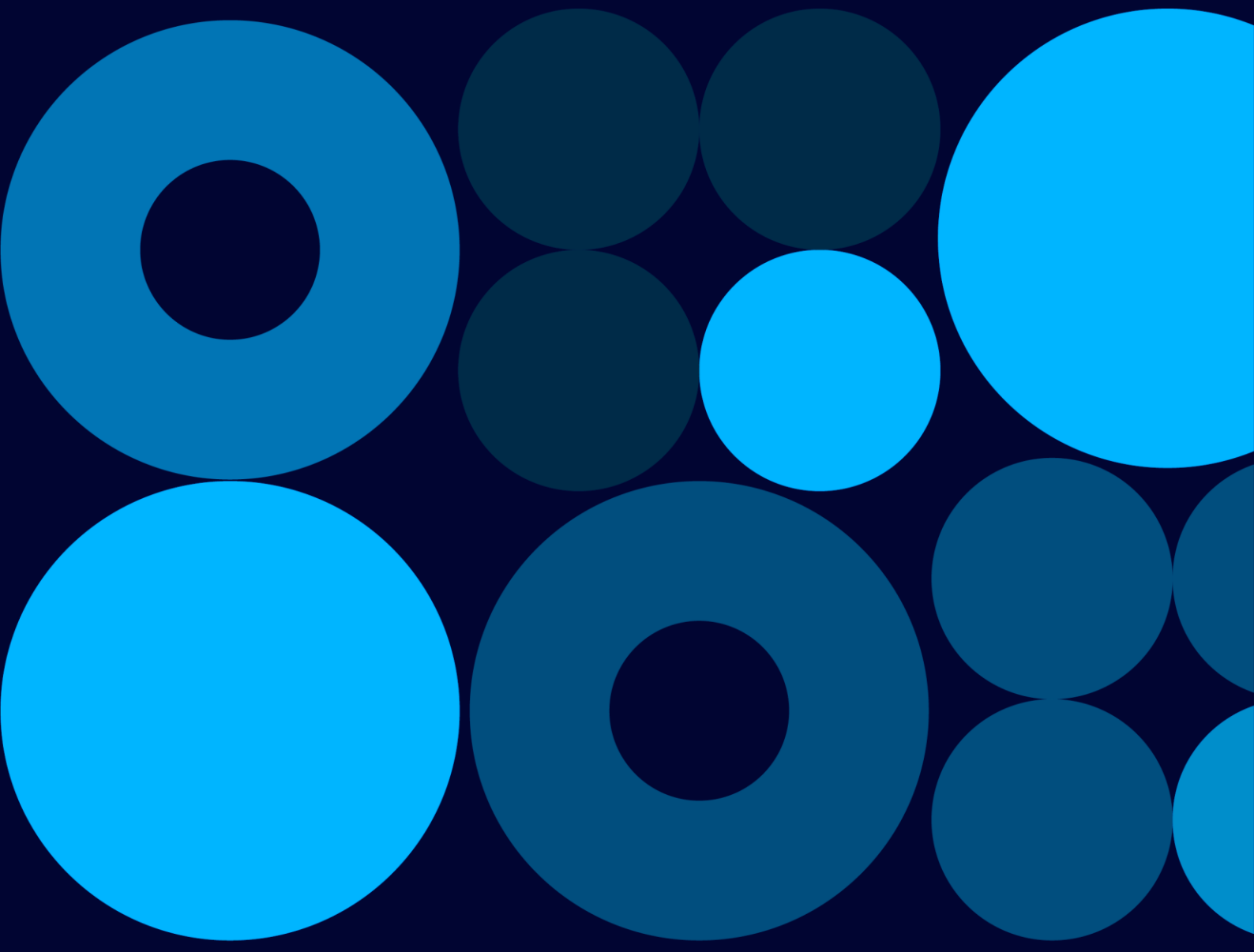
Innovation Map
Patsnap 2023 Global Disruption 50



GLOBAL DISRUPTION 50
2023

B

How are they disrupting the world?



GLOBAL DISRUPTION 50
2023

Insight 1

The Global Disruption 50 have a relatively small technology size metric but a profound technology impact.

Established within the last 15 years, the Global Disruption 50 participants have rapidly cultivated remarkable technological capabilities. Despite their relatively modest size and limited global coverage, they are already showcasing a potent technological influence that is instigating profound transformations across the world.

Insight 2

The global focus on innovation is shifting towards a “world of Atoms empowered by Bits”.

In the 2023 Global Disruption 50, the industry distribution reveals a substantial shift from the physical “world of Atoms” to the digital “world of Bits”, and then to a “world of Atoms empowered by Bits”. Nearly 30% of the 50 companies are from the Information Technology domain. Many more are integrating physical products and digital services.

Insight 3

The United States maintains a dominant position, especially in IT and Life Science & Healthcare sectors, while China is making significant progress in High-Tech Manufacturing.

The United States continues to dominate our list, with Information Services and Life Science & Healthcare technologies as its primary strengths. Meanwhile, China is rapidly advancing its revolutionary technology capabilities, particularly in the Automotive and Machinery & Equipment sectors.

Insight 4

Disruptive innovators emerge from various routes. Academic institutes and tech giants play a part in their creation.

Disruptive innovators mostly emerge from independent foundations and rapidly build outstanding innovation capabilities. Some others leverage technology achievements from research institutes, while a few draw on spin-offs from tech giants.

GLOBAL DISRUPTION 50 2023

Insight 1

The Global Disruption 50 have a relatively small technology size metric but a profound technology impact.

Established within the last 15 years, the Global Disruption 50 participants have rapidly cultivated remarkable technological capabilities. Despite their relatively modest size and limited global coverage, they are already showcasing a potent technological influence that is instigating profound transformations across the world.

While the Global Innovation 100 are technology giants who have made exceptional contributions to the shaping of our world, The Global Disruption 50 participants are those ambitious companies who aim to disrupt the world. This year's Global Disruption 50 companies are , on average, around 15 years from foundation and are actively creating new technology output at a growth rate of around 50% per year, far exceeding that of the world as well as that of the Global Innovation 100, which are growing slowly or have even stagnated.

The typical "innovation profile" of a 2023 Global Disruption 50 company is: a medium technology size metric, with approximately 3,600 patent applications; solid technology quality with an invention application percentage of 87%; strong technology influence, with each patent cited more than 8 times on average and relatively limited technology globalization, with patents applied for in only 19 countries/regions on average.

The 2023 Global Disruption 50 companies are all founded between **2009-2019**

In the past 3 years, their patent applications have grown at an CAGR of **51%**

Chart 2.1 2023 The Global Disruption 50's Innovation Profile (with selected typical metrics)

Average numbers for each company

Technology Size

Patent applications	3,618
Valid inventions	1,146

Technology Influence

Average forward citations per patent	8.3
Average forward citations of top 10 cited patents	138

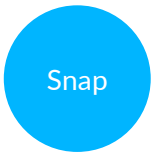
Technology Quality

Invention applications percentage (out of total patent applications)	87%

Technology Globalization

Countries/regions covered (with patent applications)	19
Total PCT filings	280

Through active growth, the Global Disruption 50 have quickly established solid technology quality and profound technology influence that are comparable to that of the Global Innovation 100. Although a typical Disruption 50 company's technology portfolio is only about 2% of the size of an Innovation 100 company, their capabilities in technology quality and technology influence almost match those of the Global Innovation 100. A typical Disruption 50 company holds an invention application percentage of 87%, almost the same as an Innovation 100 company's 91%. On average, their patents have been cited 8.3 times, similar to the Global Innovation 100's 8.6 times. In contrast, the Global Disruption 50 are far less technologically globalized, with the geographical coverage of each company's patents at only 1/4 the level of the average of the Global Innovation 100.

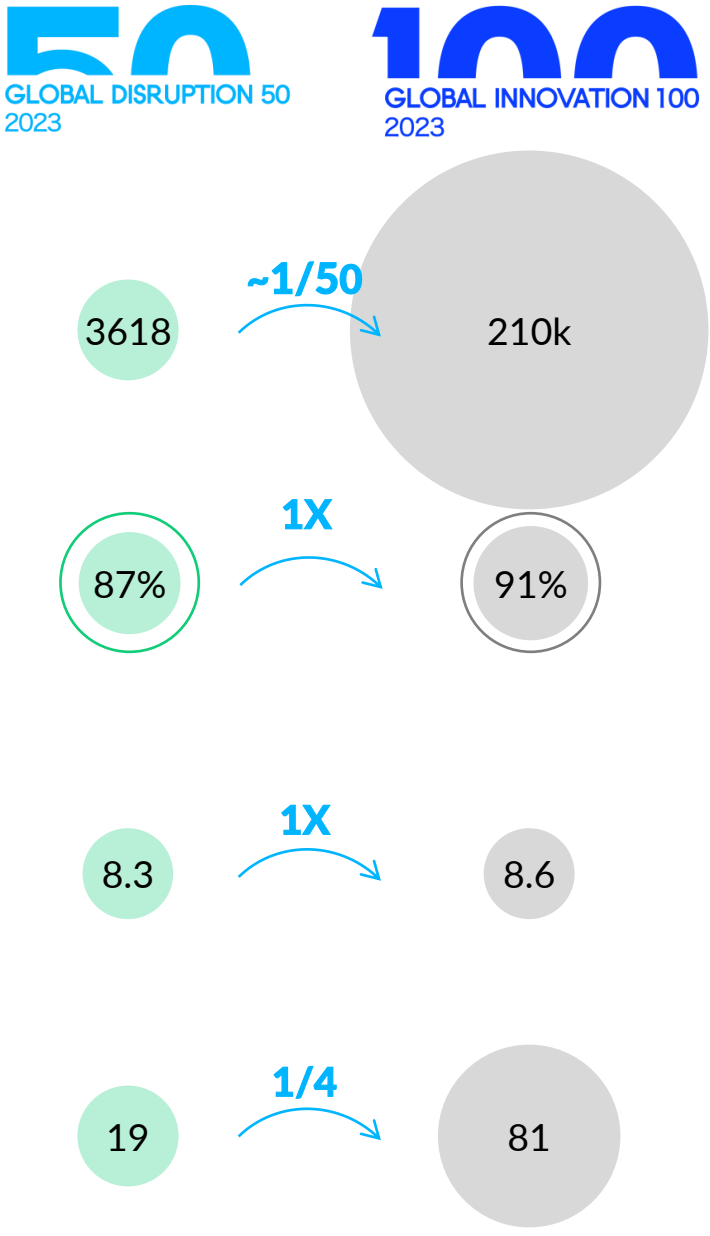


TOP10 cited patents are cited **424** times on average

Chart 2.2 Comparing the 2023 Global Disruption 50 to the 2023 Global Innovation 100

(illustrating selected typical metrics)

Average performance of each indicator for the Global Disruption 50 and the Global Innovation 100



Insight 2

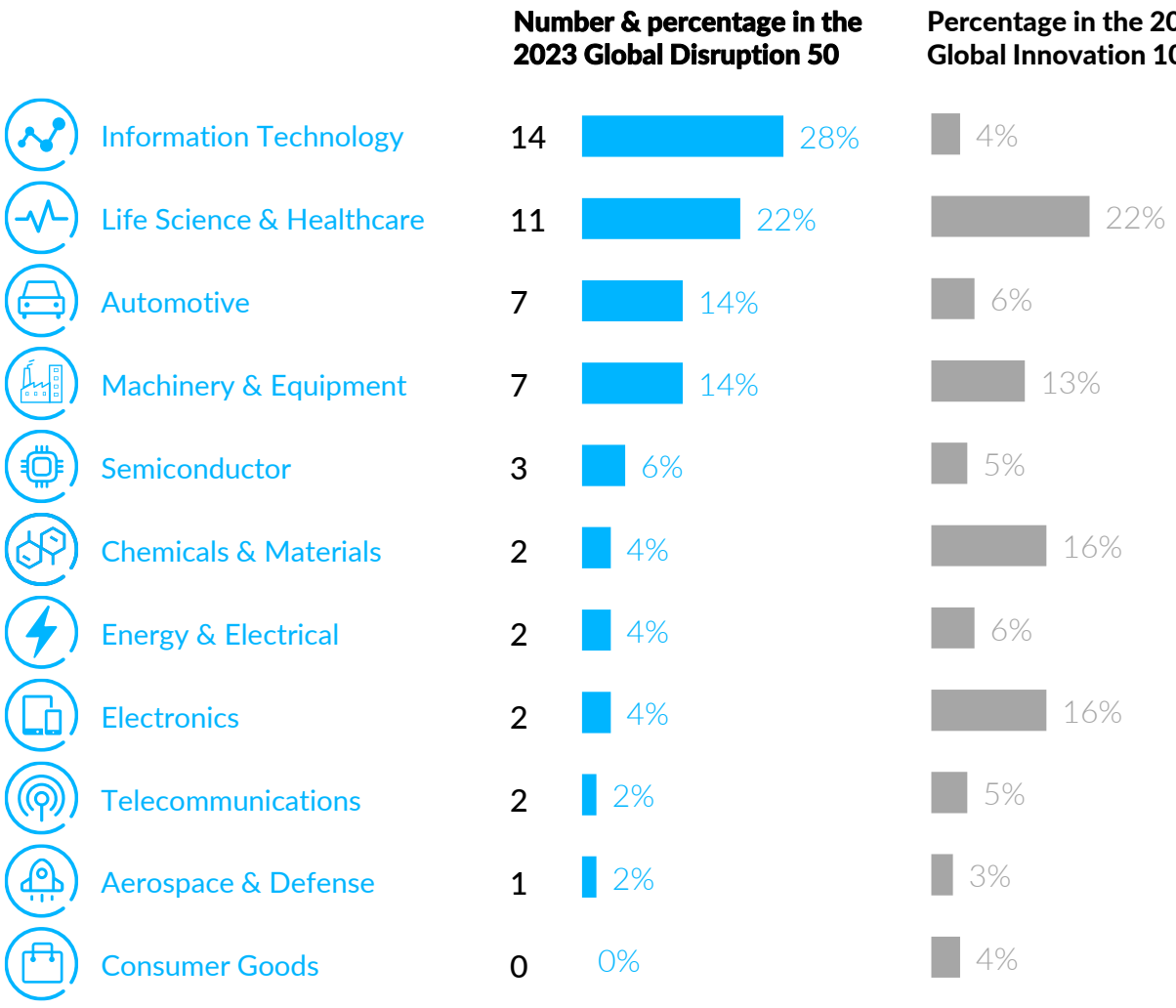
The global focus on innovation is shifting towards a "world of Atoms empowered by Bits".

In the 2023 Global Disruption 50, the industry distribution reveals a substantial shift from the physical "world of Atoms" to the digital "world of Bits", and then to a "world of Atoms empowered by Bits". Nearly 30% of the 50 companies are from the Information Technology domain. Many more are integrating physical products and digital services.

The 2023 Global Disruption 50 come from 10 industries. Among them, Information Technology, Life Science & Healthcare, and Automotive are the top3 , accounting for 64%. Other participants come from sectors including Machinery & Equipment, Semiconductor and Chemicals & Materials.

In contrast to the Global Innovation 100 list, 3 differences are clear. Firstly, there are a larger proportion of IT and automotive companies on the Disruption 50 list. Innovation disruptors from the IT sector account for 28%, almost 4 times that of the Global Innovation 100. In the Automotive sector, disruptors account for 14% of the total , nearly 3 times more than for the Global Innovation 100. Secondly, there are a smaller proportion of Chemicals & Materials and Electronics disruptors. Thirdly, there are no innovation disruptors found in the Consumer Goods sector.

Chart 2.3 Industry Distribution of the 2023 Global Disruption 50



When we take a closer look at the list, we see that in the last decade, the world's innovation is shifting from a physical world of Atoms, to a digital world of Bits, and then a "world of Atoms empowered by Bits".

On the one hand, a shift from the "world of Atoms" to the "world of Bits".

Many of the Global Disruption 50 participants use various digital technologies to provide innovative digital offerings. While **DoorDash** provides online food delivery services in the U.S., **Lyft** provides online shared transport services. And **Zoom** is reinventing the conventional teleconference with revolutionary online tools. **Hyperchain Technology**, the Chinese provider of an enterprise blockchain platform, uses blockchain to provide solutions to finance, and energy management scenarios. Snap provides a visual messaging app for the younger generation.

On the other, a trend towards integrating the "world of Atoms" with the "world of Bits".

We see more Disruption 50 companies offering solutions integrating both hardware and software. **Peloton Interactive** is a game-changer in the fitness sector providing workout equipment as well as software and platforms. **Traffic Control Technology** from China provides end-to-end solutions to rail traffic control. **Beijing Horizon Information Technology** provides auto pilot computing solutions combining both auto-pilot chips and software. **Pateo** is the end-to-end solution provider for the Internet of vehicles from automotive electronics and software to operating systems. **Cerence** is a global top player providing AI automotive assistants with its core voice technology.

The world's innovation is...

SHIFTING from **the world of Atoms** to **the world of Bits**

INTEGRATING **the world of Atoms** with **the world of Bits**

GLOBAL DISRUPTION 50 2023

Insight 3

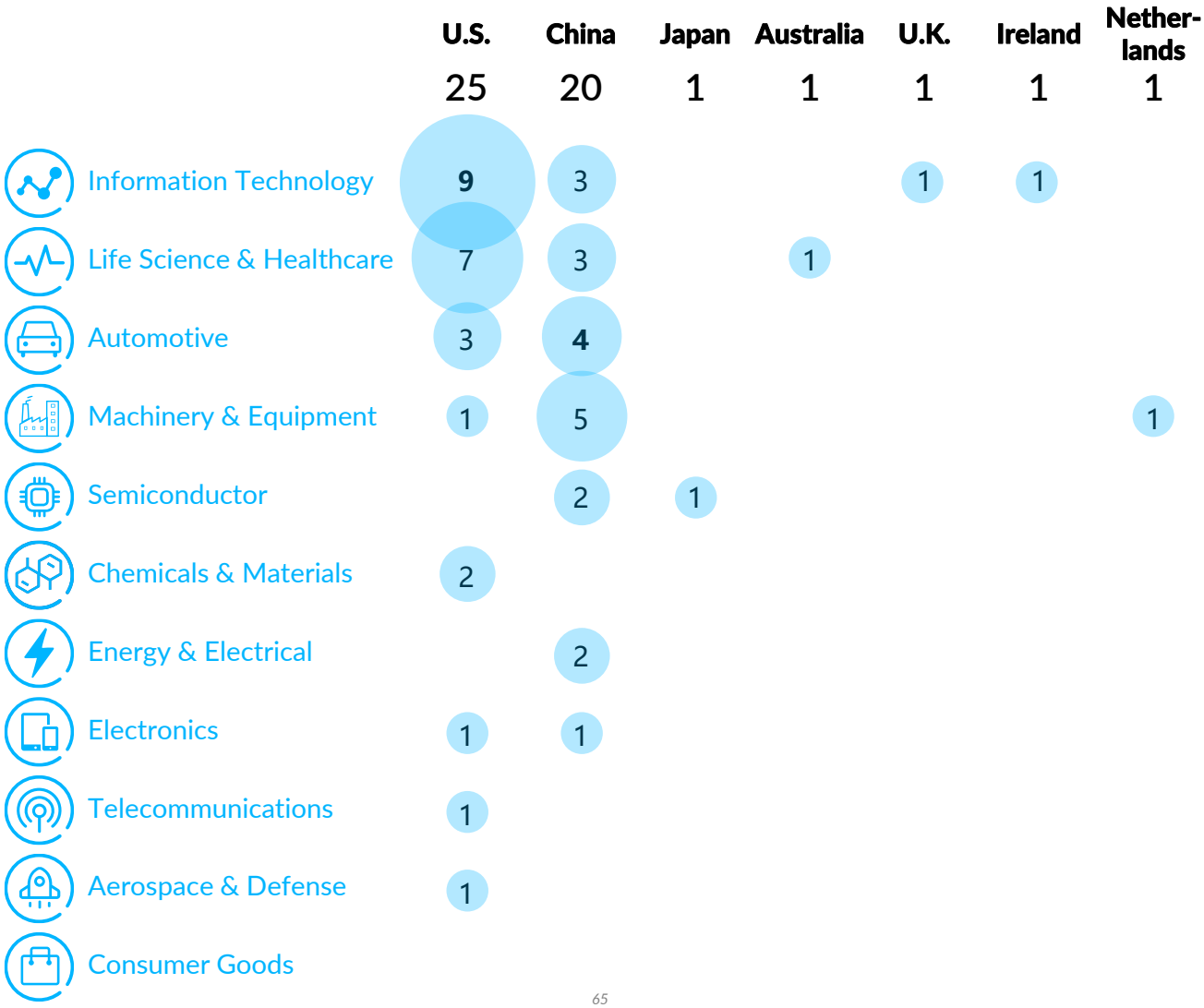
The United States maintains a dominant position, especially in IT and Life Science & Healthcare sectors, while China is making significant progress in High-Tech Manufacturing.

The United States continues to dominate our list, with Information Services and Life Science & Healthcare technologies as its primary strengths. Meanwhile, China is rapidly advancing its revolutionary technology capabilities, particularly in the Automotive and Machinery & Equipment sectors.

Country distribution on our disruption list also sees a totally different pattern to the Innovation 100 list. The U.S. has the most participants, accounting for half of the list, while China is quickly ramping up, with 20 companies among Global Disruption 50. The remaining 5 companies come from Japan, Australia, U.K., Ireland and the Netherlands.

Disruptors from the U.S. mostly focus on the Information Technology and Life Science & Healthcare sectors. The U.S. maintains its technology leadership in these sectors, having 9 and 7 companies in each sector. China dominates more in the sectors of Automotive and Machinery & Equipment.

Chart 2.4 Industry Distribution of the 2023 Global Disruption 50



GLOBAL DISRUPTION 50 2023

Insight 4

Disruptive innovators emerge from various routes. Academic institutes and tech giants play a part in their creation.

Disruptive innovators mostly emerge from independent foundations and rapidly build outstanding innovation capabilities. Some others leverage technology achievements from research institutes, while a few draw on spin-offs from tech giants.

The Global Disruption 50 participants started their journey of innovation <15 years ago, and quickly delivered outstanding technology performance. When we try to understand where these innovation disruptors come from, we've found that they come from various sources:

1) Most frequently, 40 out of 50 of our innovation disruptors started from independent foundations, led by visionary leaders who set out to make a difference. For example, the outstanding Dutch 3D printer supplier **Ultimaker** started its technology journey with the ProtoSpace FabLab in Utrecht, and became a strong challenger to traditional players like GE, HP, etc.

2) 10% of them were incubated from research institutes: 5 companies out of the Global Disruption 50 built on initial technology developed from universities or research institutes. **Saluda Medical,** an Australian global pioneer in smart neuromodulation therapy, started commercializing after years of research in Australia's Information Communications Technology Center of Excellence. **QuantumCTek,** a Chinese leading provider of Quantum Communication-based encrypted services and devices, built its first business thanks to Quantum Communication technology from the University of Science and Technology of China. **SenseTime, Inscripta** and **Arvinas** have a similar story: SenseTime cam from the Chinese University of Hong Kong; Inscripta from the University of Colorado and Arvinas from Yale University.

3) Another 10% of our list are spin-offs from tech giants: With the technologies they have inherited from their former owners, these companies have obtained unique market advantages from Day1, and they are still innovating. For example, **Resideo** and **Advansix** are both spin-offs from Honeywell, one of our 2023 Global Innovation 100 companies. **Kioxia,** the Japanese semiconductor leader, inherited their core semiconductor technology with nearly 20K patents from their former parent company Toshiba, who is also on our Global Innovation 100 list. **SVOLT** used to be a business unit of Great Wall Motor. And **Cerence** was divested from Nuance.

Quantum -CTek

6 patents co-applied with the University of Science and Technology of China

Inscripta

23 patents co-applied with the University of Colorado

169 times their patens cite the University of Colorado

KIOXIA

58% of its total 19K patents are "Inherited" from Toshiba Group

SVOLT

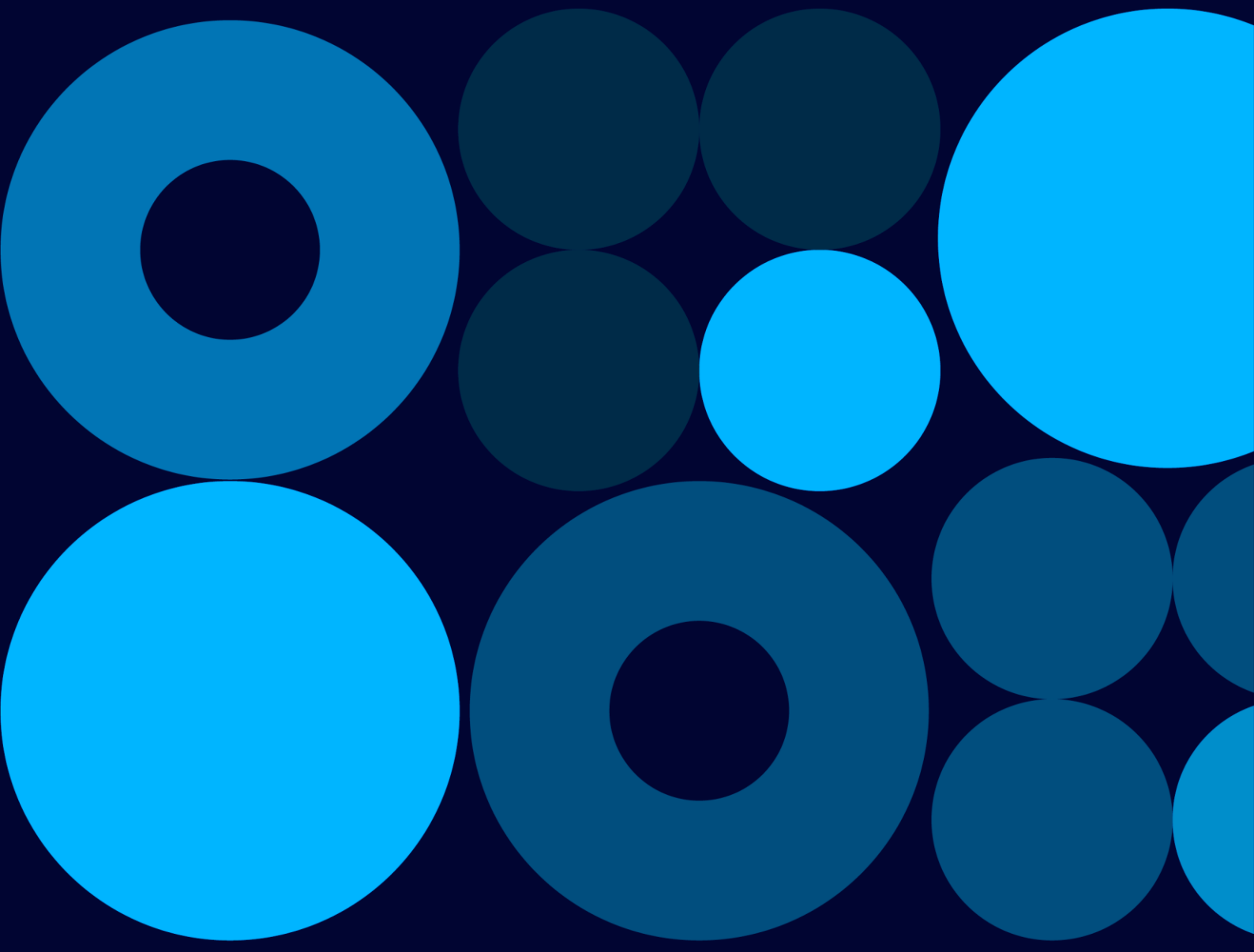
96 patents are "Inherited" from Great Wall Motor in 2018

GLOBAL DISRUPTION 50
2023

C

What are they innovating?

(illustrating the innovation capabilities of all 50 participants)



10X Genomics

U.S. Life Science & Healthcare

Established in: 2012
2019-2022 Patent Application CAGR: 31%

Established in 2012, 10X Genomics is a pioneering company specializing in the design and manufacture of gene sequencing technology for scientific research. Their single-cell sequencing technology stands out as a rapidly advancing breakthrough, having received The Scientist Top 10 Innovations award consistently from 2015 to 2021 for six consecutive years.
In the years following the company's inception, its technological influence has expanded significantly. Their innovative single-cell, spatial, and in situ technologies have been referenced in over 6,100 research papers and cited in approximately 2,000 patents, with an average citation rate of 15.6 times each. Furthermore, 10X Genomics has made remarkable strides in the global arena. They hold patents in 28 countries/regions, and their PCT filings percentage ranks 4th among the Global Disruption 50, representing a remarkable 12.7% coverage.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Average forward citations per patent	15.6
Total forward citations of patents	31k

Technology Globalization

Countries/regions covered	28
PCT filings percentage	12.7%

Advansix

U.S. Chemicals & Materials

Established in: 2016
2019-2022 Patent Application CAGR: 32%

AdvanSix, formerly Honeywell's Resins and Chemicals division, embarked on its independent journey in 2016. As a versatile chemistry company, AdvanSix is dedicated to pioneering and delivering top-notch, distinctive solutions across a diverse array of end markets and applications that have a significant impact on people's lives. These applications span from crop nutrition and food packaging to paint additives and nylon, among others.
AdvanSix has excelled in the realm of technological innovation, boasting an impressive 100% invention application percentage. This achievement places the company among the top performers in the Global Disruption 50, highlighting its exceptional commitment to technological excellence. Moreover, the company has successfully expanded its technological reach on a global scale, with its patents spanning 39 countries/regions, including China, Europe, Korea, Canada, Japan, and Australia.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage	100%

Technology Globalization

Countries/regions covered	39

Aeva

U.S. Automotive

GLOBAL DISRUPTION 50 2023

Established in: 2017
2019-2022 Patent Application CAGR: 145%

Aeva, founded by two former Apple engineers in 2017, is revolutionizing the field of autonomous technology with its groundbreaking LiDAR technology. Over the past three years, the company has experienced rapid growth, achieving an impressive 145% CAGR in patent applications.
Aeva's commitment to technological innovation is underscored by its remarkable 100% invention application percentage. This dedication has led to the recognition of Aeva's AeriesTM II and its 4D LiDARTM technology as recipients of the CES 2023 Innovation Awards and TIME's Best Inventions of 2022. These accolades were awarded in recognition of Aeva's unique instant velocity detection and long-range performance. Furthermore, Aeva is making strides in designing 4D LiDAR-on-chips across various regions, including the United States, Europe, the Middle East, and Asia, with PCT patents accounting for 8.4% of their IP portfolio.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Globalization

PCT filings percentage 8.4%

Akoustis

U.S. Telecommunications

GLOBAL DISRUPTION 50 2023

Established in: 2014
2019-2022 Patent Application CAGR: 39%

Akoustis, a high-tech company specializing in BAW RF filter solutions, is at the forefront of pioneering next-generation materials science. The company's mission is to provide the market with advanced RF filters that offer superior bandwidth, operate at higher frequencies, and deliver increased output power.
With a remarkable 97% invention application percentage, Akoustis is committed to driving innovation and revolutionizing the RF industry. The company aims to address the limitations of current RF polycrystalline filter technologies, which include issues such as phone overheating, battery drain, and signal loss. Furthermore, as a disruptive force in the industry, Akoustis has made significant strides in globalizing its technology. It boasts an impressive 10.6% PCT filings percentage, ranking 6th among the Global Disruption 50, further cementing its position as a leader in the field.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 97%

Technology Globalization

PCT filings percentage 10.6%

Apeel

U.S. Chemicals & Materials

GLOBAL DISRUPTION 50 2023

Established in: 2012
2019-2022 Patent Application CAGR: 12%

Apeel, a company founded by a group of scientists in 2012, has introduced an innovative approach to address traditional post-harvest challenges. It has achieved this through the development of two plant-based coating products known as Edipeel and Organipeel. The primary objective of Apeel is to reduce food waste and increase food availability.
Apeel distinguishes itself through its unwavering commitment to technological excellence, boasting a remarkable 100% invention application percentage. This commitment allows the company to incorporate purified mono- and diglycerides into its products, not only furthering its core mission but also ensuring the safety of its offerings. Today, Apeel stands as a leading player in the global technology landscape, boasting an impressive 14.1% PCT patent percent ranking, which places them third among the Global Disruption 50.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Globalization

PCT filings percentage 14.1%

Arvinas

U.S. Life Science & Healthcare

GLOBAL DISRUPTION 50 2023

Established in: 2013
2019-2022 Patent Application CAGR: 16%

Arvinas, a clinical-stage biotechnology company, is dedicated to enhancing the quality of life for individuals grappling with cancer and other challenging-to-treat diseases. They achieve this by spearheading groundbreaking therapies developed through their revolutionary PROTAC® protein degradation platform.
Arvinas excels in technological innovation and diligently strives to unlock the full potential of PROTAC® protein degraders. Their aim is to pioneer transformative drug discoveries that push the boundaries of conventional drug development. Furthermore, when it comes to global technology outreach, Arvinas demonstrates outstanding performance. The company has submitted patent applications in 44 countries and regions. For instance, they have filed 139 patents in the United States, 53 in Australia, 46 in Europe, 43 in Japan, and 42 in Korea, showcasing their impressive international reach and influence.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Globalization

Countries/regions covered 44

Aulton

China Automotive

Established Since: 2016
2019-2022 Patent Application CAGR: 43%

Aulton is a global advocator and fast-growing pioneer of battery swap technology, aiming to build a world-leading efficient distributed energy storage network. The founder started with pilot projects of battery swap stations for buses during the 2008 Beijing Olympics and 2010 Shanghai Expo. In 2016, with all the technology accumulation, Aulton was founded, focusing on business for passenger vehicles. It is now the top operator of battery swap stations in China, and cooperates with many NEV OEMs incl. NIO, FAW.
Aulton now has a portfolio of ~3.2K patents, covering over 30 countries. And their patent applications are still quickly growing at a CAGR of 43%. It is also a co-leader of many international standards of battery swap.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years **2579**

Technology Globalization

Non-design PCT filings **253**

Countries/regions covered **30**

Axsome

U.S. Life Science & Healthcare

Established in: 2012
2019-2022 Patent Application CAGR: 27%

Axsome is at the forefront of developing innovative therapies for central nervous system (CNS) conditions that often have limited treatment options. At present, the company has two groundbreaking products, Auvelity® and Sunosi®, and is actively advancing four late-stage neuroscience pipelines.
Axsome places a strong emphasis on the quality of its technology, evident through its remarkable 100% invention application percentage and a high pipeline-to-medicine success rate. Notably, Auvelity®, a fast-acting oral treatment for major depressive disorder (MDD), marks a significant milestone as the first of its kind to enter the market with a new mechanism of action in over six decades. This achievement underscores the company's technological leadership in the field, as evidenced by an average of 18.6 citations per patent. Additionally, the company is expanding its technological footprint globally, with patents filed in 41 countries and regions.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **100%**

Technology Influence

Average forward citations per patent **18.6**

Technology Globalization

Countries/regions covered **41**

BeiGene

China Life Science & Healthcare

Established in: 2010
2019-2022 Patent Application CAGR: 25%

BeiGene was established with the mission of discovering advanced and affordable oncology treatments, making them accessible to cancer patients around the world. The company aspires to set a transformative example in the global biotech industry. Despite being founded a decade ago, BeiGene has maintained an impressive CAGR of up to 25% in patent applications from 2019 to 2022.
BeiGene is fulfilling its goal of being a global biotech leader. On the one hand, the company exerts a wide technology influence on the industry through its top 10 cited patents with anti-PD1 antibodies being cited 1,306 times in total. On the other hand, the company is making progress in technology globalization as it has filed patent applications in 45 countries/regions worldwide and its PCT patents account for 11.0% of the total.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Total forward citations of top10 cited patents	1306

Technology Globalization

Countries/regions covered	45
PCT filings percentage	11.0%

Beijing Horizon Robotics

China Automotive

Established in: 2015
2019-2022 Patent Application CAGR: 29%

Horizon Robotics is a leading provider of energy-efficient computing solutions for advanced driver assistance systems (ADAS) and autonomous driving (AD). The company specializes in integrating hardware and software, encompassing cutting-edge, low-power hardware computing solutions alongside open software development tools.
Since its establishment in 2015, Horizon Robotics has not only carved out a distinctive niche but has also amassed a substantial technological presence. Over the past five years, the company has fortified its position by filing 977 valid patent applications and securing an impressive 404 granted inventions. Beyond these numbers, Horizon Robotics has significantly impacted the industry, with its patents collectively cited a remarkable 4,036 times. This noteworthy achievement has captured the attention of major players, prompting the Volkswagen Group and its subsidiary, CARIAD, to enter into a strategic partnership with Horizon Robotics, advancing automated driving solutions.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years	977
Granted inventions	404

Technology Influence

Total forward citations of patents	4036

Blueprint Medicines

U.S. Life Science & Healthcare

Established in: 2011
2019-2022 Patent Application CAGR: 14%

Blueprint Medicines, a global precision therapy company, is dedicated to revolutionizing treatments for individuals grappling with cancer and blood disorders. Their pioneering approach seamlessly blends unparalleled expertise in protein kinases with meticulous execution and an unwavering commitment to exploration. Distinguishing itself as a high-quality, technology-driven enterprise, Blueprint Medicines boasts a remarkable 100% invention application percentage. This achievement is underscored by the company's expansive and evolving portfolio of research programs, offering a range of investigational medicines tailored to patients with genomically defined cancers and rare diseases. Blueprint Medicines' technological footprint extends far beyond that of its counterparts in the Global Disruption 50, making it a trailblazer on a global scale. Currently, the company has submitted patent applications in 58 countries/regions, ranking it first among the other 50 disrupters.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Globalization

Countries/regions covered 58

PCT filings percentage 10.1%

Broncus

China Life Science & Healthcare

Established in: 2012
2019-2022 Patent Application CAGR: 116%

Broncus is dedicated to advancing interventional pulmonology medical devices and providing groundbreaking solutions for lung diagnostics, lung cancer treatment, chronic obstructive pulmonary disease, and global navigation platforms.
In recent years, the company has undergone rapid innovation, achieving an impressive 2019-2022 patent application CAGR of up to 116%. Notably, Broncus has successfully launched BIOSTAR®, a state-of-the-art needle that has revolutionized minimally invasive diagnostic techniques. The company's technological prowess is evident in its substantial patent performance. With patents cited a total of 16,000 times and an average of 18.4 citations per patent, Broncus surpasses the benchmark set by other entities in the Global Disruption 50.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Average forward citations per patent 18.4

Total forward citations of patents 16k

Technology Globalization

PCT filings percentage 10.5%

CATL

China Energy & Electrical

GLOBAL DISRUPTION 50 2023

Established in: 2011
2019-2022 Patent Application CAGR: 36%

CATL is a globally-leading manufacturer of lithium-ion batteries for electric vehicles and energy storage systems, including cutting-edge battery management systems (BMS). As of 2022, CATL commands a 34% market share, solidifying its position as the world's largest lithium-ion power battery manufacturer. Noteworthy clients such as Tesla, Peugeot, Hyundai, Honda, BMW, Toyota, Volkswagen, and Volvo benefit from CATL's high-quality products.
CATL's commitment to technological innovation is evident in its robust capabilities. Over the past five years, the company has filed 17,000 patent applications, establishing a substantial technology portfolio. Furthermore, CATL has made a significant impact on the industry, with its patents cited 32,000 times. The company's global technological footprint is underlined by its 13 battery manufacturing bases distributed worldwide. In terms of patent performance, CATL's achievements are remarkable. With 2,732 non-design PCT filings and a 12.7% PCT filings percentage, CATL outperforms nearly 85% of entities in the Global Disruption 50.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years: 17k

Technology Influence

Total forward citations of patents: 32k

Technology Globalization

Non-design PCT filings: 2732

PCT filings percentage: 12.7%

Cerence

U.S. Automotive

GLOBAL DISRUPTION 50 2023

Established in: 2019
2019-2022 Patent Application CAGR: 75%

As the youngest member of the Global Disruption 50, Cerence, a spin-off from Nuance, has swiftly emerged as the world's premier provider of automotive assistants. Boasting an impressive patent application CAGR of 75% from 2019 to 2022, Cerence is at the forefront of creating intelligent, flexible, and intuitive in-car experiences for leading automakers globally.
Currently, Cerence holds 425 granted inventions, representing a remarkable 99% of the total patents in its domain. The company's technological prowess extends beyond quantity to include exceptional quality, as exhibited by their influence on the industry. Notably, Cerence's top 10 cited patents have garnered attention from industry giants such as ZTE, Google, Microsoft, and LG, resulting in a total of 5,108 citations. On average, all Cerence's patents are cited 47.9 times, securing its position at the forefront of the Global Disruption 50.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Granted inventions: 425

Technology Quality

Invention application percentage: 99%

Technology Influence

Total forward citations of top10 cited patents: 5108

Average forward citations per patent: 47.9

ChangXin Memory

China Semiconductor

Established in: 2016
2019-2022 Patent Application CAGR: 65%

ChangXin Memory, a semiconductor integrated device manufacturer specializing in dynamic random-access memory (DRAM) chips, has rapidly advanced its technology with an impressive 65% patent application CAGR from 2019 to 2022, positioning itself as one of the largest DRAM providers in China. To date, the company's technological footprint comprises 10,000 patent applications, including 8,896 valid applications filed in the past five years. Originating in Hefei, Anhui, this Chinese DRAM company has expanded its innovative technology extensively in global markets. Notably, it holds 1,818 non-design PCT filings spanning semiconductor structures, hemt circuits, dielectric layers, and more. With a 17.4% PCT filings percentage, ChangXin Memory secures the 2nd rank among its Global Disruption 50 counterparts.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications	10k
Patent applications in the past 5 years	8896

Technology Globalization

Non-design PCT filings	1818
PCT filings percentage	17.4%

Cloudflare

U.S. Information Technology

Established in: 2009
2019-2022 Patent Application CAGR: 10%

Cloudflare, as one of the world's largest networks, processes millions of internet requests for websites and handles an average of 46 million HTTP requests per second. The company is dedicated to enhancing the internet experience through its services, including content delivery network, cloud cybersecurity, DDoS mitigation, and ICANN-accredited domain registration. With a remarkable 100% invention application percentage, Cloudflare stands out as a leader in technology quality, surpassing 70% of the Global Disruption 50. Notably, Cloudflare's innovative technology has a significant impact on industry giants like Huawei, Snap, Microsoft, and CISCO. In terms of patent performance, Cloudflare's patents have been cited a total of 7180 times, averaging 20.5 citations each.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage	100%

Technology Influence

Average forward citations per patent	20.5
Total forward citations of patents	7180

Dataa Robotics

China Machinery & Equipment

Established in: 2015
2019-2022 Patent Application CAGR: 58%

Dataa Robotics is at the forefront of advancing technology for the development of humanoid robots catering to both enterprises and households. The company has successfully developed a comprehensive suite of underlying technologies, including the "Cloud AI Brain," "Secure Nerve Network," and "Robot Devices." Over the past 5 years, Dataa Robotics has been dedicated to intensive innovation, resulting in the filing of 1144 valid patent applications. This effort culminated in the launch of HARIX OS in 2020, marking the world's first operating system designed specifically for robots. Looking ahead, the company is set to introduce RobotGPT, solidifying its position as a pioneer in the field of robot manufacturing. As a disruptive force in the robot industry, Dataa Robotics' groundbreaking innovations have left a significant impact, with its patents being cited a total of 6639 times, showcasing the company's influential role in shaping the industry landscape.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years **1144**

Technology Influence

Total forward citations of patents **6639**

DoorDash

U.S. Information Technology

Established in: 2013
2019-2022 Patent Application CAGR: 40%

DoorDash, an online food ordering and delivery platform, currently holds the position of the largest food delivery company in the U.S. with an impressive 65% market share as of February 2023. The platform boasts a user base of 450k merchants, 2m delivery couriers, and 20m consumers, with these numbers continuously on the rise. Distinguished as a high-tech, high-quality food delivery company, DoorDash leads the industry in innovation, boasting a 98% invention application percentage. Among its notable advancements is the integration of machine learning to enhance and optimize algorithms, resulting in a smarter and more efficient ordering processes. In terms of technological influence, DoorDash's patents have been cited a total of 5234 times, averaging 13.9 citations each. This signifies the company's impact and recognition within the industry, solidifying its position as a technological trailblazer in the realm of food delivery.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **98%**

Technology Influence

Average forward citations per patent **13.9**

Total forward citations of patents **5234**

Hyperchain

趣链科技 HYPERCHAIN

China Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2016
2019-2022 Patent Application CAGR: 91%

Hyperchain Technology stands as a prominent provider of enterprise blockchain solutions, offering the world's first full-stack blockchain 3.0 system. This comprehensive system encompasses cutting-edge underlying technology, cross-chain capabilities, efficient data sharing, and privacy computing.
From 2019-2022, Hyperchain Technology experienced rapid development and innovation. In 2021, the company successfully concluded a Series C financing round, becoming the first unicorn in China's blockchain landscape. Notably, it achieved an impressive CAGR of 91% in patent applications during this period, surpassing 90% of the Global Disruption 50. As an industry trailblazer, Hyperchain Technology extends its technological influence globally by leading and participating in the establishment of over 200 standards within the global blockchain domain—a record-setting accomplishment. In terms of patent performance, the company's patents have garnered a total of 3755 citations, underscoring its substantial impact on the field.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years: 878

Technology Influence

Total forward citations of patents: 3755

Inscripta

INSCRIPTA®

U.S. Life Science & Healthcare

GLOBAL DISRUPTION 50 2023

Established Since: 2015
2019-2022 Patent Application CAGR: 58%

Inscripta stands as a groundbreaking force in digital genome engineering, utilizing the synergy of biology and data science to introduce accessible and sustainable synthetic biology products into the market. Employing its innovative Lean Bioengineering™ methodology, Inscripta integrates Directed Evolution, CRISPR, and Machine Learning to render biomanufacturing scalable, cost-efficient, and secure.
Maintaining a commitment to technological excellence, Inscripta boasts a remarkable 100% invention application percentage, underlining its dedication to pioneering advancements. The impact of its top 10 cited patents reverberates across the biotech landscape, serving as a source of inspiration for companies like Zymergen, Novozymes, Napigen, and others. Notably, Inscripta's technological influence extends globally, with its PCT patents constituting a significant 10.4% of the total, surpassing its industry peers.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage: 100%

Technology Influence

Total forward citations of top10 cited patents: 1184

Technology Globalization

PCT filings percentage: 10.4%

Joby Aviation

U.S. Aerospace & Defense

GLOBAL DISRUPTION 50 2023

Established in: 2009
2019-2022 Patent Application CAGR: 72%

Joby Aviation, a standout in the electric aviation sector, is actively developing an electric vertical takeoff and landing (eVTOL) aircraft for use as an air taxi service. This aircraft, with the capability to cover up to 150 miles on a single charge and execute vertical takeoffs and landings, stands out as an eco-friendly and efficient mode of transportation.
Since 2012, Joby Aviation has forged notable collaborations with NASA, contributing to groundbreaking electric flight projects like the X-57 and LEAPTech. The company has not only demonstrated technological excellence but has also achieved an impressive invention application percentage of up to 100%. In terms of technology influence and global impact, Joby Aviation's patent performance outshines most peers in the Global Disruption 50. Its top 10 cited patents have garnered a total of 1075 citations from major market players, including Airbus, Boeing, Overair and Skykar, among others. Additionally, it boasts a PCT filings percentage of 11.1%.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality
Invention application percentage: 100%

Technology Influence
Total forward citations of top10 cited patents: 1075

Technology Globalization
PCT filings percentage: 11.1%

KalVista

KalVista Pharmaceuticals

U.S. Life Science & Healthcare

GLOBAL DISRUPTION 50 2023

Established in: 2011
2019-2022 Patent Application CAGR: 11%

KalVista is dedicated to the discovery and development of oral, small molecule protease inhibitors aimed at pioneering new treatments for diseases like hereditary angioedema (HAE) and diabetic macular edema (DME).With an unwavering commitment to technological excellence, the company is actively advancing its portfolio, featuring Sebetralstat—an on-demand therapy for acute HAE attacks—and KVD001—an intravitreally administered plasma kallikrein inhibitor designed for DME treatment.
In terms of global technological innovation, KalVista has left its mark with a widespread presence. The company has submitted patent applications to authorities in 54 countries/regions, including the U.S., Europe, Japan, the U.K., Canada, China, Australia, Brazil, and South Africa. Notably, it holds a prestigious position, ranking among the top 2 in the esteemed Global Disruption 50.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality
Invention application percentage: 100%

Technology Globalization
Countries/regions covered: 54

KIOXIA KIOXIA

GLOBAL DISRUPTION 50 2023

Japan Semiconductor

Established in: 2018
2019-2022 Patent Application CAGR: 102%

KIOXIA, originally stemming from the Toshiba conglomerate, stands as a key player in the NAND flash industry. Despite its global leadership in the sector, the company remains dedicated to propelling innovation and advancing the industry. Notably, from 2019 to 2022, KIOXIA achieved an outstanding CAGR of 102% in patent applications—a significant leap compared to its counterparts. With a robust technological portfolio of 20,000 patent applications and 13,000 granted inventions, KIOXIA boasts an impressive technology quality, marked by a remarkable 99% invention application percentage. The company, through its top 10 cited patents, actively addresses data storage challenges, pushing the boundaries of memory technology. These influential patents resonate across the industry, impacting tech giants such as Sandisk, Micron, Samsung Electronics, Apple, and more, amassing a total of 6862 citations.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications 20k

Granted inventions 13k

Technology Quality

Invention application percentage 99%

Technology Influence

Total forward citations of top10 cited patents 6862

Lyft

GLOBAL DISRUPTION 50 2023

U.S. Information Technology

Established in: 2012
2019-2022 Patent Application CAGR: 21%

Lyft, positioned as the second-largest ridesharing company in the U.S. after Uber, stands out for its unwavering dedication to delivering secure and seamless ride-sharing experiences. This commitment comes to life through the efficient connection of drivers and passengers facilitated by a user-friendly smartphone app. At the forefront of innovation in the transportation industry, Lyft not only pioneers autonomous vehicles but also maintains a steadfast commitment to sustainability.

Demonstrating robust patent performance, the company showcases remarkable technology influence and globalization. For instance, its patents have garnered a total of 11,000 citations, influencing industry titans such as Microsoft and Apple. Furthermore, its PCT patents constitute a significant 10.2% of the overall portfolio, solidifying its global technological footprint.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Total forward citations of patents 11k

Technology Globalization

PCT filings percentage 10.2%

Netskope

U.S. Information Technology

Established in: 2012
2019-2022 Patent Application CAGR: 33%

Netskope stands as a global leader in cybersecurity, offering comprehensive solutions in cloud, data, and network security to empower organizations in applying zero trust principles for robust data protection. Its platform ensures optimized access and real-time security for individuals, devices, and data, regardless of their location. Netskope's technological expertise is evident in its strong capabilities in quality, influence, and global reach. The company's innovations span metadata, server technology, network security, data loss prevention, and more. Remarkably, these inventions have an average citation rate of 7.8 times each, with major industry players such as IBM, Microsoft, Oracle, Amazon, and Intel acknowledging their significance. 8.4% of these inventions hold PCT patents, underscoring Netskope's commitment to cutting-edge advancements in cybersecurity.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **100%**

Technology Influence

Average forward citations per patent **7.8**

Technology Globalization

PCT filings percentage **8.4%**

Nikola

U.S. Automotive

Established in: 2014
2019-2022 Patent Application CAGR: 34%

Nikola is dedicated to revolutionizing the trucking industry with innovative zero-emissions solutions, embodying a business model that seamlessly integrates next-gen truck technology, hydrogen fueling infrastructure, and maintenance services. Presently, the company boasts two groundbreaking products: the BEV, a battery-powered truck, and the FCEV, a hydrogen electric truck. With a total of 117 granted inventions, Nikola's technological footprint covers diverse areas such as battery cells, battery packs, vehicle frames, control arms, thermal management systems, fuel cells, and more. Beyond its inventive prowess, the company is forging a path to global leadership in the industry. Notably, 8.1% of its patents are PCT patents, surpassing the majority of entities in the Global Disruption 50, solidifying Nikola's position as an industry frontrunner.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Granted inventions **117**

Technology Globalization

PCT filings percentage **8.1%**

OneTrust onetrust

U.S. Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2016
2019-2022 Patent Application CAGR: 34%

Emerging as a beacon in data security, OneTrust stands as a unicorn with its market-defining Trust Intelligence Platform, seamlessly connecting privacy, GRC, ethics, ESG teams, and data processes. With a robust presence, OneTrust boasts a clientele of over 14,000 customers, earning the trust of more than 4,500 companies in complying with regulations like CCPA, GDPR, ISO27001, and numerous global privacy and security laws.
To date, OneTrust has a portfolio of 500+ inventions, encompassing 100% of its patent holdings. These inventions revolve around pivotal data technology aspects such as data processing, data subjects, data models, data systems, data libraries, data breaches, and data streams. The profound impact of these inventions is evident in their collective 20,000 citations, with an impressive average of 39.4 citations each, including industry giants like IBM, Meta, Microsoft, GE, and others. Notably, 11.6% of these inventions hold PCT patents, solidifying OneTrust's influence and global leadership in the industry.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Influence

Average forward citations per patent 39.4

Total forward citations of patents 20k

Technology Globalization

PCT filings percentage 11.6%

Orbbec 奥比中光 ORBBEC

China Machinery & Equipment

GLOBAL DISRUPTION 50 2023

Established in: 2013
2019-2022 Patent Application CAGR: 21%

Orbbec specializes in the development of 3D cameras and computer vision technologies, enabling developers to create immersive experiences, precise measurements, and advanced visualizations that were previously unattainable with traditional 2D cameras. In a recent collaboration with Microsoft, Orbbec unveiled the Femto Bolt, a 3D depth and RGB USB-C camera. Microsoft officially recommends it as an alternative to the Azure Kinect DK.
In terms of patent performance, the company has filed 1046 patent applications in the past 5 years. Reflecting its technological influence, these patents have garnered a noteworthy 7348 total citations, averaging 4.6 citations each.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years 1046

Technology Influence

Average forward citations per patent 4.6

Total forward citations of patents 7348

Pateo

China Automotive

Established in: 2009
2019-2022 Patent Application CAGR: 23%

Based in Shanghai, Pateo is a leading provider of Internet of Vehicles (IoV) products and services in Asia. Recently, at the IAA MOBILITY 2023, Pateo unveiled three noteworthy "magic weapons": the PATEO smart cockpit platform, PATEO cloud platform, and the 5G T-Box hardware product.
Pateo is dedicated to continuous innovation through collaborations with strategic partners like Tencent, BlackBerry, Amazon, and Qualcomm. Its commitment to original innovation is evident in the accumulation of 5078 patent applications. Furthermore, Pateo's significant impact on the industry is underscored by the fact that its patents have been cited 13,000 times by renowned innovative companies such as Corning, Panasonic, ZTE, Volkswagen, BYD, Honda, and others.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications 5078

Technology Influence

Total forward citations of patents 13k

Peloton Interactive

U.S. Machinery & Equipment

Established in: 2012
2019-2022 Patent Application CAGR: 31%

Established in 2012, Peloton Interactive has swiftly risen to prominence as a key player in the fitness industry. Renowned for its cutting-edge exercise equipment featuring internet-connected touch screens, the company streams live and on-demand fitness classes. Peloton wields a profound influence in the industry, with its patents garnering an impressive 16,000 citations and an average citation rate of 11.4 times. Major players in the fitness sector, including Nike, Adidas, Woodway, Precor, and Steelcase, draw inspiration from its technological innovations. Through the globalization of its technology, Peloton Interactive is charting a course to become a global leader in the fitness industry. Currently, the company's patents have made their mark in 53 countries and regions outside the U.S., including China, Germany, Australia, Japan, and more.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Average forward citations per patent 11.4

Total forward citations of patents 16k

Technology Globalization

Countries/regions covered 54

Qi An Xin

China Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2014
2019-2022 Patent Application CAGR: 25%

Qi An Xin is a prominent security provider specializing in safeguarding critical and valuable internet assets across various sectors, including government, military, finance, energy, and telecoms. The company has received the prestigious 2020 World Internet Leading Technology Achievement for its innovative "Endogenous Security Framework."
Since its inception, Qi An Xin has consistently ranked as one of the fastest-growing companies in the Chinese security market. Over the past five years, the company has amassed an impressive technology portfolio, comprising 1495 valid patent applications and 931 granted inventions. Highlighting its technological influence, Qi An Xin's patents have been cited a total of 7980 times, showcasing its significant impact in the industry. Leading tech giants such as Alibaba, Tencent, ZTE, Huawei, and Siemens have drawn inspiration from Qi An Xin's patents, attesting to the company's strong capability and influence in the technology landscape.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years	1495
Granted inventions	931

Technology Influence

Total forward citations of patents	7980

QuantumCTek

China Machinery & Equipment

GLOBAL DISRUPTION 50 2023

Established in: 2009
2019-2022 Patent Application CAGR: 10%

QuantumCTek, born out of the University of Science and Technology of China, stands as a frontrunner in China's quantum information industrialization. With a dedicated focus on quantum information technology (QIT), the company has emerged as one of the world's largest manufacturers of QIT-enabled products. QuantumCTek's product portfolio includes advancements in quantum computation and quantum communication technologies. Over the past five years, the company has amassed a significant intellectual property footprint, with over 400 valid patent applications covering a spectrum of quantum technology domains, including quantum key distribution, encryption, authentication, and server-related technologies. This commitment is further reflected in the company's impressive tally of 244 granted inventions.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years	444
Granted inventions	244

Quantum-Si

U.S. Life Science & Healthcare

GLOBAL DISRUPTION 50 2023

Established in: 2013
2019-2022 Patent Application CAGR: 31%

Quantum-Si is a disruptive force in the growing field of proteomics. The company's suite of technologies is powered by a first-of-its-kind semiconductor chip designed to enable single-molecule next-generation protein sequencing and digitize proteomic research. The company's accomplished team of scientists and engineers has unveiled a state-of-the-art benchtop sequencer, leveraging binding kinetics to detect single amino acids with remarkable precision. Notably sensitive to protein variants and post-translational modifications, this sequencer represents a cutting-edge advancement in the field.
In terms of patent performance, Quantum-Si boasts capabilities in technology size, quality, and influence. Over the past five years, the company has amassed 725 valid patent applications, achieving a 100% invention application percentage. The top 10 cited patents from Quantum-Si have garnered 1244 citations, underscoring the company's impact and recognition within the biotech landscape, with acknowledgments from industry leaders such as Illumina and Invitae.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years: 725

Technology Quality

Invention application percentage: 100%

Technology Influence

Total forward citations of top10 cited patents: 1244

Resideo

U.S. Electronics

GLOBAL DISRUPTION 50 2023

Established in: 2018
2019-2022 Patent Application CAGR: 18%

Established in 2018 through a spin-off from Honeywell, Resideo has become a prominent player in the smart-home industry. Specializing in the manufacturing and distribution of smart-home products and software, the company's key focus areas include air, water, and security monitoring, along with temperature, humidity, and lighting control.
Resideo's influence within the industry is manifested through its commitment to innovation, particularly evident in its patent portfolio. The company's top 10 cited patents have garnered recognition from industry pioneers such as Google, Samsung Electronics, and Schneider. Resideo's patents boast an impressive average citation rate of 20.7 times, surpassing 90% of the Global Disruption 50. Notably, Resideo's patent footprint extends its impact to markets in 29 countries/regions, showcasing the company's expansive global reach and market presence.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Total forward citations of top10 cited patents: 3858

Average forward citations per patent: 20.7

Technology Globalization

Countries/regions covered: 29

Rubrik

U.S. Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2014
2019-2022 Patent Application CAGR: 26%

Established in 2014, Rubrik is pioneering the domain of Zero Trust Data Security™ with the objective of empowering organizations to fortify their defenses against cyberattacks, internal malfeasance, and operational disruptions. At present, the company serves over 5,500 customers globally.
Dedicated to technological excellence, Rubrik boasts a remarkable 97% invention application percentage. Leveraging this innovation, the company has constructed the Rubrik Security Cloud platform—an advanced, machine learning-powered architecture rooted in the principles of zero trust. This platform ensures the security of data, monitors potential risks, and facilitates swift data recovery, regardless of its location. The company's numerous patents, spanning topics such as backup, virtual machines, data storage, data libraries, and file systems, have garnered an average citation rate of 6.1 times each, solidifying its influence in the field.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **97%**

Technology Influence

Average forward citations per patent **6.1**

Saluda Medical

Australia Life Science & Healthcare

GLOBAL DISRUPTION 50 2023

Established in: 2013
2019-2022 Patent Application CAGR: 23%

Saluda Medical, incubated by NICTA and established in 2013, has dedicated itself to the transformative mission of enhancing patients' lives through groundbreaking neuromodulation solutions. Rooted in over a decade of rigorous research and development, the company stands out as the pioneer in employing Evoked Compound Action Potentials (ECAPs) to directly assess the physiological response of the spinal cord to stimulation.
With an invention application percentage of 99%, Saluda Medical places an emphasis on the quality of its technology. Through its innovative technologies, the company not only influences but also challenges conventional norms. Its patents predominantly revolve around neural stimulus, neural response, and neuromodulation, with an average citation rate of 11 times for each. Notably, the company's top 10 cited patents serve as a source of inspiration for industry leaders such as Medtronic and Boston Scientific.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **99%**

Technology Influence

Total forward citations of top10 cited patents **1098**

Average forward citations per patent **11.0**

SenseTime

China Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2014
2019-2022 Patent Application CAGR: 60%

Emerging from the Chinese University of Hong Kong, SenseTime has positioned itself as one of the most valuable AI companies globally, specializing in the development of AI technologies such as facial recognition, object detection, autonomous driving, and remote sensing. Since its inception, SenseTime has achieved several technological milestones including the formulation of superior algorithms surpassing human eye detection accuracy and aligning text-to-image models more effectively with human preferences. The company's trajectory of innovation is relentless, evident in its staggering patent application CAGR of 60% during the period from 2019 to 2022. In terms of patent performance, SenseTime exhibits impressive capabilities in technology breadth, influence, and global reach. Over the past five years, it has amassed a total of 5754 patent applications. Impressively, the cumulative citation count for all its patents stands at 20,000 and its non-design PCT filings number reaches 758, surpassing 90% of its industry counterparts.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size
Patent applications in the past 5 years **5754**

Technology Influence
Total forward citations of patents **20k**

Technology Globalization
Non-design PCT filings **758**

Snap

U.S. Information Technology

GLOBAL DISRUPTION 50 2023

Established in: 2011
2019-2022 Patent Application CAGR: 41%

Snapchat, the precursor to Snap, has evolved into a cornerstone of Snap's product portfolio, alongside the augmented reality (AR) platform Lens Studio and AR glasses Spectacles. Since its inception in 2011, Snapchat has rapidly gained popularity and now stands as one of the most widely used social media platforms globally. Throughout its existence, Snapchat has been a continuous hub of innovation. This is evidenced by its robust Technology Size of 5610 patent applications. The platform has introduced several pioneering features such as Chat, Our Story, Tap to View, Lenses, and more. Notably, these features outpaced competitors like Instagram and Facebook, compelling them to introduce their own iterations. The impact of Snapchat's innovation is further underscored by the impressive citation count of its top 10 patents, totaling 4236 citations.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size
Patent applications **5610**

Technology Quality
Invention application percentage **96%**

Technology Influence
Total forward citations of top10 cited patents **4236**

Snowflake

U.S. Information Technology

Established in: 2012
2019-2022 Patent Application CAGR: 156%

Established in 2012 by three data warehousing experts driven by a vision to revolutionize the data landscape, Snowflake emerged as a game-changer in the industry. Recognizing the limitations of existing data platforms, the founders set a goal that propelled the creation of Snowflake's innovative architecture. Their groundbreaking approach marked a significant move from traditional data warehouse design, propelling the company towards unparalleled growth.
Despite being at the forefront of industry disruption, Snowflake remained committed to continuous innovation. Over the past five years, the company filed a remarkable 1027 valid patent applications, showcasing an impressive CAGR of 156% from 2019 to 2022. This strategic focus on innovation serves as a competitive edge in the fiercely contested cloud data market, where Snowflake competes with tech giants like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Total valid patent applications in past 5 years **1027**

Technology Quality

Invention application percentage **96%**

Stripe

Ireland Information Technology

Established in: 2010
2019-2022 Patent Application CAGR: 47%

Stripe specializes in providing payment processing software and application programming interfaces (APIs) for e-commerce websites and mobile applications, with a lofty mission to "increase the GDP of the internet." Widely adopted globally, Stripe's payment processing system is utilized by prominent companies, including Amazon, Google, WhatsApp, Salesforce, and others.
The core of Stripe's innovation revolves around pivotal technology domains such as payment processing, financial transactions, point of sale, and authentication, constituting an impressive 94% of its entire patent portfolio. Currently, the company's patents have an average citation count of 37 times, surpassing 94% of entities listed in the Global Disruption 50. Notably, Stripe's top 10 cited patents have garnered a remarkable 3214 citations, attesting to their significant impact and recognition by major tech players including Google, IBM, Microsoft, Paypal, Amazon, and Micron.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage **94%**

Technology Influence

Total forward citations of top10 cited patents **3214**

Average forward citations per patent **37.0**

SVOLT

China Energy & Electrical

GLOBAL DISRUPTION 50 2023

Established in: 2018
2019-2022 Patent Application CAGR: 88%

Established in 2018 as an independent entity, SVOLT originated from the Battery Business Unit of Great Wall Motors, evolving to become a pivotal player in the industry. Over the years, SVOLT has demonstrated unwavering commitment to propelling the industry into a new "Stacking Age" through the advancement of high-speed stacking technology for prismatic batteries.
From 2019 to 2022 SVOLT exhibited an impressive CAGR in patent applications reaching up to 88%. During this time frame, the company successfully introduced groundbreaking technologies, including NCMA and NMx batteries, cobalt-free battery cells, and 20Ah-class sulfide all-solid-state prototype cells. In terms of patent performance, SVOLT has amassed a substantial portfolio of 5407 valid patent applications over the past five years. These patents cover a spectrum of technology domains, encompassing battery cells, battery packs, electrodes, electrolytes, and pole pieces. Aligned with SVOLT's globalization strategy, the company has taken a proactive approach by filing 160 non-design PCT filings to date.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size
Patent applications in the past 5 years: 5407

Technology Globalization
Non-design PCT filings: 160

Traffic Control

China Machinery & Equipment

GLOBAL DISRUPTION 50 2023

Established Since: 2009
2019-2022 Patent Application CAGR: 32%

Traffic Control Technology (TCT) stands out as a premier rail transit solution provider in China, offering comprehensive telecom signal system solutions for the entire lifecycle of rail transit, encompassing both software and hardware components. Widely trusted, TCT serves the majority of subway operators in China and commands a substantial 25% share in the development of total greenfield rail projects.
TCT's commitment to technological excellence is evident in its collaborations and knowledge-sharing initiatives with various Chinese universities and institutes. This collaborative approach has yielded a robust technology portfolio, comprising a total of 1674 patent applications. The impact of TCT's technology extends beyond its own domain, influencing key players in the Chinese market, including Casco and Hisense. This influence is underscored by the noteworthy citation rate of TCT's patents, totaling an impressive 8,000 citations.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size
Patent applications: 1674

Technology Quality
Invention application percentage: 89%

Technology Influence
Total forward citations of patents: 8036

Ubtech Robotics

China Machinery & Equipment

Established Since: 2012
2019-2022 Patent Application CAGR: 16%

UBTECH Robotics stands as a trailblazer in the realm of AI-based humanoid robots, encompassing diverse application scenarios such as health, education, and commercial services. The company embarked on its journey by developing proprietary servomotors, gradually expanding its expertise to encompass end-to-end robotics technology, including visual sensing, movement control, and smart interaction. Today, UBTECH proudly holds the distinction of being one of the world's pioneering commercialized humanoid robot companies, earning widespread recognition for its innovation and excellence in the field of robotics.
With a comprehensive technology portfolio, UBTECH boasts nearly 4,000 patent applications. These patents span various application domains, with a particular emphasis on pattern recognition, vehicle control, image analysis, and more. This diverse and expansive patent portfolio solidifies UBTECH's position as a leader in pushing the boundaries of robotics technology across multiple domains.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications	3834
Granted inventions	1039

Technology Influence

Total forward citations of patents	7032

Ultimaker

Netherlands Machinery & Equipment

Established Since: 2011
2019-2022 Patent Application CAGR: 18%

Ultimaker is a key player in the realm of premium 3D printing solutions, offering a comprehensive suite that includes 3D printers, 3D printing software, and branded materials tailored for both commercial and industrial applications.
Distinguished by a commitment to innovation, Ultimaker continuously refines its product portfolio, striving to deliver a user experience characterized by precision, speed, intelligence, and user-friendliness. Since its inception, Ultimaker has ascended to global prominence, emerging as a challenger to established industry players such as GE and HP. Despite a modest total of 297 patent applications, Ultimaker's impact is substantial, with each patent holding significant quality and influence within the industry. The average citation count for each of its patents stands at 11, underscoring the depth and significance of Ultimaker's contributions to the 3D printing landscape.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Influence

Average forward citations per patent	11.0

Technology Globalization

PCT filings percentage	10.1%

United Imaging

China Life Science & Healthcare

Established Since: 2011
2019-2022 Patent Application CAGR: 13%

United Imaging is a fast-growing med-tech company providing various high-end medical imaging products, including MR, CT, XR. With only 12 years since founding, United Imaging is a game changer to the industry full of longstanding tech giants. It deeply integrated AI to make medical imaging far more intelligent and efficient. It also successfully developed high-performance core parts to build end-to-end product capability. United Imaging is now selling its products globally with multiple approvals from FDA & CE.
Started from learnings from GE, Siemens, Philips etc., United Imaging now has a technology portfolio of 7K Patent applications. It is also radiating its technology to other Chinese players and even global top players. Its patents have been cited for a total of 22K times.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications	7366
Granted inventions	2875

Technology Influence

Total forward citations of patents	22k

Technology Globalization

Non-design PCT filings	441

V-Nova

U.K. Information Technology

Established Since: 2011
2019-2022 Patent Application CAGR: 35%

V-Nova is famous for innovation in data compression technology for video and images with wide applications. Based on multi-layer coding, parallel processing and deep learning technologies, its flagship product PERSEUS provides high-quality video compression with 50% of the bandwidth required by other products. V-Nova partners with lots of leading tech and media companies, including Nvidia, Amazon, to provide fully-integrated products. It is also (co-)developer of multiple international standards.
V-Nova's technology also has a very wide global coverage, as it has patent applications in 28 countries/regions.

GLOBAL DISRUPTION 50 2023

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications	731

Technology Quality

Invention application percentage	100%

Technology Globalization

Countries/regions covered	28
PCT filings percentage	11.1%

Xiaomi

China Electronics

GLOBAL DISRUPTION 50 2023

Established Since: 2010
2019-2022 Patent Application CAGR: 13%

Xiaomi is a Chinese consumer electronics company. It is now a top 3 manufacturer of smartphones in the world. It is also famous for reinventing various consumer electronics with cost-effectiveness and IoT. Founded in 2010, it is now a rising tech giant with over 40K patent applications covering 38 countries/regions.
Xiaomi is a fast learner and open-minded innovator. It learned a lot from the global smart phone pioneers incl. Apple, Samsung L.G. etc. with 1K patent citations from each of them. It also conducts cooperative R&D projects with dozens of companies and universities. Now, Xiaomi is also extending its technology influence to many other smartphone players.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications	43.6k
Granted inventions	11.2k

Technology Influence

Total forward citations of patents	104k

Technology Globalization

Countries/regions covered	38

Xpeng

China Automotive

GLOBAL DISRUPTION 50 2023

Established Since: 2014
2019-2022 Patent Application CAGR: 64%

XPENG is one of the disruptive Chinese electric vehicle startups, aiming at driving Smart EV transformation and shaping the future mobility experience. The company offers sleek, intelligent, and adventurous vehicles and appeals to the large and growing base of technology-savvy middle-class consumers in China. In 2022, it sold 120K automobiles with only 6 models.
By learning from global top automobile companies, Xpeng has quickly established its unique technology capability esp. in autonomous driving area. It has a total of 4.2K patent applications and is still growing at a CAGR as high as 64%. Now Xpeng is also influencing many other Chinese traditional automobile manufacturers, with its patents being cited a total of 9K times.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years	3479
Granted inventions	1104

Technology Influence

Total forward citations of patents	9112

Technology Globalization

Non-design PCT filings	210

Yangtze Memory

China Semiconductor

GLOBAL DISRUPTION 50 2023

Established Since: 2016
2019-2022 Patent Application CAGR: 37%

Yangtze Memory Technologies (YMTC) is the top Chinese memory chip maker specializing in flash memory (NAND) chips. Its 3D NAND chips were the first to be domestically mass-produced in China.
YMTC was founded with a goal of building the country's independent capability on chips. In only 7 years, YMTC built up a large technology size of ~10K patents, with the number of granted inventions reaching 4K, and is still growing at a fast pace. With the successful design of its Xtacking architecture, YMTC has gradually established capabilities in advanced NAND chips and become a strong challenger to traditional chip giants including Micron, SK Hynix, Samsung. Now YMTC also has a wide technology influence with its patents being cited a total of 19K times.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Size

Patent applications in the past 5 years 7161

Granted inventions 4000

Technology Influence

Total forward citations of patents 19k

Technology Globalization

Non-design PCT filings 789

Zoom

U.S. Information Technology

GLOBAL DISRUPTION 50 2023

Established Since: 2013
2019-2022 Patent Application CAGR: 442%

Zoom is the video conference pioneer founded by a former Cisco engineer and executive. With its simple, flexible, diversified and streamlined conferencing features, it gained phenomenal growth during Covid-19, and now has more than 300 million daily participants.
Zoom has established solid technology capability on video conferencing. Its top cited patents were cited up to ~200 times each on average.
Starting from California, now Zoom has a worldwide business landscape. Its technology presence also shows a high globalization level as PCT patents count for 22% of its Patent applications, outstripping all other Disruption 50 companies.

Key Innovation Indicators

selected metrics to illustrate advantages

Technology Quality

Invention application percentage 100%

Technology Influence

Total forward citations of top10 cited patents 2138

Technology Globalization

PCT filings percentage 21.7%

【Statistics Methodology】

1) All data used in the report are from Patsnap's Global Patent Database and Company Innovation Capability Evaluation Platform. All statistics are up to 2023.07.31.
2) In order to remove impacts brought about by the time lag between a patent's application and disclose, all data statistics are calculated using the announcement date.

About Patsnap

Founded in 2007, Patsnap is the company behind the world's leading innovation intelligence platform. Patsnap is used by more than 12,000 customers in over 50 countries around the world to access market technology, and competitive intelligence as well as patent insights needed to take products from ideation to commercialization. Customers are innovators across multiple industry sectors, including Biotechnology, Medical devices, Pharmaceuticals, Chemicals, Electronics Manufacturing, Automotive, Consumer Goods, Aviation & Aerospace, Education, Legal Firms.

Patsnap's team of 1200+ employees work from its global headquarters in Singapore, London, and Toronto. To learn more about how Patsnap is improving the way companies innovate, visit www.patsnap.com.

About Patsnap Research

Patsnap Research is a research team owned by Patsnap. Based on Patsnap's powerful data resources on the whole life cycle of science and technology innovation, such as patents, investment and financing, Patsnap Research carries out independent research on technology innovation and various vertical fields, generating diversified outputs, such as reports, briefings, and rankings, etc. Patsnap Research is committed to conveying valuable insights into the world's innovation with a unique viewpoint to empower technological progress.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