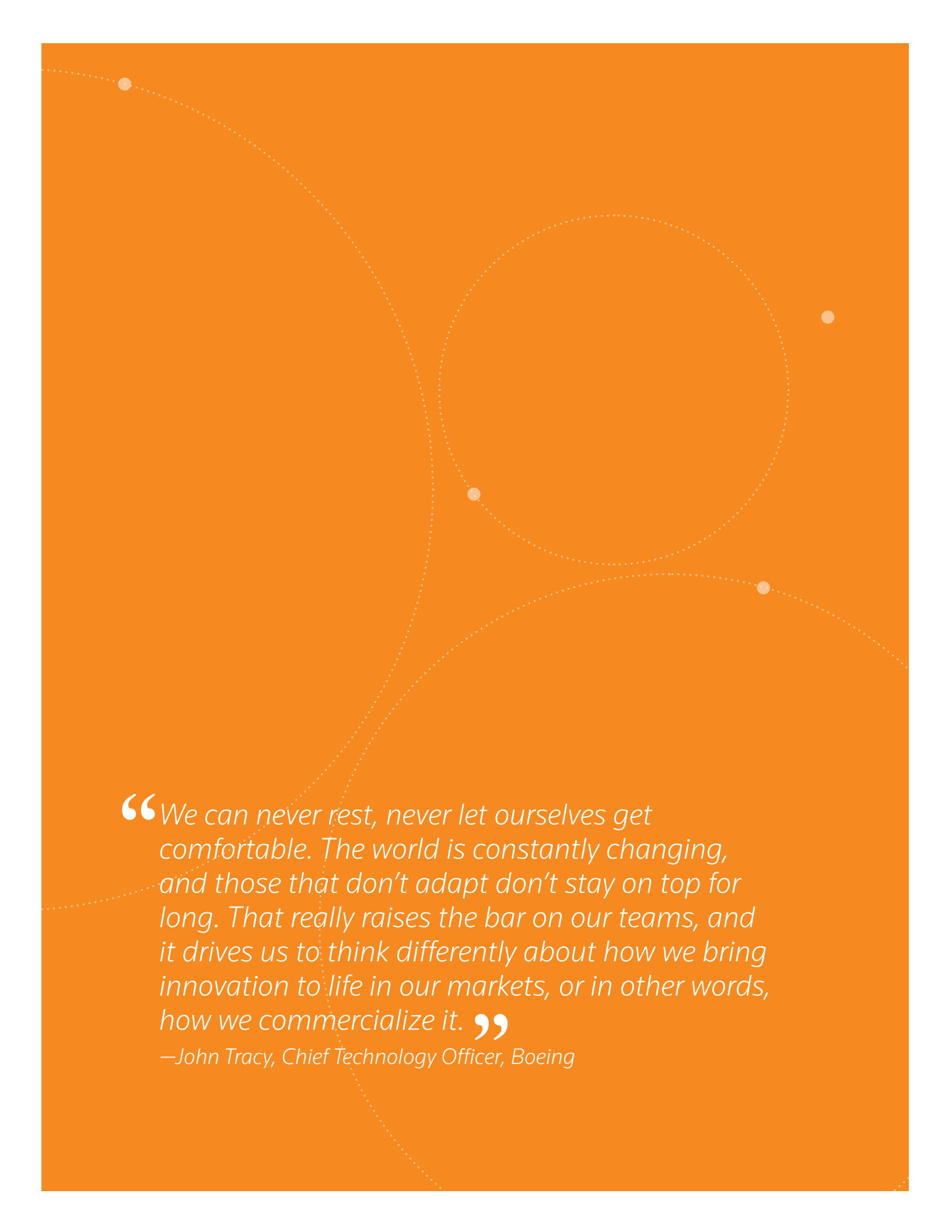


THE FUTURE IS OPEN

2015 State of Innovation



THOMSON REUTERS



“We can never rest, never let ourselves get comfortable. The world is constantly changing, and those that don’t adapt don’t stay on top for long. That really raises the bar on our teams, and it drives us to think differently about how we bring innovation to life in our markets, or in other words, how we commercialize it. ”

—John Tracy, Chief Technology Officer, Boeing

TABLE OF CONTENTS

Introduction 4

Observations & Findings 5-6



Aerospace & Defense 7-12



Automotive 13-18



Biotechnology 19-24



Cosmetics & Wellbeing 25-30



Food, Beverage, Tobacco 31-36



Home Appliances 37-42



Information Technology 43-48



Medical Devices 49-54



Oil & Gas 55-60



Pharmaceuticals 61-66



Semiconductors 67-72



Telecommunications 73-78

OPENING UP THE FUTURE OF INNOVATION

Innovation is global and is at the heart of the global economy. In the last 10 years, we've witnessed the introduction of driverless cars, the advent of bionic limb reconstructions, and the discovery of the Higgs boson. Meanwhile, Big Data and artificial intelligence are fundamentally shifting the way societies work. Advancements like these are inspiring new generations of innovators, agents of change and curious minds to imagine and create a better tomorrow.

Every two days now, humanity creates as much information as we did from the dawn of civilization up until 2003. That's something like five exabytes of data. Given this amount of information, it's no surprise that innovation activity is at an all-time high. We see a bleeding of technologies into tangential sectors, inspired by the Internet of Things. This is opening up new revenue streams for progressive companies prepared to expand into different areas.

Take Samsung, reinventing itself, over and over and over again. Soon, as well as watching a Samsung TV, you may be taking Samsung-branded prescription drugs, consuming Samsung energy drinks, wearing Samsung make-up and orbiting earth in a Samsung spaceship.

The Future Is Open

As you'll read in *The Future Is Open: 2015 State of Innovation*, we're also seeing leading companies like Toyota embracing and encouraging open innovation. While brand protection is as important as ever, patent information has become an increasingly strong indicator of a company's value, especially as companies work to reduce their time-to-market cycles. Many more are reaching out, inviting people in, partnering with entrepreneurs and academia. At the same time, the way consumers interact with brands is fundamentally shifting the way we do business—creating new challenges for innovators looking to protect their inventions from counterfeiters and piracy.

Pace of Innovation

Today's tsunami of Big Data information is a catalyst for innovation. That's why it's surprising to hear our finding that year-over-year innovation activity has dropped to its slowest pace since the global economic recession. While the impact is

still to be determined, one thing we know with certainty is that innovation is a key driver of economic success and growth. And although a slowing of the pace of innovation could be a result of other factors, like changes to patent legislation, if the trend continues it will be something corporations and governments will want to pay close attention to.

Lifecycle of Innovation

In the past year, while watching these trends, I've made a point of meeting hundreds of customers. I wanted to learn what innovation looks, sounds and feels like in different companies across their innovation experiences. At Thomson Reuters, we call this process the 'Lifecycle of Innovation.' From the initial stage of Discovery, when an idea is conceived and vetted; through to Protection, when it's approved and deemed viable; to Commercialization, when the ultimate product or solution is brought to market.

For today's innovators, Thomson Reuters is a trusted partner. They rely on us to power their work across the Lifecycle of Innovation. The business people I met want to get their products to market more quickly. This means enabling the professionals who actually do the work in this lifecycle to find better solutions through connecting and collaborating.

As you work through *The Future Is Open: 2015 State of Innovation*, I would ask you to bear one thing in mind. There's a great opportunity here for those involved in the business of innovation to achieve quicker and better results. Especially organizations that understand innovation as one entity. Now is the time to make the activity of innovation more visible. To connect the previously unconnected in the lifecycle of innovation. To improve the journey of a product to market. To value the world of innovation for its successes.

Basil Moftah, President, Thomson Reuters IP & Science

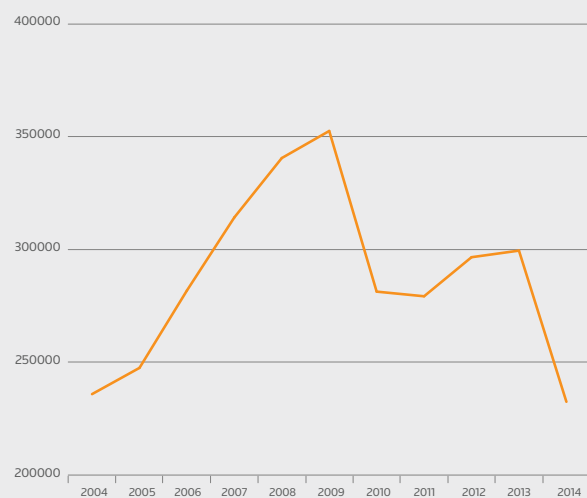
OBSERVATIONS & FINDINGS

Innovation activity is at an all-time high. Using patents as a proxy for innovation, there were more unique inventions that were published applications or granted patents over the last year than ever before in the history of humankind.

However, quantity alone only paints a portion of the picture. More is needed. That's why Thomson Reuters analysts also looked at scientific literature output to determine the level of research activity, comparing it to patenting, for a full view.

It is commonly said that scientific literature is a precursor to patenting by approximately three-to-five years. The discovery phase of the lifecycle of innovation happens before protection and commercialization, and scientific research leads discovery. By assessing scientific research (see *Figure 1*) alongside patent activity (*Figure 2*), you see the truest picture of what's happening in terms of research and innovation.

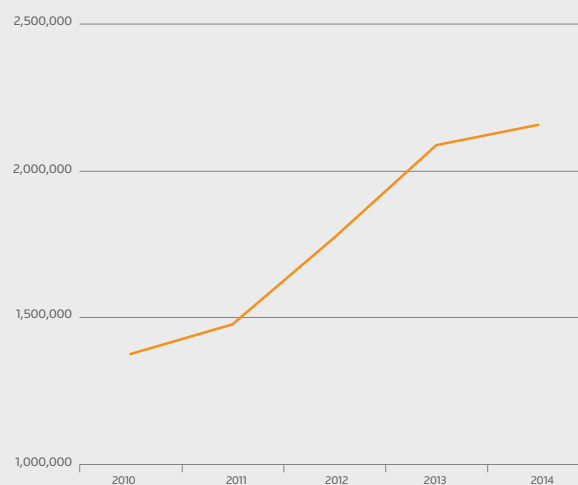
Figure 1: Scientific Literature Volume across 12 Industries in State of Innovation (2004 – 2014)



Source: Thomson Reuters Web of Science

Another finding this year is that while patent activity has been on an upward climb, its ascent over the past year was the slowest since the global economic recession in 2009 (see *Figure 2*). This could be the result of myriad factors, from changes in legislation to economic, political, social or industry stresses. Thomson Reuters analysts are closely monitoring the landscape to see if the trend continues and what the future holds in terms of advances and declines.

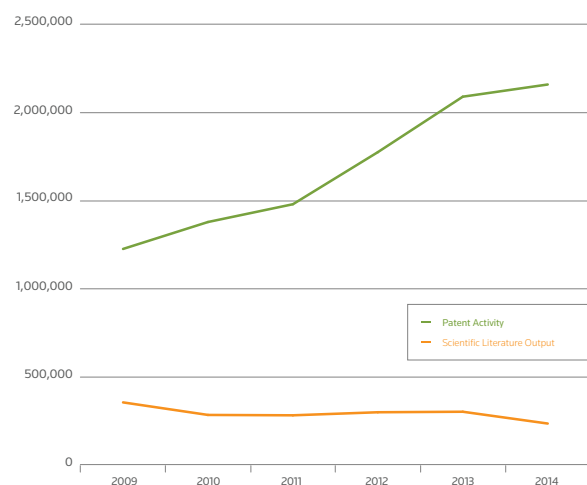
Figure 2: Patent Volume across 12 Industries in State of Innovation (2010 – 2014)



Source: Thomson Reuters Derwent World Patents Index

Figure 3 shows the scientific research output and patent activity from 2009 to 2014 across all 12 sectors. The downward decline in research, as mentioned earlier, may be an early indicator that innovation is truly slowing. This will be clearer once the data for all of 2015 is in (in early 2016).

Figure 3: Joint Scientific Literature & Patent Activity (2009 – 2014)



Sources: Thomson Reuters Derwent World Patents Index & Web of Science

Another innovation finding: open innovation is alive and well, backed by the proof that companies across nearly every sector are collaborating with academic institutions, individual researchers and others to bring their ideas to market more

quickly. Given the fast pace of global innovation, it is no longer possible for individual organizations to innovate solely on their own. By leveraging that which has been done before and partnering with organizations that may solve for one aspect of an invention, companies are able to go to market more quickly and meet consumer demand for faster innovation time cycles. Samsung is a perfect example of a company that embraces open innovation: approximately 130 of every 10,000 patents it files are done jointly with an academic institution.

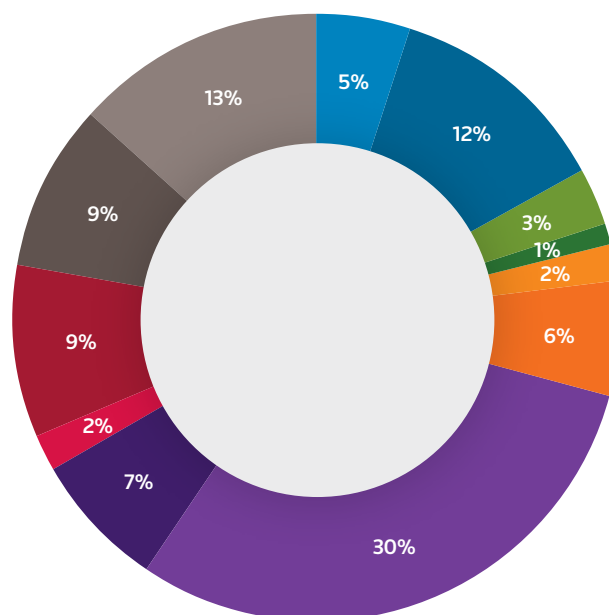
The final innovation trend identified is the bleeding of organizations into tangential areas, outside of their traditional areas of expertise. Driven by the Internet of Things, the need to remain competitive and the quest to exceed shareholder expectations, more and more companies are extending their reach into related fields, bringing their unique specialization to new areas. Dozens of organizations are doing this, including Apple, DuPont, General Electric, IBM and Samsung. Samsung happens to be the most extreme example, as it ranks among the top 25 innovators globally in nine of the 12 industries analyzed in this study. And, it has an innovation presence in all 12 sectors.

Read on to find out more about the specific activity in each area, who's leading, what is hot and what's coming next.

Overall View of Innovation

%	Industry	2014 Volume	2013 Volume	% Change
5%	Aerospace & Defense	62,162	63,080	-1%
12%	Automotive	153,872	152,221	1%
3%	Biotechnology	42,584	39,685	7%
1%	Cosmetics & Well Being	11,017	10,197	8%
2%	Food, Tobacco & Beverage Fermentation	26,333	21,758	21%
6%	Home Appliances	71,278	71,118	0%
30%	Information Technology	380,325	367,028	4%
7%	Medical Devices	93,462	99,290	-6%
2%	Oil & Gas	24,158	23,925	1%
9%	Pharmaceuticals	111,479	99,950	12%
9%	Semiconductors	112,625	119,099	-5%
13%	Telecommunications	161,739	153,153	6%

Source: Thomson Reuters Derwent World Patents Index





AEROSPACE & DEFENSE

You may not be ready for manned space exploration,
but the window on your world is about to change.

A WINDOW OF OPPORTUNITY

Imagine sitting back in your cabin seat and using the window next to you as a tablet computer. Airbus has begun to think about providing you with up-to-date information on the flight and destination through bigger windows equipped with touchscreen capabilities.

Airbus has filed a patent for its smart aircraft window—including a transparent OLED touchscreen and a passenger-facing camera that detects what you're looking at. Add to this an environment-monitoring camera positioned on the outside of the aircraft, providing a wider view of the world below your window.

Above And Below The Clouds

Cloud-based technology means something different to the aerospace community, where the arc of innovation runs from consumer satisfaction to national security.

While innovation in airplane technology continues apace, aerospace innovation as a whole saw a decline from 2013 to 2014.

The top three innovative aerospace manufacturers hail from the U.S., led by United Technology Corp. in 2014. However, Boeing shows the most dramatic increase in innovation in Space Technology, a subsector within Aerospace & Defense. The company has more product and technology development in progress today than at any time in the last 50 years. While continuing to develop the latest commercial airplanes, it's stretching out at the forefront of manned space exploration.

While European universities are involved in setting the pace—including Sapienza, in Italy, and the Centre Nationale de la Recherche Scientifique, in France—the scientific literature citations tell us that the most impactful aerospace research is happening in the U.S., with the University of Michigan taking center stage.

The University of Michigan's current specializations are not the kind to enthuse consumers, yet research into the use of surrogates in place of expensive models for testing components and nickel-based super alloys for advanced turbine engines will surely bring more recognizable benefits as the innovation lifecycle progresses.

“It's a new generation of interactive information that puts the in-flight magazine back in the last century. You're flying over the Nile valley, tapping your window and getting information on the pyramids below. But don't get obsessed on the window. It could be a windowless cabin with the same thing happening on the wall beside you. The important thing is the visualization opportunity.”

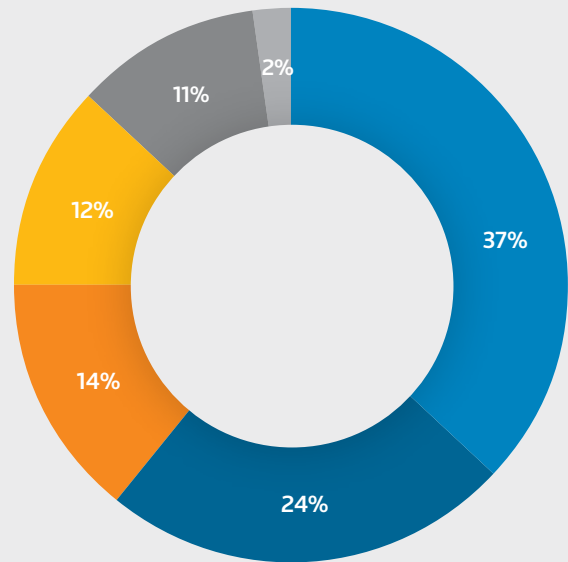
—George Jack, Engineering Expert, Thomson Reuters



AEROSPACE & DEFENSE OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
37%	Production Techniques	18,823	20,100	-6%
24%	Advanced Materials	12,233	11,660	5%
14%	Structures & Systems	7,136	5,709	25%
12%	Instrumentation	6,270	4,727	33%
11%	Propulsion Plants	5,894	4,867	21%
2%	Space Technology - Vehicles and Satellites	1,156	985	17%

Source: Thomson Reuters Derwent World Patents Index



Financials of Top 5 Aerospace Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
United Technologies Corp	U.S.	65,100.0	1,024	62,626.0	4%
General Electric	U.S.	148,589.0	619	146,045.0	2%
Boeing	U.S.	90,762.0	560	86,623.0	5%
Airbus	France	73,465.7	544	79,324.4	-7%
Jiangxi Hongdu Aviation Industry Group Corp. LTD	China	556.2	488	472.5	18%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Space Technology Innovators – Asia (2010 - 2014)

Company	Country	# Inventions
Korea Aerospace Research Institute	S. Korea	147
Harbin Institute of Technology	China	139
Aerospace Dongfanghong Satellite	China	97
University Beijing Aeronautics & Astronautics	China	97
Beijing Institute of Control Engineering	China	84
Mitsubishi Electric	Japan	77

Source: Thomson Reuters Derwent World Patents Index

Top 5 Space Technology Innovators – Europe (2010 - 2014)

Company	Country	# Inventions
Airbus	France	211
Energiya Rocket	Russia	103
Thales	France	78
Information Satellite Systems Reshetnev	Russia	52
Cent Nat Etud Spatiales	France	42

Source: Thomson Reuters Derwent World Patents Index

Top 5 Space Technology Innovators – North America (2010 - 2014)

Company	Country	# Inventions
Boeing	U.S.	210
Honeywell	U.S.	50
Lockheed Martin	U.S.	41
Raytheon	U.S.	34
NASA	U.S.	28

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific-Research Institutions in Aerospace (2004 – 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
University of Michigan System	U.S.	446	1.78
University of Michigan	U.S.	445	1.77
Sapienza University	Italy	318	1.44
University of Texas Austin	U.S.	324	1.38
U.S. Department of Energy	U.S.	405	1.38
Goddard Space Flight Center	U.S.	604	1.32
Centre National de la Recherche Scientifique (CNRS)	France	504	1.32
Massachusetts Institute of Technology (MIT)	U.S.	482	1.31
Penn State University	U.S.	408	1.3
Pennsylvania Commonwealth System of Higher Education	U.S.	446	1.3

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Head In The Clouds, Feet On The Ground

The two great customer bases of aerospace research and manufacturing are being driven by similar needs.

Both commercial and defense customers are asking innovators to help them succeed in changing markets and environments that are full of competitive challenges.

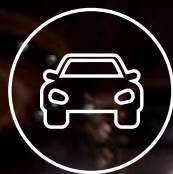
In a world where security is increasingly in the public eye, both sets of customers are wanting more value, capability and reliability—more quickly and more affordably, and with more certainty of delivery than ever before.

All are seeing that, if they don't or can't provide these things, others are happy to enter the market who can and will, whether or not they are currently recognized as key players in aerospace.

“That’s the thing about what we call our ‘more-for-less’ world: to succeed within it requires more, not less, innovation and development, application and replication of technology. This isn’t about whether or not we innovate. It’s about delivering the innovative solutions that will allow our customers to succeed.”

—John Tracy, Chief Technology Officer, Boeing





AUTOMOTIVE

Many of us are going to be travelling in driverless cars before we know it.
Do people want driverless cars? Did we know we wanted iPhones?

COMPUTERS ON WHEELS

According to Jen-Hsun Huang, CEO of Nvidia Corp, a Santa Clara-based chip manufacturer, what happened with the mobile industry is about to happen with the car. “Your car is going to be one delightful computer rolling down the street.”

From driverless cars to alternative-fuel vehicles, cars are quickly becoming the most advanced computers we use.

Are We Open To Innovation?

Japanese, U.S. and German companies appear well placed to adapt quickly to a sector dominated by energy and technology issues.

The Toyota Prius is 20 years old, yet some people still consider it a step too far. On the surface, this year’s automotive State of Innovation figures seem to support this viewpoint. Alternative-power vehicle innovation dropped by 5% year-over-year. But dig down and we’ll find the real reason lying with the world leader in automotive innovation, Toyota.

In a bold bid for open innovation, the company has offered up its fuel cell patent portfolio to unlicensed use. This is certainly one factor explaining the meager 1% overall growth in the automotive sector. Yet it could lead to a much bigger market for Toyota down the line.

We’re also seeing possibilities for open innovation in the U.S., where we find the most prolific research institutions in automotive innovation.

In terms of the most impactful research institutions, the University of Michigan leads the way, focusing on control-oriented modelling and analysis for automotive fuel-cell systems. Ford is focused on hydrogen-storage materials for automotive applications. These two are neighbors—surely a perfect case for collaboration between academia and the corporate world.

In Europe, Germany is the overall leader in automotive innovation, with companies like Bosch dominating as a component innovator in the automotive accessory space.

“The real hybrid is the car that continues to be driven on the uncertainty of fossil fuels while crammed with ever smarter computer technology. Manufacturers and innovators are aware of this and watching consumer reactions like hawks. The tipping point is coming.”

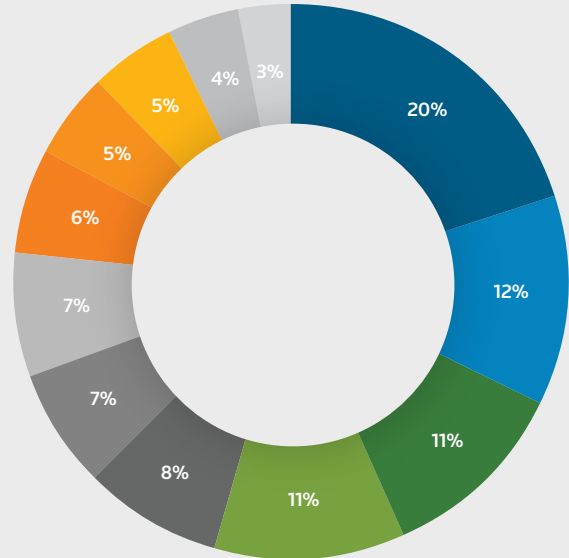
—Kevin Chapman, Lead Engineering Expert, Thomson Reuters



AUTOMOTIVE OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
20%	Alternative Powered Vehicles	32,973	34,629	-5%
12%	Safety	18,893	17,768	6%
11%	Navigation Systems	18,538	18,399	1%
11%	Transmission	18,484	18,776	-2%
8%	Seats, Seatbelts & Airbags	13,596	15,535	-12%
7%	Steering Systems	11,599	11,402	2%
7%	Suspension Systems	11,003	10,694	3%
6%	Pollution Control	9,677	10,070	-4%
5%	Security Systems	8,360	8,899	-6%
5%	Engine Design & Systems	7,334	7,396	-1%
4%	Braking Systems	6,831	6,950	-2%
3%	Entertainment Systems	4,267	4,332	-2%

Source: Thomson Reuters Derwent World Patents Index



Financials of Top 5 Automotive Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Toyota	Japan	246,431.6	4,338	251,729.5	-2%
Hyundai	S. Korea	81,204.9	3,214	82,728.6	-2%
Bosch	Germany	N/A	2,912	N/A	N/A
Denso	Japan	39,222.8	2,383	40,680.7	-4%
Honda	Japan	114,496.2	2,120	115,922.3	-1%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Auto Innovators – Asia (2010 -2014)

Company	Country
Toyota	Japan
Hyundai	S. Korea
Denso	Japan
Honda	Japan
Nissan	Japan

Source: Thomson Reuters Derwent World Patents Index

Top 5 Auto Innovators – Europe (2010 -2014)

Company	Country
Bosch	Germany
Daimler	Germany
Volkswagen	Germany
Schaeffler Group	Germany
Audi	Germany

Source: Thomson Reuters Derwent World Patents Index

Top 5 Auto Innovators – North America (2010 -2014)

Company	Country
General Motors	U.S.
Ford	U.S.
Halla Visteon	U.S.
Caterpillar	U.S.
IBM	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Prolific Scientific Research Institutions in Automotive (2004 – 2014)

Institution	Country	# of Papers (WoS)
University of Michigan	U.S.	324
Ford Motor Company	U.S.	232
Polytechnic University of Turin	Italy	170
Technical University of Munich	Germany	167
Shanghai Jiao Tong University	China	166
Ohio State University	U.S.	142
Univesity of Erlangen-Nuremberg	Germany	141
Indian Institute of Technology	India	134
Seoul National University	S. Korea	130
RWTH Aachen University	Germany	126

Source: Thomson Reuters Web of Science

We'll All Be Back-Seat Drivers

Without a doubt, falling oil prices have also contributed to a reduction in the appeal of alternative power when it comes to automotive innovation.

While futurists will tell us to regard this as a blip, the near future is an interesting space for the automotive sector.

The battle for positioning on the energy sources of the future has begun in earnest. The stats show innovation increasing in the petroleum industry at a time when institutions are under pressure to divest from fossil fuels.

While improvements in safety and the environmental performance of vehicles continues, look out for drastic improvements in propulsion systems on the road to autonomous vehicles.

Hydrogen propulsion technology needs substantial investment in the hydrogen fuel delivery infrastructure. At the same time, the establishment of more recharging stations will enable the growth of battery electric vehicles, especially with improvements in battery performance.

“Already today, Advanced Driver Assistance Systems such as automatic emergency braking systems are on the market. More and more will be introduced in the next few years, with systems able to autonomously perform substantial parts of the driving task, with the ultimate long term vision of fully autonomous vehicles. However, while no insurmountable technological problems exist in the short, medium, or long term, other issues have to be addressed as well, such as the legislation, traffic rules, social acceptability.”

—Yong-Geun KIM, President, The International Organization of Motor Vehicle Manufacturers





BIOTECHNOLOGY

Get better acquainted with your molecules—they're unique to you,
and so is the medical treatment you need to give them.

CANCER GETS EVER MORE PERSONAL

Until recently, the world has viewed cancer as one disease that affects individuals in different anatomical areas—lung, breast, prostate, etc. So, why is it that people with the same cancer respond differently to the same medicine?

Innovation in biotechnology is responding to the knowledge that, while every cancer patient faces similar challenges, every patient's cancer is his/her own unique version, driven by individual biological factors.

Academia Makes It Personal

Cancer innovation is one of the few areas that has more top innovative organizations hailing from the academic sphere than from corporations.

The move toward precision medicine and more targeted treatments had an 11% increase in year-over-year innovation activity.

Sector leaders from Roche (Switzerland) and DuPont (U.S.) to MIT (U.S.) and the Universities of California (U.S.) and Seoul National University (S. Korea) are actively protecting their inventions for future commercial advantage.

In terms of scientific research, the Broad Institute is the most influential institution in biotech. Thomson Reuters named Broad Institute's Eric Lander as one of the World's Most Influential Scientists of 2014. The Institute's genomics research is focused on building a functional landscape for cancer drug resistance—including the Genome Analysis Toolkit, a framework for analyzing next-generation DNA sequencing data.

Not only has there been a surge in biotech innovation related to drug treatments for cancer, but biotech innovation also has an effect on other areas, like pharmaceuticals and food/beverage/tobacco compositions, all areas which saw a jump in year-over-year innovation activity.

“Innovation in genome sequencing technology is transforming the future of medicine and heralding the prospect of precision and personalized medicine. In the future, the healthcare we receive and the treatments we are prescribed will be tailored to the molecular changes that are detected in an individual. Tests are now being developed to identify molecular changes in a patient's cancer cells that will be used to define the best course of treatment using strategies designed to target these precise changes.”

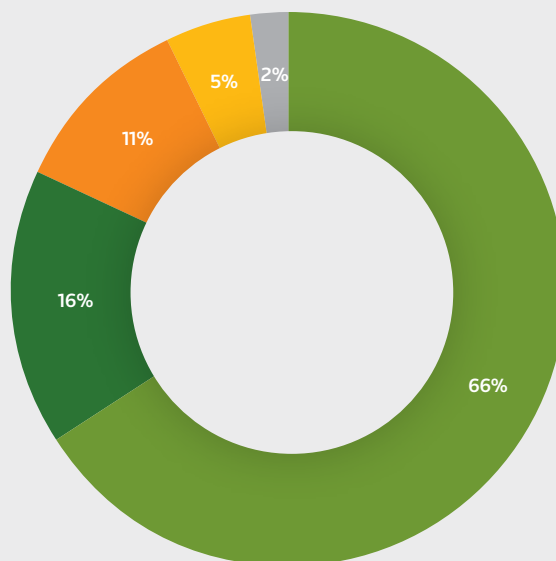
—Clara Fernandez, Biotechnology Expert, Thomson Reuters



BIOTECHNOLOGY OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
66%	General biotechnology	29,374	26,858	9%
16%	Diagnosis of diseases	6,984	6,541	7%
11%	Cancer treatment	4,855	4,378	11%
5%	Genetically modified crops	2,153	2,487	-13%
2%	Drug discovery	951	1,204	-21%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Biotech Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
DuPont	U.S.	34,906	456	35,921	-3%
Chinese Academy of Sciences	China	N/A	309	N/A	N/A
Jiangnan University	China	N/A	280	N/A	N/A
Monsanto	U.S.	15,582	240	15,065	3%
Zhejiang University	China	N/A	237	N/A	N/A

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Cancer Innovators – Asia (2010 - 2014)

Company	Country
Seoul National University	S. Korea
University of Fudan	China
Korea Research Institute of Bioscience & Biotechnology	S. Korea
Onco Therapy Science	Japan
Agency for Science, Technology & Research (A*STAR)	Singapore
University of Tokyo	Japan
Yonsei University	S. Korea

Source: Thomson Reuters Derwent World Patents Index

Top 5 Cancer Innovators – Europe (2010 - 2014)

Company	Country
Roche	Switzerland
Inserm	France
CNRS	France
Novartis	Switzerland
Sanofi-Aventis	France

Source: Thomson Reuters Derwent World Patents Index

Top 5 Cancer Innovators – North America (2010 - 2014)

Company	Country
University of California	U.S.
Genentech	U.S.
US Department of Health	U.S.
University of Texas	U.S.
Johns Hopkins University	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific-Research Institutions in BioTech (2004 – 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
Broad Institute	U.S.	392	7.54
Massachusetts Institute of Technology (MIT)	U.S.	1355	4.24
Howard Hughes Medical Institute	U.S.	869	3.87
Wellcome Trust Sanger Institute	UK	690	3.78
Memorial Sloan Kettering Cancer Center	U.S.	328	3.38
European Molecular Biology Laboratory (EMBL)	EU	774	3.38
Lawrence Berkeley National Laboratory	U.S.	553	3.24
Harvard University	U.S.	2922	3.05
University of California, Berkeley	U.S.	1330	2.96
Dana-Farber Cancer Institute	U.S.	405	2.93

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Your Molecular Future

Academic and corporate innovators are opening up possibilities for an individual-based approach to medicine.

We can expect greater focus on recent advances in genomics and molecular biology, as innovators look to identify genetic and modular variations of an individual patient's cells.

Gradually, this must lead to targeted drugs in treatment strategies that address the unique make-up of a human being.

“Many cancers can now be attacked based on the molecular errors that they carry. For the first time, we have the knowledge and capabilities to identify some of the genetic disruptions in an individual patient's cancer cells that may be the molecular drivers of that person's unique cancer.”

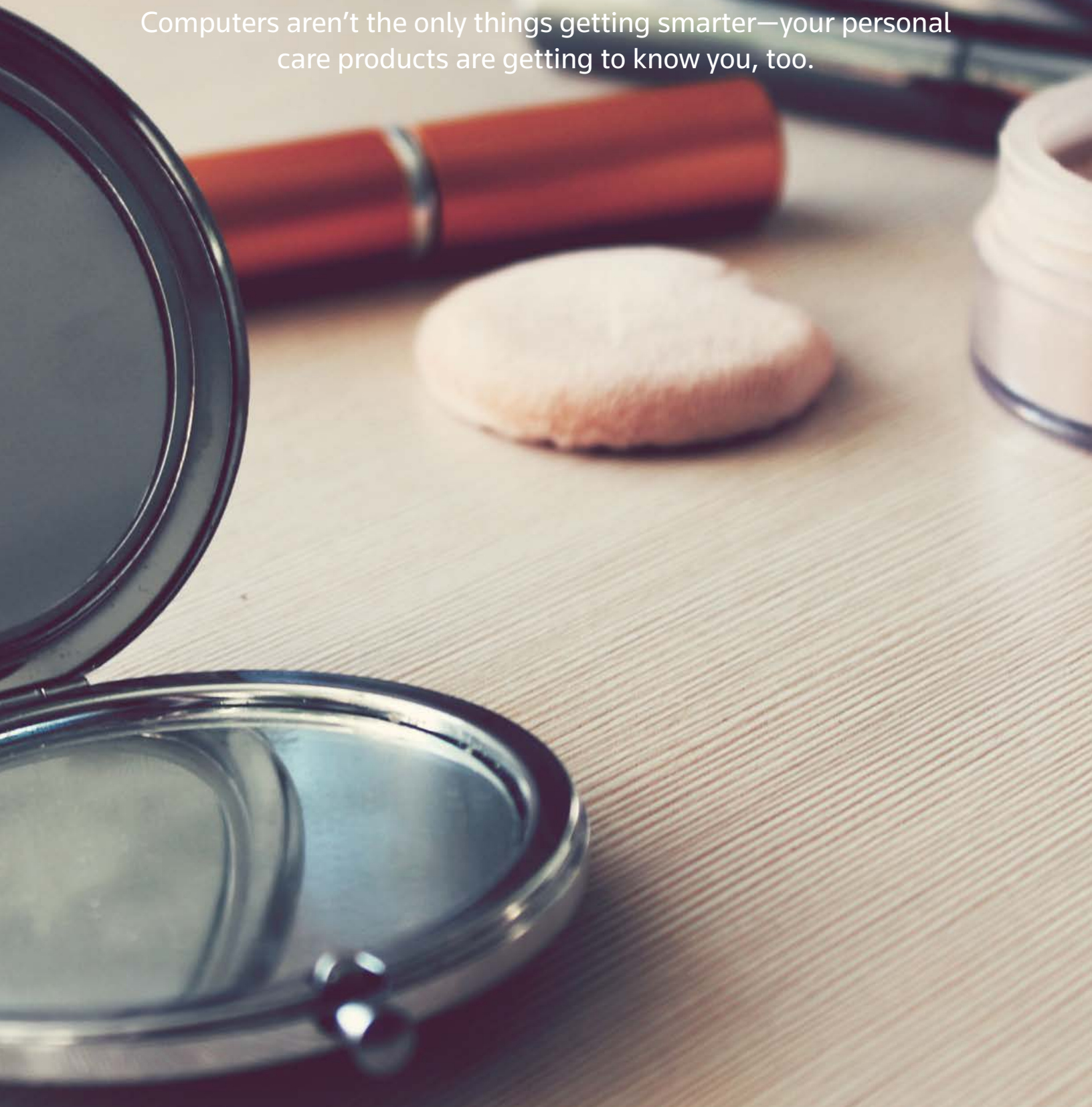
—John Quackenbush, Co-Founder and Board Chair, GenoSpace





COSMETICS & WELLBEING

Computers aren't the only things getting smarter—your personal care products are getting to know you, too.



FORGET THE MIRROR

Some say beauty is in the eye of the beholder. In which case, the mirror never lies.

Well, the mirror doesn't know you like your skincare products know you. That's the future. You won't have to adapt your beauty strategies to the product—the product will adapt to you.

Smart products have to be the goal of innovation in the cosmetics and wellbeing sector. Mirrors are so last century.

All Is Vanity

People are increasingly taking beauty into their own hands. In fact, the personal care industry is projected to reach \$630 billion in revenue by 2017.

That revenue will comprise a number of new-and-improved solutions, ranging from make-up and lipsticks to traditional Chinese cosmetic remedies and cosmeceuticals.

The most active area over the past year was in shampoos, where 19% of all the beauty-innovation activity was focused. Coming in a close second was the category of cosmeceuticals, where cosmetics and pharmaceuticals converge, followed closely by skin cleansers and soaps.

In the area of Cosmeceuticals, U.S. manufacturer Pharmacyclics developed a skin ointment for inhibiting epidermal growth in patients having cancer—a clear example of a cosmetic-based application being used to treat disease through best practice across two sectors.

For those seeking more natural means of beautification, a number of companies can be found, including China's Qingdao Hengbo Instrument Co. Ltd., which sought protection for a traditional Chinese medicinal facial mask useful for treating chloasma.

Overall, L'Oreal leads the pack in beauty-enhancing innovation, and is approximately 200 percent more active than its nearest competitor. The top five beauty-related companies innovating in 2014 hail from Europe, Asia and North America, one of the few technology sectors analyzed in this report to have all three regions represented: L'Oreal (France), Kao (Japan), Henkel (Germany), AmorePacific (S.Korea) and P&G (U.S.).

Brazil shines through as the hotbed for cosmetics-related research papers, with the University of Sao Paulo and the State University of Campinas taking the first and eighth spots, respectively, in research output for North and South America over the last decade.

“Like many other sectors, the cosmetics and well-being industry is evolving in pace with new technological and chemical advancements. For instance, the use of nanoparticles and the merging of best practices in cosmetics and pharma show just how advanced personal care and health items have become. Beauty and wellness come in many different packages, but constant to them all is an innovation mindset that pushes the envelope and uses the latest techniques.”

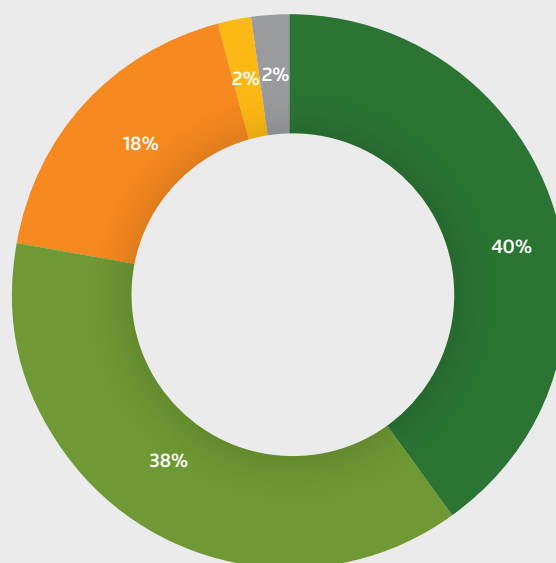
—Peta Leggatt, Pharmaceutical and Technical Expert, Thomson Reuters



COSMETICS & WELLBEING OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
40%	Make-up	5,722	5,576	3%
38%	Skin	5,407	4,857	11%
18%	Hair	2,614	2,550	3%
2%	Perfume	342	306	12%
2%	Antiperspirant	274	280	-2%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Cosmetics Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
L'Oreal	France	27,264.8	482	30,486	-11%
Kao	Japan	11,691.1	240	12,513.4	-7%
Henkel	Germany	19,878.7	183	22,536.4	-12%
AmorePacific	S. Korea	3,524.5	139	2,937.8	20%
P&G	U.S.	82,086	123	81,596	1%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Make-up Innovators – Asia (2010 - 2014)

Company	Country
Kao	Japan
AmorePacific	S. Korea
Shiseido	Japan
Kose	Japan
Pola Chem Industris	Japan

Source: Thomson Reuters Derwent World Patents Index

Top 5 Make-up Innovators – Europe (2010 - 2014)

Company	Country
L'Oreal	France
Henkel	Germany
BASF	Germany
Unilever	UK
Beiersdorf	Germany

Source: Thomson Reuters Derwent World Patents Index

Top 6 Make-up Innovators – North America (2010 - 2014)

Company	Country
P&G	U.S.
Pioneer Hi-Bred	U.S.
Dow Corning Toray	U.S.
Celanese	U.S.
ISP Investments	U.S.
Avon Products	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Prolific Scientific Research Institutions In Cosmetics (2004 – 2014)

Institution	Country	# of Papers (WoS)
University of Sao Paulo	Brazil	153
Cosmetic Ingredient Review	U.S.	95
US FDA	U.S.	92
Procter & Gamble Co.	U.S.	90
Harvard University	U.S.	78
Seoul National University	S. Korea	75
University of California, Los Angeles	U.S.	75
Chinese Academy of Sciences	China	70
State University of Campinas	Brazil	70
University of California, San Francisco	U.S.	65

Source: Thomson Reuters Web of Science

Opening Up Innovation

The need to keep innovating is the norm in the personal-care-item industry, where manufacturers continue to iterate and push boundaries through R&D investments and efforts.

Collaboration is also essential, as the pace of innovation accelerates to the point where companies can no longer do it on their own. L’Oreal leads in the area of open innovation.

The future of cosmetics and wellbeing is sure to bring many new solutions for consumers as market leaders accelerate the pace of innovation to slow the pace of looking and feeling older.

The smallest particles known to humankind continue to make their way into personal-care products. Nanoparticles in cosmetics comprise a smaller share of the overall market today, 4%, but these ‘secret agents’ have the potential to become much more prevalent in the future.

“We experiment with a lot of things quickly and prototype...revealing a multidisciplinary playground to quickly kill some ideas and foster some others to bring them to market faster...taking different disciplines that don’t necessarily work together and bring them to the center with R&D people.”

—Sandrine Gadol, Chief Innovation Officer, L’Oreal





FOOD, BEVERAGE, TOBACCO

Are we seeing the end of the food-as-fuel era? Back to the future, with a move away from processed food in pursuit of health.

YOU WILL BE WHAT YOU USED TO EAT

Food with health benefits! Who knew? Highly processed convenience food was once seen as the hallmark of progress, proof of humankind's conquest of nature. Truth is, it's made many of us fat or unhealthy. It's built a culture of diet food consumption that is itself now part of the problem.

Hippocrates famously said, 'Let food be thy medicine and medicine be thy food.' More than 2,000 years later, consumers are taking this mantra to heart, demanding that manufacturers produce food and beverage products that use natural ingredients and are nutritionally balanced.

Snake oil? Hold your assumptions. When it was studied in the 1980s, oil from water snakes was found to be rich in omega-3-fatty acids. These compounds are prescribed today in modern medicines to reduce inflammation and blood pressure.

Looking Back To Move Forward

Given the size of its population, it may come as little surprise that China dominates the world in food, beverage and tobacco innovation. 70% of the Top 10 global innovators in this category all hail from China.

In what could be a page out of an early 19th century shaman doctor's travels, China appears to be taking a step back in time as it seeks to protect a number of ancient herbal medicinal remedies with patents.

These inventions, falling under the industry category of Food, Beverage, Tobacco, are part of what contributed to the overall 21% increase in year-over-year innovation activity for this sector.

Food-related research has long been an area where the academic community has contributed to the body of available knowledge—especially in adding nutritional value and identifying health benefits from natural ingredients. The University of British Columbia is leading the way, by studying health issues in dairy cows. The Universitat de Lleida in Spain is focused on the microbiological quality of fresh, minimally-processed fruit, vegetables and sprouts from retail establishments, as well as changes in commercial virgin olive oil during storage. These initiatives all contribute to a greater understanding of the role natural products play in our nutritional needs.

“Food is the sustenance of life. And if you are what you eat, it is no wonder there's a movement to consume foods and drinks made from better ingredients. This push is evidenced in Harbin Shanbao's protection of medicinal tonics, as well as in steps being made by global food manufacturers promising consumers healthier alternatives.”

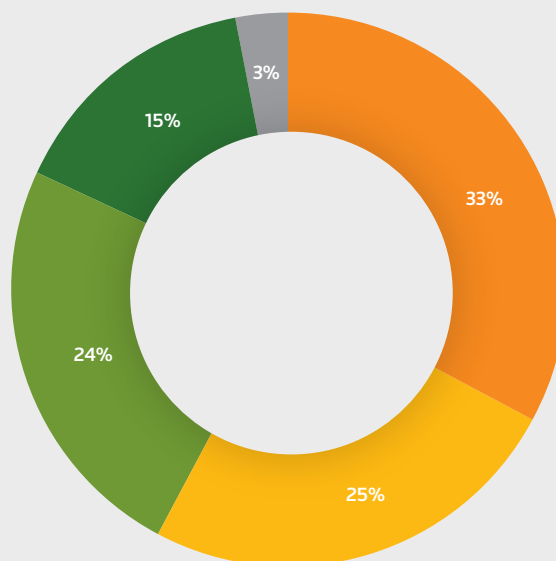
—Jenny Arscott, Pharmaceutical and Food Expert, Thomson Reuters



FOOD, BEVERAGE, TOBACCO OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
33%	Meat	9,033	6,888	31%
25%	Bakery	6,841	5,645	21%
24%	Brewing	6,479	5,351	21%
15%	Tobacco	4,215	3,906	8%
3%	Sugar & Starch	689	775	-11%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Publicly Traded Brewing Companies

Company	Country	2014 Revenue	2013 Revenue	% Change Revenue
Novozymes	Denmark	2,024.6	2,169.5	-7%
Kirin Beer	Japan	18,314.3	21,450.8	-15%
Suntory	Japan	10,486.5	10,669	-2%
DSM	Netherlands	11,109.5	12,205.9	-9%
Chr. Hansen	Denmark	1,004.9	971.5	3%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top Innovators In Food, Tobacco & Beverage Fermentation Globally (2014)

Company	Country	2014 Inventions
China Tobacco	China	865
Harbin Shanbao Wine	China	127
Shenzhen Heyuan	China	101
Univ Jiangnan	China	84
Hunan Zhongyan	China	84

Source: Thomson Reuters Derwent World Patents Index

Top 5 Food, Beverage, Tobacco Innovators – Asia (2010-2014)

Company	Country
China Tobacco	China
Harbin Shanbao Wine	China
Shenzhen Heyuan	China
Jiangnan University	China
Hunan Zhongyan	China

Source: Thomson Reuters Derwent World Patents Index

Top 5 Food, Beverage & Tobacco Innovators – Europe (2010-2014)

Company	Country
Hauni	Germany
Kuban State Technological University	Russia
British American Tobacco	UK
Novozymes	Denmark
DSM	Netherlands

Source: Thomson Reuters Derwent World Patents Index

Top 5 Food, Beverage & Tobacco Innovators – North America (2010-2014)

Company	Country
Philip Morris	U.S.
Reynolds Tobacco	U.S.
DuPont/Danisco	U.S.
Altria Client Services	U.S.
General Mills	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific Research Institutions In Food Science & Technology (2004–2014)

Institution	Country	# of Papers (WoS)	Citation Impact*
University of British Columbia	Canada	400	1.99
Universitat de Lleida	Spain	565	1.81
South Dakota State University	U.S.	317	1.79
Aarhus University	Denmark	884	1.79
University of Reading	UK.	552	1.65
University of Wisconsin, Madison	U.S.	1212	1.64
University of Massachusetts, Amherst	U.S.	693	1.63
University of Wisconsin	U.S.	1263	1.59
University of Massachusetts	U.S.	744	1.59
Cornell University	U.S.	1535	1.56
University of Padua	Italy	338	1.56

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Health Plus Taste Equals Happy Customer

The food and beverage industry needs to focus on health and wellness to stay relevant. The next ten years will see an increased emphasis on innovation as this sector battles to retain the hearts, palettes and perhaps, most importantly, the wallets of the world's consumers.

Kraft Foods recently announced that 2015 would be the last year that Kraft Macaroni and Cheese, an icon processed food product, would be made with artificial preservatives, or synthetic colors. The revised product will be colored using paprika, annatto and turmeric.

The food industry is making major shifts to meet consumer demands for nutritionally balanced foods made from natural ingredients. Kraft invested a considerable amount of time and money into finding replacements in order to ensure that the taste, and overall user experience of enjoying macaroni and cheese, would not change.

Across the board, food and beverage companies are looking at healthy fats, low glycemic impact grains, low calorie natural sweeteners, and a variety of other approaches to decrease the health risks associated with processed foods and the diet many people have followed for more than 50 years.

While consumers are demanding healthier alternatives, they are not willing to sacrifice taste. Another challenge the industry faces is the need to develop natural flavoring substances that will deliver a pleasant eating experience without the drawbacks of a convenience-based cuisine.

“Americans are falling out of love with many big legacy ‘processed food’ brands. Nutrition, health and wellness is proving increasingly every year to be the main growth driver.” —Peter Brabeck-Letmathe, Chairman, Nestle





HOME APPLIANCES

If your washing machine wants to talk to you, it had better
look the part and be a team player.

FROM ONE MACHINE TO ANOTHER... LET'S CONNECT

A smart home used to be one boasting the latest trends in fabrics, colors and furniture. Today, these things are background to a world of increasingly interactive machinery.

From TV to telephone and washing machine to dishwasher, connectivity is an area of innovation growing in importance for all kinds of home appliances. The digital and mobile revolution is finally creating the necessary preconditions for smart homes to become a reality.

The smart home is full of smart machines that connect with other machines both inside and outside the building.

They're Cleaning Up In Asia

How often you replace your vacuum cleaner, and why, are factors exercising the minds of researchers and manufacturers in the world of domestic appliances.

From Panasonic (Japan) to Mitsubishi (Japan) and LG (S. Korea) to Midea (China), Asia is the dominant region for innovation in household appliances, with the top five most prolific innovators coming from this region. Worldwide, only BSH Bosch & Siemens (Germany) can match the number of inventions pouring out of these companies.

Yet, overall, the domestic appliance sector barely nudged above its 2013 level of innovation last year (2014), with just 0.2% year-over-year growth.

In terms of scientific research, domestic appliance work is led globally by Zaragoza University in Spain. The huge range of opportunity in this sector is characterised by this university's focus: on refinements for domestic induction cookers and other appliances; on the techno-economic assessment of an off-grid, PV-powered community kitchen for developing regions; and on the design of ambient intelligent systems in the context of assistive technologies.

Despite a Spanish institution taking the spot for the largest number of domestic appliance-related research papers, China and the U.S. vie for the most prolific domestic appliance research nations over the last decade.

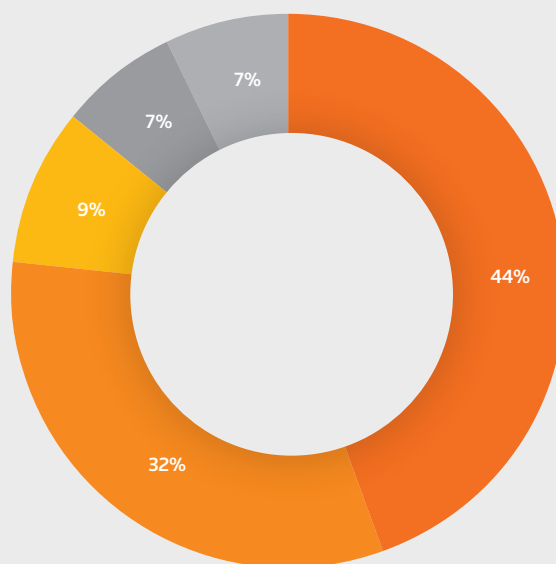
“This race for assistive living is compelling manufacturers like Electrolux to reduce its time to market by as much as 30%. How? By having clear processes and tools to support organizations in taking projects all the way through the lifecycle of innovation, from idea to reality, and being able to do that again and again.”
—Bob Stembridge, Senior IP Analyst, Thomson Reuters



HOME APPLIANCES OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
44%	Kitchen	33,590	33,770	-1%
32%	Heating & Air Conditioning	24,316	22,371	9%
9%	Household Cleaning	6,718	6,900	-3%
7%	Laundry	5,659	6,138	-8%
7%	Human Hygiene	5,203	5,915	-12%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Household Appliance Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Midea Group	China	22,938.6	3608	20,030.9	15%
Panasonic	Japan	71,959.8	1631	76,140.3	-5%
Zhuhai Gree Electric Appliances	China	N/A	1314	N/A	N/A
Mitsubishi Electric	Japan	39,986	1081	38,348.3	4%
LG Electronics	S. Korea	53,714.9	776	53,794.8	0%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Kitchen Appliance Innovators – Asia (2010 - 2014)

Company	Country
Panasonic	Japan
LG Electronics	S. Korea
Mitsubishi Electric Home Appliances	Japan
Midea Group	China
Hefei Hualing	China

Source: Thomson Reuters Derwent World Patents Index

Top 5 Kitchen Appliance Innovators – Europe (2010 - 2014)

Company	Country
BSH Bosch & Siemens	Germany
Electrolux	Sweden
SEB	France
Nestec	Switzerland
Arcelik	Turkey

Source: Thomson Reuters Derwent World Patents Index

Top 5 Kitchen Appliance Innovators – North America (2010 - 2014)

Company	Country
Whirlpool	U.S.
General Electric	U.S.
Carrier Corp	U.S.
York International Corp	U.S.
Halla Visteon Climate Control Corp	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Prolific Scientific Research Institutions In Household Appliances (2004 – 2014)

Institution	Country	# of Papers (WoS)
University of Zaragoza	Spain	102
University of California, Berkeley	U.S.	59
National Cheng Kung University	Taiwan	49
Waseda University	Japan	39
Chinese Academy of Sciences	China	39
University of Tokyo	Japan	38
Tsinghua University	China	36
Tohoku University	Japan	33
Politecnico Di Milano	Italy	33
Kyoto University	Japan	32

Source: Thomson Reuters Web of Science

Altogether Now

The paradigm of if-it-ain't-broken-don't-fix-it has gone West. Or rather, East.

More and more as consumers, we're assessing domestic equipment against three key criteria: not only does it have to function well, but also look good and complement the surrounding home environment.

So much so that, as soon as we think they don't fit, we're increasingly throwing away perfectly good appliances that still work. In a world of scarce resources demanding a greater focus on sustainable product development, there will be innovation opportunities for re-purposing, or extending, the purposeful life of domestic appliances.

For researchers and manufacturers, this will mean recognizing the need for greater cross-functional collaboration in the innovation process. With a need to include all perspectives yet speed up the process, departments from R&D to Design will be cooperating throughout the life of a development project.

“At Whirlpool, we understand that innovation takes its first step backward when it stops moving forward. That’s why we’ll never stop pursuing new products that resonate with the people who use them. We work tirelessly to create exceptional design and purposeful technology that blends into the home rather than stands out in a house. Some companies want you to concentrate on them. We’d rather help you with laundry, cooking, dishes and other tasks so that you have more time to concentrate on the people and activities that matter most to you.”

—Steven John Kuehl, Principal Technologist, Whirlpool





INFORMATION TECHNOLOGY

Wherever you are, whatever you're doing, there's an application that can help you do it faster, shorter, longer, better, crisper, to a turn.

INFORMATION TECHNOLOGY

Remember virtual reality? It took a while to grasp. The Internet of Things? We may still not fully understand it, even if we're getting used to connective appliances in our smarter homes. Maybe the understanding will finally hit home when the applications we connect with are inside our bodies and minds, as well as in the kitchen and bathroom.

As mobile phones, heart monitors and calorie counters become wearable technology, there will be very little that cannot connect us to computers of varying sciences—for our own regular, daily use or linked to health and nutritional professionals we trust.

Not Yet Robotic

As we connect our cell phone to our kneebone while monitoring the ozone, it's clear that Asia has an edge over North America in its computer-related innovation.

IBM and Samsung have long vied for the top innovator spot. In fact, Samsung (S. Korea) takes it, with the most Computing & Peripherals innovation overall in 2014, followed very closely by IBM (U.S.), Canon (Japan), the State Grid Corp of China, and Ricoh (Japan).

In terms of computer-science related research, there's been a precipitous drop in activity since 2008. The U.S. and China are neck-and-neck, whereas China trails the U.S. in nearly all other categories.

When it comes to consistently influential academic research, Europe hits the charts taking the first and third slots, respectively, with Czestochowa University of Technology (Poland) and University of Glamorgan (UK). Stanford University (U.S.) is wedged between for the second listing.

Despite a modest output, Czestochowa scores highly in citation impact compared against a normalized baseline.

While Stanford seems to be more interested in compressed sensing and randomized gossip algorithms, Czestochowa registers strongly in artificial intelligence, focusing much of its research on adaptive and general regression neural networks.

“Many people have dismissed the Internet of Things as an abstract concept that, at best, adds up to a 3D printer. Very soon, far from a virtual experience, the internet is going to become wearable, tangible, personal—especially in our health and leisure activities, but also as the forerunner of our relationship with robots and artificial intelligence.”

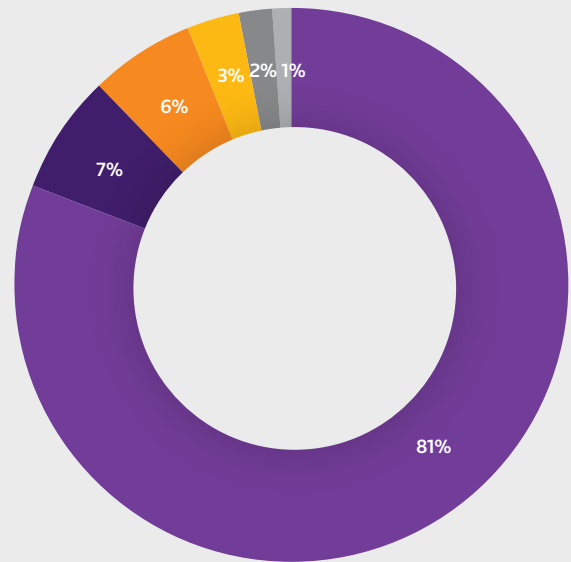
—George Jack, Engineering Expert, Thomson Reuters



INFORMATION TECHNOLOGY OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
81%	Computing	340,386	323,834	5%
7%	Other peripherals	29,550	31,178	-5%
6%	Printers	23,359	25,521	-8%
3%	Smart media	13,494	14,908	-9%
2%	Screens	7,692	7,989	-4%
1%	Scanners	4,510	4,627	-3%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Computing & Peripherals Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Samsung	S. Korea	N/A	5948	N/A	N/A
IBM	U.S.	92,793	5894	98,367	-6%
Canon	Japan	31,087.6	5281	35,501.5	-12%
State Grid Corp of China	China	N/A	5134	N/A	N/A
Ricoh	Japan	20,781.3	4265	20,998.3	-1%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Computing Innovators – Asia (2010 - 2014)

Company	Country
Samsung	S. Korea
Canon	Japan
State Grid Corp of China	China
Ricoh	Japan
Huawei	China

Source: Thomson Reuters Derwent World Patents Index

Top 5 Computing Innovators – Europe (2010 - 2014)

Company	Country
Siemens	Germany
Ericsson	Sweden
Nokia	Finland
Alcatel Lucent	France
Philips	Netherlands

Source: Thomson Reuters Derwent World Patents Index

Top 5 Computing Innovators – North America (2010 - 2014)

Company	Country
IBM	U.S.
Google	U.S.
Qualcomm	U.S.
Microsoft	U.S.
Hewlett Packard	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific-Research Institutions in Computer Science (2004 – 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
Czestochowa University of Technology	Poland	348	6.26
Stanford University	U.S.	4572	2.91
University of Glamorgan	UK	353	2.83
University of California Berkeley	U.S.	4392	2.78
Ecole Normale Supérieure (ENS)	France	561	2.74
California Institute of Technology	U.S.	1879	2.72
Massachusetts Institute of Technology	U.S.	5749	2.72
University of California, Los Angeles	U.S.	3227	2.64
Rice University	U.S.	1160	2.6
Weizmann Institute of Science	Israel	865	2.58

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Breaking Through Boundaries

We may not be living on the moon or heading off into space. Not yet. Science fiction was wrong in this sense. Yet had Isaac Asimov talked about the appearance in the same timeline of body temperature-controlled clothing, cars that drove themselves or suggested that you connect your coffee maker to your toaster via your mobile phone, we'd have called it far-fetched. We were more interested in worlds that would change our lives. And have become obsessed with products that will change our world.

Today's researchers and manufacturers of computers and peripherals may be focusing on creating differentiated analog and embedded processing products or driving innovation in

semiconductor technology. Or high-voltage power solutions, autonomous vehicles, sensing, industrial 4.0, wireless connectivity. The outcomes in a future very close to many of us will be products in industrial and consumer markets that crash through the reality we understand, change the way we live and seem like science fiction come true.

Recent news like the \$3.2 billion Google acquisition of connected thermostat and smoke detector developer, Nest Labs, has made it clear that we're on the verge of an all-out technology arms race for control of the smart home.

“Innovation at Texas Instruments is all about turning ambitious dreams into realities by creating technologies that improve our lives. Innovations can range from incremental achievements to breakthrough, game-changing discoveries.”

—Dr. Ahmad Bahai, Chief Technology Officer, Texas Instruments





MEDICAL DEVICES

Needles. We all need them. But it looks like we're turning
our backs on the hypodermic syringe



PAINS AND NEEDLES

About 10% of the adult population has trypanophobia - phobia of needles. Up to two million health workers are injured each year by sharp needles after use. The World Health Organization estimates that 21 million cases of hepatitis B are caused by needle reuse each year.

Very recently, researchers have developed a solution that attempts to eliminate all these disadvantages—microneedles.

Professor Ryan Donnelly and his team at Queen's University Belfast have patented a production technique which produces a clear, plastic microneedle patch. No more tissue damage, scarring and bruising. Less pain, fewer post-operative complications. No fear.

Code Blue—Resuscitation Required

Despite exciting developments in areas such as microneedles and electroceuticals (the use of bioelectronic medicine that employs electrical stimulation to affect body functions), global innovation activity in medical devices has dropped 6% year on year.

This decline in innovation in physical instruments that diagnose, prevent or treat diseases and conditions was reflected across all subsectors of the industry.

Asia leads the world in overall Medical Devices innovation, with the top three innovators coming from Japan: Toshiba, Olympus Optical and Toshiba Medical Covidien (Ireland) and Boston Scientific (U.S.) take spots four and five overall.

Even in the subsector of Diagnosis and Surgery, Japan takes the lead, adding one more company to its roster of top innovators: Fuji Film. The appearance of Ireland's Covidien could be related to its merger with Medtronic—a move that indicates the medical device industry's need to deliver solutions that bring more value while costing less.

The United States is the absolute world leader in terms of medical-device-related research. All of the top 10 institutions in this area hail from that country, with the U.S. FDA and Harvard University topping the charts in terms of prolific activity.

“We’ve come a long way since the first fully implantable pacemaker in 1958. Leadless pacemakers are just the size of a silver dollar, and have a battery life that can last more than 15 years depending on pacing needs. Meanwhile, current research on energy harvesting systems for self-powering pacemakers is just the start of some very exciting developments. Similar research is going on at Linköping University, Sweden, and at University of Bern, Switzerland. What if they connected and collaborated?”

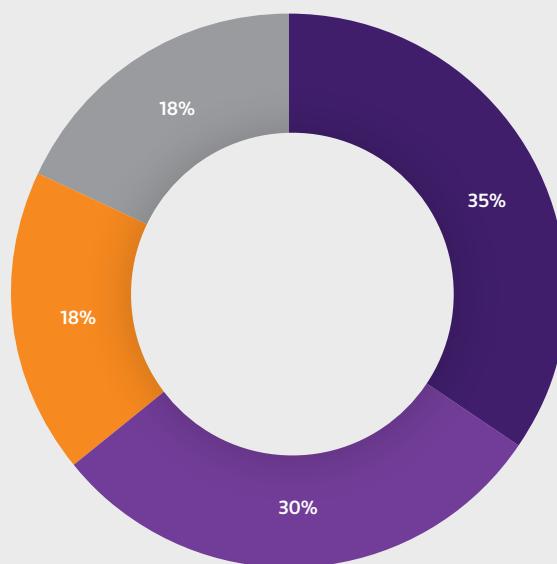
—Laia Bayarri, Scientific Editor, Thomson Reuters



MEDICAL DEVICES OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
35%	Diagnosis & Surgery	36,929	37,245	-1%
30%	Sterilising, Syringes, Electrotherapy	31,898	35,122	-9%
18%	Dentistry, Bandages, Prosthesis	19,250	20,294	-5%
18%	Medical Aids, Oral Administration	18,694	21,168	-12%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Medical Device Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Toshiba	Japan	61,943.9	725	62,891.1	-1%
Olympus Optical	Japan	6,927.2	699	7,035.8	-2%
Toshiba Medical	Japan	N/A	672	N/A	N/A
Covidien	Ireland	N/A	623	N/A	N/A
Boston Scientific	U.S.	7,380	595	7,143	3%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Diagnosis & Surgery Innovators – Asia (2010 - 2014)

Company	Country	# Inventions
Fuji Film	Japan	3248
Olympus Optical	Japan	3035
Toshiba Medical	Japan	2699
Canon	Japan	1636
Samsung	S. Korea	1202

Source: Thomson Reuters Derwent World Patents Index

Top 5 Diagnosis & Surgery Innovators – Europe (2010 - 2014)

Company	Country	# Inventions
Siemens	Germany	2786
Covidien	Ireland	2462
Philips Electronics	Netherlands	1956
Warsaw Orthopedic	Poland	507
Aesculap	Germany	361

Source: Thomson Reuters Derwent World Patents Index

Top 5 Diagnosis & Surgery Innovators – North America (2010 - 2014)

Company	Country	# Inventions
General Electric	U.S.	1742
Boston Scientific	U.S.	1199
Ethicon Endo-Surgery	U.S.	1152
Medtronic	U.S.	1135
DePuy Synthes	U.S.	819

Source: Thomson Reuters Derwent World Patents Index

Most Prolific Scientific Research Institutions In Medical Devices (2004 – 2014)

Institution	Country	# of Papers (WoS)
US FDA	U.S.	201
Harvard University	U.S.	166
University of Pennsylvania	U.S.	92
University of Minnesota	U.S.	85
Duke University	U.S.	78
University of Michigan	U.S.	76
Stanford University	U.S.	76
MIT	U.S.	71
Brigham and Women's Hospital	U.S.	71
University of North Carolina	U.S.	67

Source: Thomson Reuters Web of Science

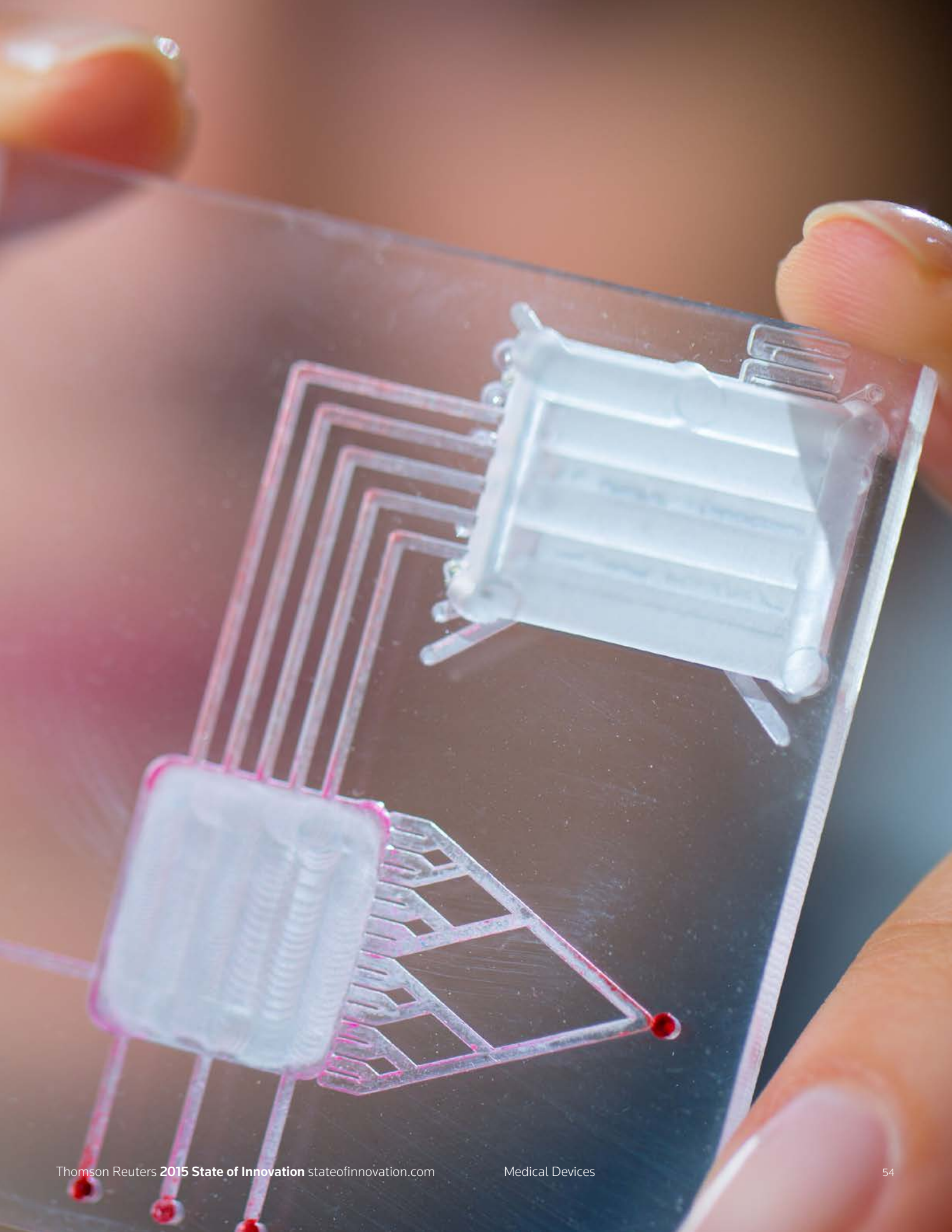
Journey Into The Nervous System

The incredibly small size of microneedles means there's no pain because they only penetrate the top layer of skin and do not contact nerves. If clinical trials are successful, patients could benefit from microneedle patches in a few years' time. Companies working on vaccines and gene therapy have contacted the Queen's University team and the technology may also be useful in the cosmetics industry.

Other developments in medical devices are focusing directly on the nerves. Research in molecular medicine is showing that disease occurs when the body's electrical signals are not functioning well. The development of electroceuticals will enable healthcare professionals to target a specific nerve and modify electrical impulses to treat the problem.

“Medical Devices are the unsung heroes of the life sciences sector. These instruments provide doctors, surgeons, nurses and patients with much needed insight and support, however are often overlooked in the value they provide as compared to breakthrough drugs and genomics. Nevertheless, despite a shift in year-over-year activity levels, the future is extremely promising, especially as physicians grapple with an aging population and debilitating diseases.”

—Ke Zhang, Senior Director, Medical Devices, Thomson Reuters





OIL & GAS

We all want energy that's cheap, constant and secure.
But is the Oil & Gas industry above going green?

STILL GROUND-BREAKING

With global oil demand projected to increase by 1% this year, it is logical to question what the Oil & Gas industry is doing to curb the trend of global greenhouse gas growth.

In the environmentally conscious world of the 21st century, it seems counterintuitive that global greenhouse gas emissions have risen 35% since 1990, according to the U.S. Environmental Protection Agency (EPA).

If 95% of the world's scientists recognize the role of human endeavor in accelerating climate change, why is petroleum innovation holding its own year-over-year?

Despite automotive innovation to reduce fossil-fuel dependency, more oil is consumed today than in 2014 and years prior. China's innovation activity in this sector seems to signal it's casting a blind eye to the global effort to reduce fossil-fuel emissions.

The Last Explorers

Over the last two years, the Petroleum industry has stayed consistent in terms of its level of innovation.

In fact, petroleum industry innovation saw a 1% year-over-year increase in activity, with China taking center stage as the most innovative region in this sector.

Sinopec and PetroChina take the top two spots, followed by Halliburton (U.S.), Schlumberger (U.S.) and China National Offshore Oil Corp at #5.

Unfortunately for those who are environmentally minded, fossil fuel consumption continues apace, with little 'green' in sight.

Sinopec innovation is focused downstream on everything from crude oil fractionation and cracking to produce heavy oil/diesel fractions to synthesis of petrochemicals such as polymers, aromatic compounds, alcohols, aldehydes, and acids. Similarly, PetroChina is focused upstream on the discovery, exploration, drilling, extraction, well-head processing, and pipeline technologies. Whether up- or downstream, they are in the business of navigating both streams to get the most out of the natural resources far below.

In terms of academic research related to this field, Imperial College London (U.K.) and the U.S. Department of Energy lead the pack, followed by Stanford University (U.S.) and Tallinn University of Technology (Estonia).

“As is well documented, the main activity that contributes to greenhouse gases is the combustion of fossil fuels, including coal, natural gas and oil, for transportation and energy. Yet governments continue to respond to pressures for cheaper energy in the short term, which everybody wants. When cheaper energy demands fracking for fuel under our feet or the Arctic pole, it becomes more and more difficult to keep a consensus on the way we find and use energy both today and in the longer term.”

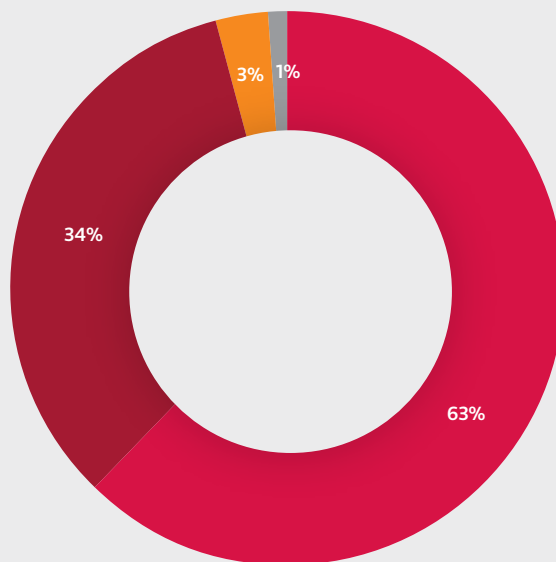
—Bob Stembridge, Senior IP Analyst, Thomson Reuters



OIL & GAS OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
63%	Petroleum & Gas Exploration, Drilling, Production and Processing	15,589	15,480	1%
34%	Petroleum & Gas Fuels and Other Products	8,459	8,464	0%
3%	Petroleum & Gas Transportation and Storage	658	664	-1%
1%	Petroleum Refining	183	178	3%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Petroleum Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Sinopec	China	455,498.7	1946	475,777.8	-4%
PetroChina	China	367,982.3	1520	373,003.2	-1%
Halliburton	U.S.	32,870	783	29,402	12%
Schlumberger	U.S.	48,631	448	46,459	5%
China National Offshore Oil Corp	China	44,267.2	384	47,218.7	-6%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Petroleum & Gas Exploration Innovators – Asia (2010 - 2014)

Company	Country
Sinopec	China
PetroChina	China
China National Offshore Oil Corp	China
University of China Petroleum	China
University of Southwest Petroleum	China

Source: Thomson Reuters Derwent World Patents Index

Top 5 Petroleum & Gas Exploration Innovators – Europe (2010 - 2014)

Company	Country
Tatneft Stock Co	Russia
Shell Oil Co	Netherlands
IFP Energy Nouvelles	France
Saudi Aramco	Saudi Arabia
BASF SE	Germany

Source: Thomson Reuters Derwent World Patents Index

Top 5 Petroleum & Gas Exploration Innovators – North America (2010 - 2014)

Company	Country
Halliburton Energy Services	U.S.
Schlumberger	U.S.
Baker Hughes	U.S.
ExxonMobil	U.S.
UOP LLC	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific Research Institutions In Petroleum (2004 - 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
Imperial College London	UK	128	4.93
United States Department of Energy (DOE)	U.S.	111	3.05
Stanford University	U.S.	203	2.69
Tallinn University of Technology	Estonia	172	2.48
Heriot Watt University	UK, UAE	134	1.99
Norwegian University of Science & Technology	Norway	142	1.81
National Institute of Advanced Industrial Science & Technology	Japan	100	1.74
University of Texas, Austin	U.S.	314	1.6
University of Oklahoma	U.S.	172	1.57
University of Tulsa	U.S.	132	1.57
Texas A&M University College Station	U.S.	311	1.57
Texas A&M University	U.S.	313	1.57

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Postponing The Inevitable

Today, it's clear that in most countries the pursuit of fossil fuels to an unspecified end is the political norm. The American Petroleum Institute lauds the development of fracking as a game-changer for domestic energy production. It highlights the significant economic benefits from shale energy resurgence—to families and businesses.

However, the short-term scramble for the planet's remaining fossil-fuel resources raises political pressures that can only get more difficult in the long term.

For oil and gas exploration companies, it's a race—not just to capture what's still in the ground but to do so until it becomes socially impossible to continue or we arrive at a point when renewable energy becomes cheaper to create.

Innovation in the petroleum industry will therefore increasingly focus on speeding up the capture of oil and gas, wherever it can be found, while reducing the reasons that will bring forward the inevitable date when renewable energy sourcing takes over.

“For Halliburton, innovation is a key to bringing our customers cutting edge solutions in the increasingly challenging quest for oil & gas resources. Halliburton has always been a science and technology company; it is what our customers expect and demand and is a part of the DNA of Halliburton.”

—Dr. Greg Powers, Vice President of Technology, Halliburton





PHARMACEUTICALS

We just want to get better. And pharmas just want to get better returns.
It ought to be a happy marriage.

HEALER, HEAL THYSELF

Pharma companies are here to heal us or make us feel better. That is, once they meet shareholder expectations.

To keep up with Board demands and new technologies, pharmas have found creative ways to support their own health. From precision medicine to patient stratification, they're becoming more focused (at the DNA level) in order to expand their bottom lines.

By adapting drugs for new purposes, and following the lead of genomics, pharmas are applying lessons learned from clinical trials and Big Data to find new, targeted applications and therapies.

The result is a nearly 12% increase in year-over-year innovation activity – a shot in the arm for an industry whose future was in question just a couple years ago.

New World Has To Wait

While the traditional blockbuster drug model may have had its day, the industry is far from needing life support. In fact, it is one of the few that showed an increase in year-on-year activity, by 12%. And in fact, we're seeing the emergence of a new era of blockbuster drugs.

China is the rising star, leading this burst in pharmaceutical activity, holding the top slot for the most active innovator globally: the Chinese Academy of Sciences. Switzerland, Russia and the U.S. take the next four spots regionally. Even semiconductor and telecoms giant Samsung Electronics

appears among the top innovators in this sector, taking the #17 slot globally for pharmaceutical innovation.

Germany leads the world in terms of the most impactful pharmaceutical academic research, with Goethe University Frankfurt Hospital, Ernst Moritz Arndt Universität, University of Duisburg Essen, and University of Bonn taking the first, third, fourth and fifth slots. Sandwiched into second place for the most impactful academic research is Gilead Sciences (U.S.).

“The 2015 Drugs to Watch forecast from Thomson Reuters identifies a substantial increase in the number of predicted blockbusters, inviting discussion around the current status of the blockbuster model. As the pharmaceutical industry navigates constantly evolving revenue streams, we are pleased to once again predict the therapies with the strongest sales potential.”

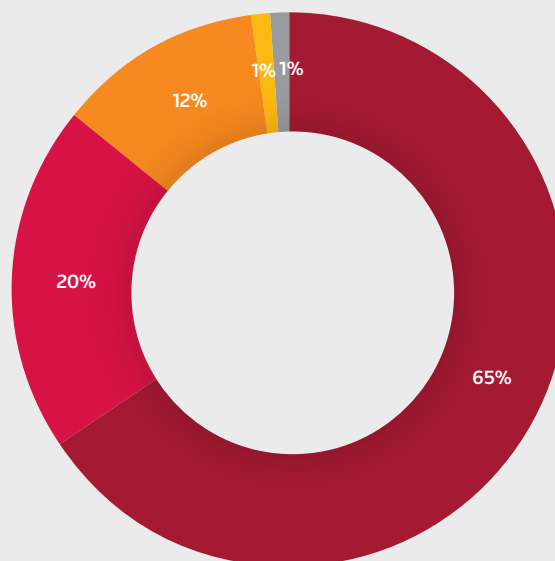
—Wendy Hamilton, Global Head of Life Sciences, Thomson Reuters



PHARMACEUTICALS OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
65%	Organics	85,679	72,538	18%
20%	General	26,774	26,587	1%
12%	Heterocyclics	16,272	15,757	3%
1%	Inorganics	1,373	1,213	13%
1%	Steroids	1075	1,162	-7%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Pharmaceutical Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Chinese Academy of Sciences	China	N/A	481	N/A	
Roche	Switzerland	47,765.3	400	52,600.2	-9%
Abbott Cardiovascular Systems	U.S.	N/A	338	N/A	
University of California	U.S.	N/A	324	N/A	
Zhejiang University	China	N/A	320	N/A	

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Heterocyclics Innovators – Asia (2010 - 2014)

Company	Country
China Pharmaceutical University	China
Takeda Pharmaceuticals	Japan
Shanghai Institute of Pharmaceutical Industry	China
University of Nanjing	China
Daiichi Sankyo	Japan

Source: Thomson Reuters Derwent World Patents Index

Top 5 Heterocyclics Innovators – Europe (2010 - 2014)

Company	Country
Roche	Switzerland
Novartis	Switzerland
GlaxoSmithKline	UK
Sanofi	France
Boehringer Ingelheim	Germany

Source: Thomson Reuters Derwent World Patents Index

Top 5 Heterocyclics Innovators – North America (2010 - 2014)

Company	Country
Merck Sharp & Dohme	U.S.
Abbvie Inc	U.S.
Bristol-Myers Squibb	U.S.
Allergan	U.S.
Gilead Sciences	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Influential Scientific Research Institutions In Pharmaceuticals (2004 – 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
Goethe University Frankfurt Hospital	Germany	392	4.87
Gilead Sciences	U.S.	458	3.76
Ernst Moritz Arndt Universität Greifswald	Germany	469	3.75
University of Duisburg Essen	Germany	748	3.49
University of Bonn	Germany	1718	2.64
University of California, Riverside	U.S.	362	2.56
Suzhou University	China	666	2.52
Barbara Ann Karmanos Cancer Institute	U.S.	347	2.48
University of Vienna	Austria	1078	2.35
Goethe University Frankfurt	Germany	1707	2.29

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Keep Taking The Pills

Despite the dawn of 21st century precision medicine and genomics-driven, target-based drug discovery, we're not going to see the end of blockbuster drugs in the near future.

Pharmaceutical companies are still turning out successful blockbuster drugs.

Some blockbuster drugs are controversial. Gilead Science's oral drugs, Sovaldi and Harvoni, for Hepatitis C, cost \$84,000 and \$95,000 respectively for a course of treatment, yet are expected to have multi-billion dollar sales by 2019.

In 2015, we'll see the introduction of a wide range of blockbuster drugs, including the rise of immuno-oncology approaches for treating cancer, the race to be the next big cholesterol drug, the entry of a first-in-class heart failure drug, and the entry of more convenient all-oral regimens for HCV.

“Rather than forgo the benefits of biologics, governments and payers are counting on biosimilars to dramatically change drug development and patient costs by reducing the price tag of important biologics and increasing access to life-saving drugs. For this to happen, biosimilars must deliver the power of the reference drugs at a price developing countries can afford and gain the confidence of the marketplace. They have to create their own market.”

—Jon Brett-Harris, Managing Director, Thomson Reuters Life Sciences





SEMICONDUCTORS

The mother of all innovations makes faster computers, more efficient cars, smarter watches and toasters that talk.

JUST HOW MUCH FASTER AND SMALLER?

Moore's Law—the observation that, over the history of computing, the number of transistors in a circuit will double every two years—turned 50 this April. Named for Gordon Moore, the co-founder of Intel Corporation, the law is the basic governing principle behind the idea that technology will continue to get faster and smaller forever.

It's never been easy. To design and test a typical chip today typically costs \$132 million, up from just \$16 million in 2005. The mounting cost of keeping pace with new innovation in the sector has caused many start-ups to go out of business. Even established players are fighting to keep pace. Ever faster, ever smaller. Watch this space while you still can.

Own The Chip, Own Everything

The race for faster and smaller hasn't stopped the true leaders in the semiconductor industry—companies like Samsung, LG, BOE, IBM, Toshiba and TSMC—from continuing to break new ground in this ultracompetitive field.

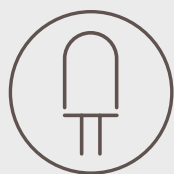
Think Samsung is just focused on TVs and smartphones? Think again. Samsung ranks among the top 25 patent assignees in nine of the 12 categories analyzed.

That means that the company you know today as a consumer electronics and telecom giant also has one of the world's largest patent portfolios in categories like aerospace, automotive, biotech, domestic appliances, medical devices, pharmaceuticals and semiconductors. Samsung has the most

patents in the semiconductor industry by a landslide, filing for 4,036 unique inventions in 2014 alone. That's over 1,000 more than the number two company in the space, LG, which had 2,920.

In terms of the most active institutions doing research related to semiconductors, Asia again takes the lead with four of the top five spots globally. The Chinese and Russian Academy of Sciences are first and second in terms of research output, followed by Japan's University of Tokyo, Tohoku University and Osaka University. The U.S. comes in sixth with the University of California, Berkeley, and Europe appears in the tenth spot with the University of Cambridge.

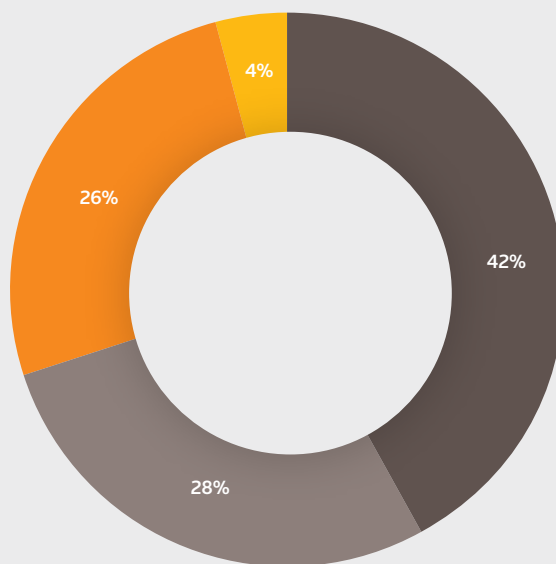
“Every innovation we are seeing today—wearable computing, big data analytics, the Internet-of-things, hyper-connected automobiles—is built on the back of semiconductor innovation. The challenge the industry has right now is how to keep pace with the lightning fast growth that has occurred over the last decade.”
—Jason Foster, Quality Expert in Engineering, Thomson Reuters



SEMICONDUCTORS OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
42%	Semiconductor Materials and Processes	56,827	60,945	-7%
28%	Discrete Devices	38,571	42,259	-9%
26%	Memories, Film and Hybrid Circuits	35,220	38,837	-9%
4%	Integrated Circuits	5,775	6,429	-10%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Semiconductor Materials and Processes Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Samsung Electronics	S. Korea	187,605	4036	216,698.4	-13%
LG Display	S. Korea	24,069.1	2920	25,615.2	-6%
BOE Technology Group	China	N/A	2300	5,578.9	N/A
IBM	U.S.	92,793	1610	98,367	-6%
Toshiba	Japan	61,943.9	1483	62,891.1	-2%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Semiconductor Materials and Processes Innovators – Asia (2010 - 2014)

Company	Country
Samsung Electronics	S. Korea
Toshiba	Japan
LG	S. Korea
SK Hynix	S. Korea
TSMC	Taiwan

Source: Thomson Reuters Derwent World Patents Index

Semiconductor Materials and Processes Innovators – Europe (2010 - 2014)

Company	Country
Infineon Technologies	Germany
Osram Opto Semiconductors	Germany
STMicroelectronics	Switzerland
ASML	Netherlands
Commissariat Energie Atomique	France

Source: Thomson Reuters Derwent World Patents Index

Semiconductor Materials and Processes Innovators – North America (2010 - 2014)

Company	Country
IBM	U.S.
Applied Materials	U.S.
Micron Technology	U.S.
Global Foundries	U.S.
Texas Instruments	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Prolific Scientific Research Institutions In Semiconductors (2004 – 2014)

Institution	Country	# of Papers (WoS)
Chinese Academy of Sciences	China	6425
Russian Academy of Sciences	Russia	3574
University of Tokyo	Japan	2037
Tohoku University	Japan	1712
Osaka University	Japan	1700
University of California, Berkeley	U.S.	1622
Nanyang Technological University	Singapore	1512
National Chiao Tung University	Taiwan	1509
Tokyo Institute of Technology	Japan	1367
University of Cambridge	England	1297

Source: Thomson Reuters Web of Science

Open Up

Semiconductors are the base components of nearly every technological device we use, and will use, in the future. Innovation in this sector is akin to the role of the sun in fostering plant life. So, it's perplexing to see a 7% year-over-year drop in semiconductor innovation activity, the first such plunge since the economic recession earlier this century.

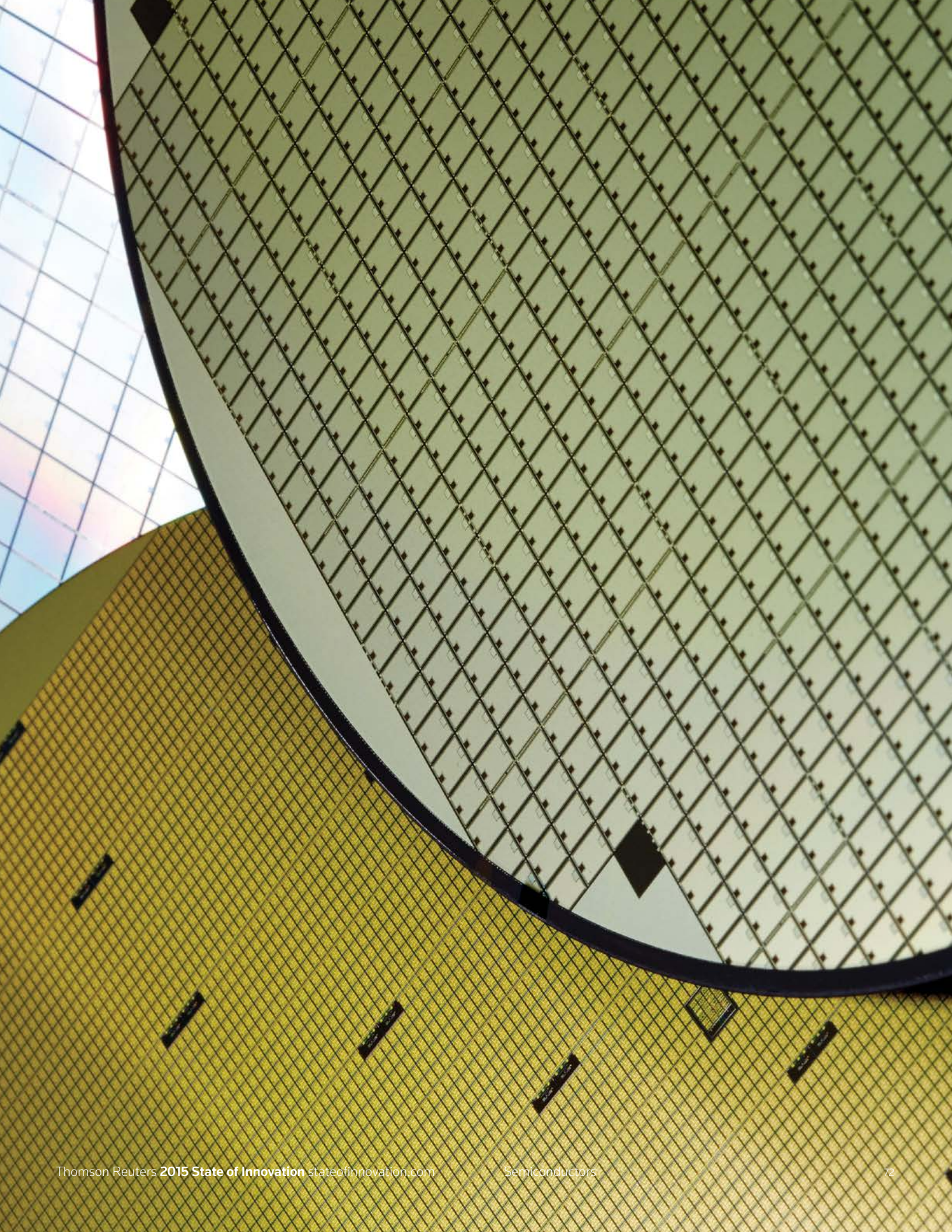
This sector is in a transitional state, as manufacturers look to partner with others via open innovation, and also to consolidate for greater returns and faster time to market.

At the same time, players are expanding into tangential areas, extending the reach of their intellectual capital and company profits.

The future is sure to be active as the Internet of Things is actualized. But the leading players will likely remain the same, at least in the near term, as they strengthen their footholds and implement self-preservation strategies for future success.

“Texas Instruments is focused on creating differentiated analog and embedded processing products that will change the world. We drive innovation in every aspect of our products including semiconductor technology, circuit, packaging, system architecture and testing. We see the biggest opportunity for these changes in the industrial and automotive markets, including new areas like GaN and high-voltage power solutions, autonomous vehicles, sensing, industrial 4.0, wireless connectivity and the Internet of Things (IoT).”

—Dr. Ahmad Bahai, Chief Technology Officer, Texas Instruments





TELECOMMUNICATIONS

The race is on to win in mobile telecoms.
But what's it got to do with consumers?



WE JUST WANT TO COMMUNICATE

Who drives innovation in the telecomms industry? Not consumers, that's for sure. We never knew we needed the iPhone and the world reacted against the invasiveness of Google Glass. The big hits of the sector were texting and tweeting—by-products of bigger plans the major players had for us. Phones started big, went small, got big again. The industry is leading consumers who simply want to communicate.

Never before in history have there been such rapid and progressive advancements in the methods and devices on which humans can communicate. Nor has there been such a voracious appetite to gobble up low band, high band and middle band spectrums.

The Race To Master

The quest to break into 5G LTE (long-term evolution) is on as telecomm innovators race to master the communications space.

Not surprisingly, telecomm innovation saw a healthy 6% year-over-year jump, and mobile telephony grew 22% from 2013 to 2014. South Korea and China again outpace the rest of the world in terms of innovation activity, with giant Samsung leading the pack.

Following Samsung as the world's leading telecomms innovator are: Huawei (China), LG (S. Korea), ZTE Corp (China) and Qualcomm (U.S.), based on 2014 innovation activity.

Ericsson takes the top spot as leading telecomm innovator in Europe, while IBM takes the second slot in the U.S., on the heels of Ericsson.

Unlike innovation activity which is dominated by Asia, the top three spots for generating the most impactful telecomms research all hail from the U.S.: Rice University (Texas), University of California Berkeley, and State University of New York (SUNY) Stony Brook, respectively.

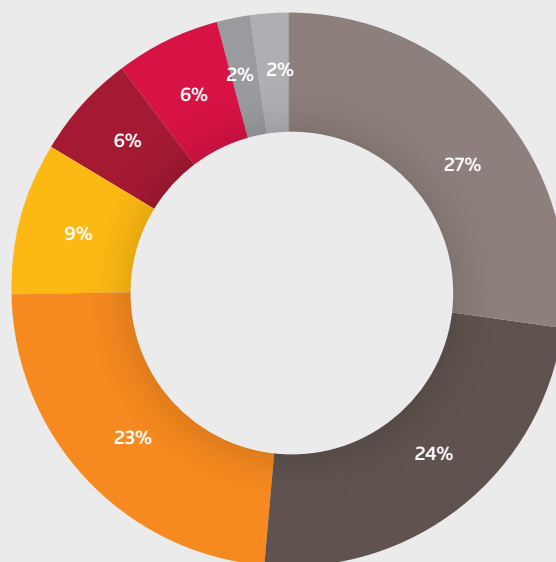
“*The Internet of Things is the Internet of Mobile Things. Everything is connected to mobile devices. Innovation in this space is exploding, and will continue this way for some time to come.*” —Vashe Kanesarajah, IP Consultant, Thomson Reuters



TELECOMMUNICATIONS OVERVIEW

%	Subsectors	2014 Volume	2013 Volume	% Change
27%	Mobile Telephony	77,477	71,091	9%
24%	Data Transmission Networks	69,614	67,516	3%
23%	Telephone Subscriber Equipment	64,760	58,966	10%
9%	Digital Information Transmission Systems	27,053	25,125	8%
6%	Telemetry & Telecontrol	18,437	18,992	-3%
6%	Multiplex Information Transmission Systems	16,256	17,377	-6%
2%	Telephone Communications Systems & Installations	7,003	6,687	5%
2%	Telephone Exchange Systems	5,954	6,139	-3%

Source: Thomson Reuters Derwent World Patents Index



Financials of 2014's Top 5 Mobile Telephony Innovators Globally

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Samsung	S. Korea	N/A	4261	N/A	N/A
Huawei	China	N/A	4070	N/A	N/A
LG	S. Korea	8975.5	2538	9285.3	-3%
ZTE Corp	China	13,132.1	2379	12,427.3	6%
Qualcomm	U.S.	26,964	2208	25,470	6%

Sources: Thomson Reuters Derwent World Patents Index and Thomson Reuters Eikon

Top 5 Mobile Telephony Innovators – Asia (2010 - 2014)

Company	Country
Samsung	S. Korea
LG Electronics	S. Korea
Panasonic	Japan
Sony	Japan
Sharp	Japan

Source: Thomson Reuters Derwent World Patents Index

Top 5 Mobile Telephony Innovators – Europe (2010 - 2014)

Company	Country
Ericsson	Sweden
Nokia	Finland
Alcatel Lucent	France
Sony Ericsson	Sweden/Japan
Nokia Siemens	Finland/Germany

Source: Thomson Reuters Derwent World Patents Index

Top 5 Mobile Telephony Innovators – North America (2010 - 2014)

Company	Country
Qualcomm	U.S.
Apple	U.S.
Blackberry	Canada
Microsoft	U.S.
Intel	U.S.

Source: Thomson Reuters Derwent World Patents Index

Most Impactful Research Institutions In Telecomms (2004 - 2014)

Institution	Country	# of Papers (WoS)	Relative Citation Impact*
Rice University	U.S.	323	4.31
University of California Berkeley	U.S.	800	3.76
State University of New York (SUNY)	U.S.	341	2.89
Swiss Federal Institute of Technology	Switzerland	723	2.64
University of Texas, Austin	U.S.	1070	2.58
Carnegie Mellon University	U.S.	763	2.55
Princeton University	U.S.	641	2.47
Chinese University of Hong Kong	Hong Kong	959	2.45
New York University	U.S.	421	2.43
University of Washington, Seattle	U.S.	562	2.42

Source: Thomson Reuters Web of Science

* Citation impact normalized against average for field and year of publication (n = 1.00)

Consolidated Conglomeration

Telecoms and mobile technology are expanding at an unprecedented rate. Google, Microsoft, Facebook have all acquired mobile companies. Google also recently launched its Android-OS Nexus 6 smartphone, in conjunction with Motorola, which it had acquired the patent rights from a few years prior.

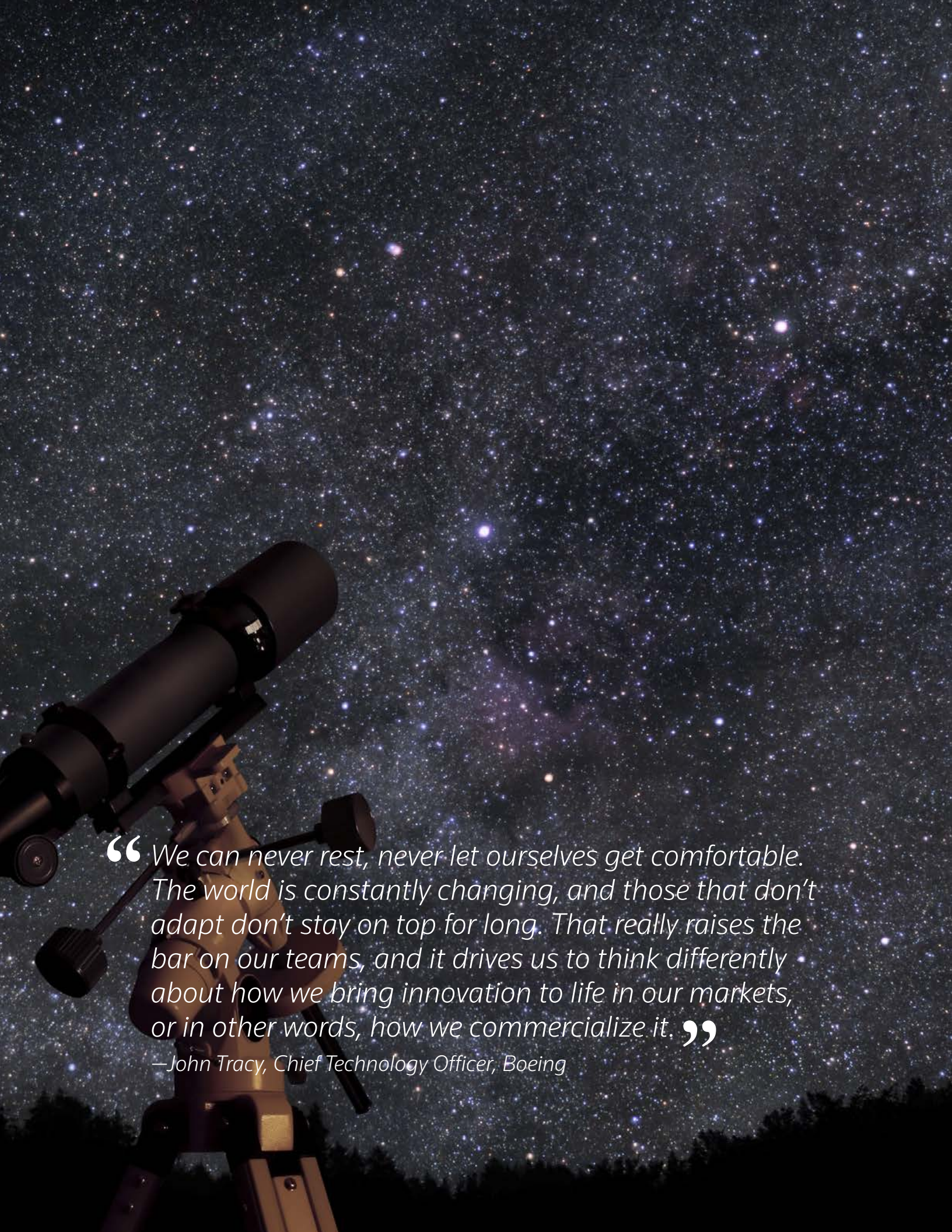
The time is ripe for consolidation, as content providers look for reliable channels they can own and manage to transmit their content. Right now the players are too scattered; consolidation of carriers that possess bandwidth access is the prime target for content generators.

Spectrum is the lifeblood of the entire industry. All the players are vying for access to bandwidth to disseminate information. Those with the rights hold the best playing cards.

Deutsche Telekom is in the game, looking for a buyer. Google would make for an excellent suitor—and a combo of T-Mobile and Sprint would make for a sweet deal that would put Google in an enviable spot, while also giving AT&T and Verizon some real competition.

“Consolidation in the industry is not a matter of if, but when and how. And, I’m going to add a word to that: who...Social and content and entertainment are going to the internet, and the internet is going mobile. You need to start thinking of adjacent industries in a totally different way.” —John Legere, CEO, T-Mobile (on CNBC interview)



A large, detailed image of a night sky filled with stars. In the lower-left corner, a portion of a telescope is visible, pointing upwards towards the stars. The telescope has a black barrel and a gold-colored base. The sky is dark with numerous stars of varying brightness and colors, including blue, white, and orange. The Milky Way is faintly visible as a band of light across the sky.

“We can never rest, never let ourselves get comfortable. The world is constantly changing, and those that don’t adapt don’t stay on top for long. That really raises the bar on our teams, and it drives us to think differently about how we bring innovation to life in our markets, or in other words, how we commercialize it.”

—John Tracy, Chief Technology Officer, Boeing

OPENING UP THE NEAR FUTURE



Aerospace & Defense. Both commercial and defense organizations are asking innovators to help them find more value, capability and reliability—more quickly and more affordably, and with more certainty of delivery than ever before.



Automotive. Look out for drastic improvements in propulsion systems, such as hydrogen, and improvements in battery performance, enabling the growth of battery electric vehicles. All on the road to autonomous vehicles.



Biotechnology. Academic and corporate innovators are opening up possibilities for an individual-based approach to medicine—aiming for targeted drugs in treatment strategies that address the unique make-up of a human being.



Cosmetics & Wellbeing. This sector is the true home of open innovation, as it persists in its determination to slow the pace of looking and feeling older. Where the smallest particles known to humankind meet the largest collaborations in innovation.



Food, Beverage, Tobacco. Under pressure to meet demands for healthier, nutritionally balanced foods made from natural ingredients, the food industry is moving away from processed convenience and investing in replacements that taste and do you good.



Home Appliances. Increasingly, we're throwing away perfectly good appliances that still work. The challenge for innovators is to embrace function, fashion and overall fitness for purpose. As well as extending the purposeful life of domestic appliances.



Information Technology. From talking toasters to intelligent hobs, we're on the verge of a race for control of the smart home. Watch consumer products crash through the reality we understand and change the way we live, like so much science fiction.



Medical Devices. While hypodermic syringes have got on people's nerves for the past half century, innovation in bioelectrics will enable healthcare professionals to target a specific nerve and modify electrical impulses to treat the problem.



Oil & Gas. Year-over-year, the short-term scramble for the planet's remaining fossil-fuel resources raises political pressures that can only get more difficult in the long term. It's a fast-innovating, octane-fuelled race towards an inevitable tipping point.



Pharmaceuticals. The future of medicines is individual, genomics-driven, target-based drug discovery, but the near future is all about yet more mass market, blockbuster drugs that reap the billions the pharma industry has invested in the innovation lifecycle.



Semiconductors. Smaller, cheaper, faster. The Internet of Things that you can no longer see. The very basis of life lived by human beings, semiconductors are fast becoming the mother of all sectors. Leading companies in the space can be anything they choose.



Telecommunications. The era will continue to be known for people doing something else while communicating via a mobile device. Formerly toys, now utter necessities, these devices increasingly dismantle the boundaries between work and leisure.

