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WEARABLE TECH

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INNOVATION

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WHEN INNOVATION GETS PERSONAL

In the business world, we frequently talk about innovation as a kind of holy grail that we're constantly striving to find and unlock. It's the *secret sauce*, the unquantifiable magic that has the power to create entirely new product categories or topple old business models. Inasmuch as innovation is such a lofty, communal goal for so many of us, it can also be an intensely personal experience.

That moment when the collective focus of global teams of R&D personnel, intellectual property professionals, branding and sales experts, and supply chain specialists truly comes to life, is when a single consumer interacts with a new piece of technology for the first time and it changes their existence forever.

We've all had that experience. Sometimes it's with a simple smile, like the first time we tried on a fitness tracker and wondered how this tiny rubber band could possibly know how many steps we've taken. Other times it's more dramatic, such as the first time we ever let the autopilot function on a car drive us around a corner. Every now and again it stops us in our tracks, such as when a new pharmaceutical development actually cures a disease.

Those real-world moments when years and years of work, commitment and passion are brought to life in a single, intensely personal experience are our focus in this edition of *Innovation* magazine.

In our feature stories, we dive into some of the hottest new technologies, such as the aforementioned fitness trackers and self-driving cars, to find out which companies are leading the way to breakthrough technologies and how today's leaders could soon be challenged by more nimble upstarts.

We also take a close look at some of the most promising pharmaceutical products making their way through the drug development pipeline, including our exclusive projections for seven new blockbuster drugs poised to hit the market this year. And, we share our predictions for forthcoming developments in clean energy technology to shed light on how we'll continue to power our planet well into the future.

Whether we're wearing it on our wrists or using it to fuel our planet, innovation is much more than just a business goal. It is the thing that connects us all, both literally and figuratively, in the forward march towards healthier, more productive, safer, cleaner and more fully developed lives. We hope you enjoy reading about the path these technology-enabled ideals and innovative organizations are taking to enter the mainstream!



Vincent J. Caraher
President, IP & Science
Thomson Reuters

THOMSON REUTERS INNOVATION

EDITORIAL

Jaimie Brown
Head of Communications
Thomson Reuters, IP & Science

Laura Gaze
Director, Enterprise Communications
& Thought Leadership
Thomson Reuters

Christopher King
Editor
Thomson Reuters, IP & Science

Marie Oberriter
Program Manager, Marketing
& Communications
Thomson Reuters

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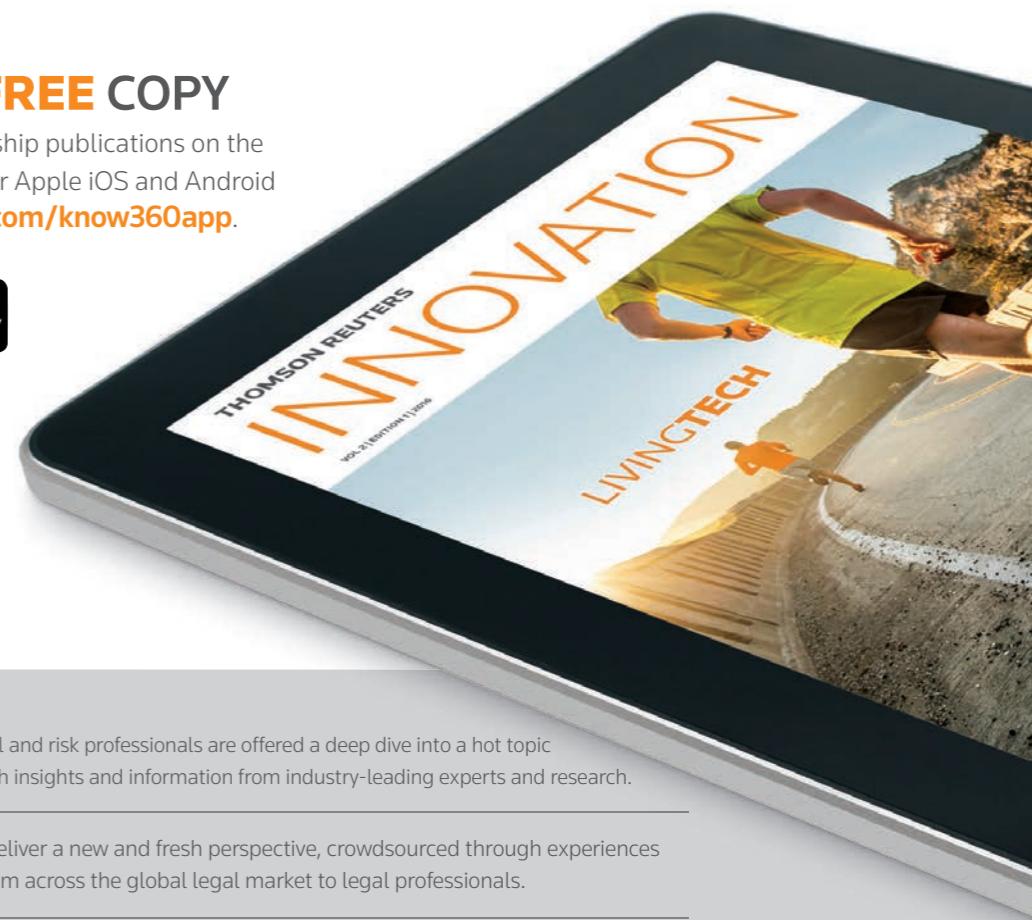
Yassir Touhami
Head of Content
Thomson Reuters, IP & Science

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What does "innovation" mean to you, and how would you like to see the topic covered? By definition, it means the act or process of introducing new ideas, devices or methods – that's why we need you! We welcome your thoughts, questions, suggestions, ideas and even your criticisms. This magazine is about you and for you, so reach out and join the conversation. Email us at stateofinnovation@thomsonreuters.com.



WEARABLE TECHNOLOGY

The Revolution in Sports Clothing and What's Next

By Bob Stembridge

Citius, Altius, Fortius.

The Olympic motto captures the competitive spirit with its vision of competitors going faster, reaching higher and being stronger. With the 2016 Summer Olympics just around the corner, we will once again thrill to the exceptional performances of athletes who live by the Olympic ideal and strive to be the best in the world.

Advanced technology has always played a significant role in the equipment used in sports. An Olympic-standard bicycle uses technology and materials borrowed from the aerospace industry. The latest high-performance tennis racquet uses state-of-the-art metal and Kevlar-based hybrid strings, costing north of

\$300 for an unstrung stick. Annual golf-club R&D budgets typically run in the tens of millions.

What you wear can also contribute to enhanced sporting performance. The use of running spikes to increase grip and running speed goes back to their invention in 1890, which led to the creation of the sports

shoe company now known as Reebok. The use of advanced materials in swimwear to reduce drag and increase swimming speed dates from more recent times, featuring the invention of a material that mimics the hydrodynamics of a shark's skin. At the 2000 Sydney Olympics, 83 percent of medals were won by swimmers wearing a suit of this material.¹

According to a recent report, in 2014 the US sports industry employed over 1.5 million people and the global revenues were estimated to be \$700 billion. Wearable-sports technology is projected to become a significant part of the sports industry market with revenues forecast to be \$9.4 billion by 2020.²

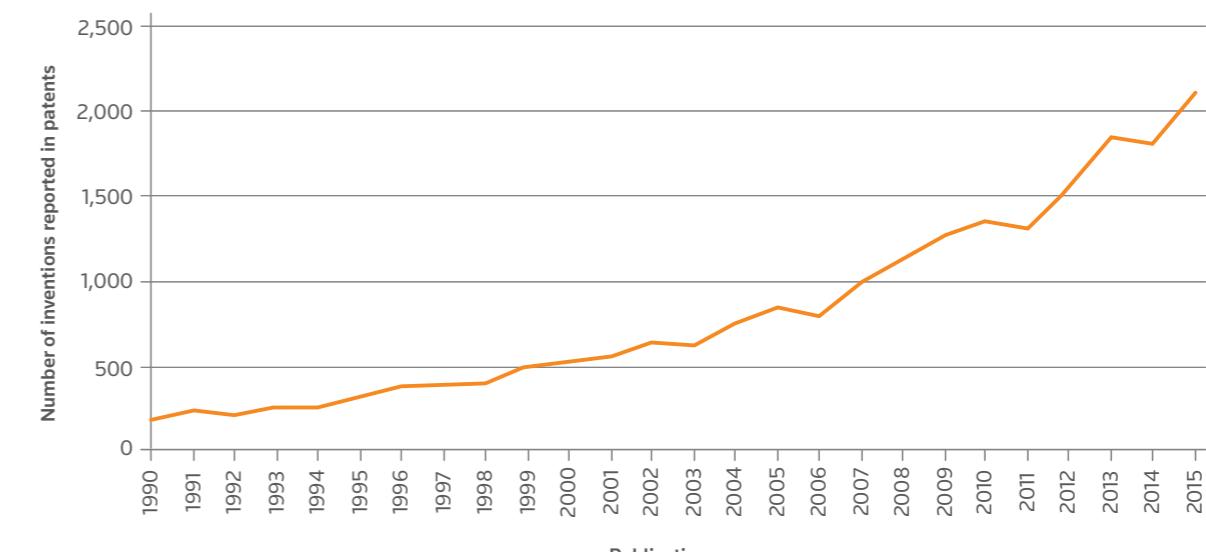
The field of wearable-sports technology is broad and diverse, including areas such as advanced materials for

athletic footwear, sports clothing and swimwear; mechanical enhancements to prevent hyperextension of joints; and wearable smart technology such as speed-and-distance monitors to enhance training and performance. This article explores the latest developments in sports technology and the benefits they provide athletes, today and in the future.

WHAT ARE THE CURRENT TRENDS IN WEARABLE-SPORTS TECHNOLOGY?

A good way to track new developments in a technology area is to look at patented inventions. Patents provide a mechanism to protect and commercialize an idea that provides a material advantage over existing technology. Improvements in sportswear fall squarely into this category, making it possible to identify key trends and developments in wearable-sports technology.

Figure 1: Wearable-Sports-Technology Inventions (1990-2015)



Source: Derwent World Patents Index™

THE EVOLUTION OF WEARABLE-SPORTS TECH

Looking at inventions published in patents over the last quarter century, innovation in wearable-sports technology has been steadily jumping in recent times and looks set to continue into the future, as shown in Figure 1.

From 1990-2005, inventions in this field increased steadily by around 10 percent per year, from 195 inventions in 1990 to 852 in 2005. Since 2006,

however, growth has accelerated to approximately 12 percent annually, from 802 inventions in 2006 to 2,117 last year. This reflects the increasing interest and intensification of competition in the wearable-sports-technology market, which is forecast to grow to \$9.4 billion by 2020.²

¹ A revolutionary swimsuit, Finalist for European Inventor of the Year 2009 in the "Industry" category, EPO website at www.epo.org/learning-events/european-inventor/finalists/2009/fairhurst.html

² Wearable-Sports Technology Market Landscape and SoC Trends, Damian Anzaldo, Maxim Integrated

MAJOR PLAYERS

According to the latest published revenue figures, the four largest sports equipment and clothing companies are Nike (\$27.80 billion), Adidas (€14.53 billion), Under Armour (\$3.96 billion) and Puma (€3.17 billion).

In terms of patented inventions, Nike holds the largest portfolio both in absolute terms and in relation to revenue, as shown in Figure 2.

Regarding maturity of innovation, over half of Puma's patent portfolio dates from before the turn of the century, as shown in Figure 3. By contrast, much of Nike's and all of Under Armour's innovation belongs to this millennium.

Figure 2: Comparison of Patent Portfolios and Revenues of Major Players

Company	All inventions	2014 Annual revenue (\$ billion)	Patents per \$ billion annual revenue
Nike	2,727	27.80	98.1
Adidas	883	12.00	73.6
Under Armour	77	3.96	19.4
Puma	182	2.62	69.5

Source: Derwent World Patents Index; Thomson Innovation®

Figure 3: Comparison of Patent Portfolios and Timeliness of Inventions

Company	Percentage of portfolio post-2000	Wearable-sports-tech inventions	Percentage of wearable-sports tech to total inventions
Nike	95%	992	36%
Adidas	74%	123	14%
Under Armour	100%	23	30%
Puma	42%	52	29%

Source: Derwent World Patents Index; Thomson Innovation

WHAT TECHNOLOGIES CAN WE EXPECT TO SEE?

Nike

As expected, Nike's patented technology is focused on footwear and the various aspects of features, design and manufacture (polymer applications, fabrics, etc.). Nike also shows a strong presence in sports equipment including balls, racquets, clubs, bats and the like, as well as in training equipment, computer processing for sports and training, and software products. This is focused on athletic-performance monitoring equipment.

Among the footwear technology from Nike, the Nike Hyperdunk+ basketball shoe is designed to help basketball players improve their performance by

Wearable-sports technology is a subsector of these companies' overall patent portfolios.

Nike is at the head of the pack with 992 wearable-sports-tech inventions, followed by Adidas (123), Puma (52) and Under Armour (23).

Nike also has the largest portion (36 percent) of its innovation portfolio directed toward wearable-sports tech.

A number of other companies feature in the list of top assignees for wearable-sports inventions. These are principally fiber and textile manufacturers (Toray, Kimberly-Clark, Teijin Fibres and DuPont) with various innovations on fabrics intended for use in sports and swimwear.

Figure 2: Comparison of Patent Portfolios and Revenues of Major Players

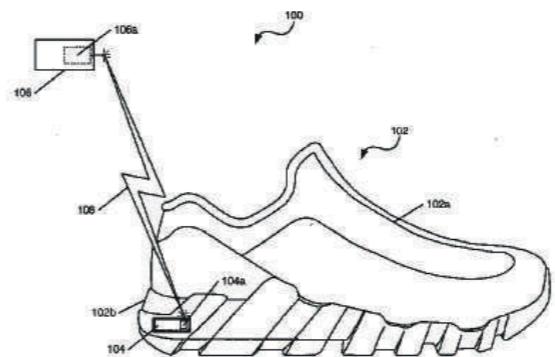
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Source: Derwent World Patents Index; Thomson Innovation®

monitoring their speed, jump height and overall game performance. There are sensors on the shoe that transmit information to a smartphone via Bluetooth.



These shoes are based on technology described in an August 2009 published patent record (US7579946) for "footwear products including data transmission capabilities," which was cited in 59 later inventions.



The patent describes footwear "for transmitting user identification data, footwear product identification data, physical data associated with footwear usage, and physiological data associated with footwear usage to monitor athletic performance. Footwear articles include a shoe, a boot, a baseball cleat or a ski boot. Data is transmitted to a computer, a watch or an LCD display."

Other Nike patented technologies we may expect to see in future products include:

- **US20120180191A1, Title – DWPI:** Athletic glove, e.g., baseball glove, has embedded inserts that are temporarily pliable, when heated beyond threshold temperature, such that insert is molded and molded shape is retained to provide molded inserts in desired shape

- **WO2008055133A2: Title – DWPI:** Goalkeeper's glove for use during soccer, has extension attached to proximate tip of each glove finger, where extension includes open arch from which attachment legs extend, and provides air gap between closed tip and arch

- **US20070006489A1: Title – DWPI:** Footwear system, e.g., shoes, has monitor which is engaged with footwear to detect and store data indicating speed or distance information associated with use of footwear

Adidas

The Adidas portfolio of patented inventions is focused on training equipment, computer processing and software for sport and training equipment. This includes fitness monitoring equipment, route tracking systems and a group monitoring system for monitoring multiple individuals engaged in athletic activity.

Recent products from Adidas have been for devices intended to be worn on the wrist such as the miCoach Smart Run.

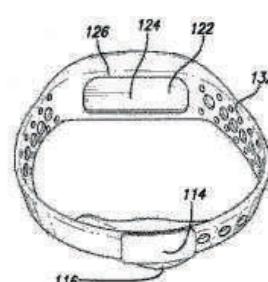
This is based on Adidas patented technology as described in, for example, US 20130162427 for "Portable Fitness Monitoring Systems with Displays and Applications Thereof" published in June 2013 and cited by 13 later published inventions.

This is for "an article for wearing; comprising a band or straps for coupling the device to the individual's wrist, and is secured on athlete's forearm, wrist, finger, head, chest, hip or foot. The device utilizes a sensor selected from a group consisting of a heart rate sensor, accelerometer and a global positioning system (GPS) receiver."

However, the future according to Adidas is for smart clothing with embedded sensors. It predicts that connected clothing is the absolute future and that smaller, non-intrusive sensors are more efficient at data processing and energy-harvesting capabilities will lead to making wearables an intrinsic part of our lives.³

This would seem to be affirmed by further patented technology such as US 20130274587 for "Wearable Athletic Activity Monitoring Systems" published in October 2013 and cited by 10 later patents.

The invention is for "a garment part formed of textile material (530). A sensor module (102) is inseparably coupled to the textile material of the garment part. The sensor module comprises a radio antenna (516), i.e., near field communication (NFC) antenna, for transmitting data generated by a sensor, where an exterior of the sensor module is portless. The sensor module is powered by a supercapacitor. The sensor module is sewn, laser welded or adhered to the garment part. The sensor module is sealed within a



waterproof membrane or sealed between two layers of thermo-formable film or membrane."

It is intended for use as a "sensor garment, e.g., jersey, glove and hat, for monitoring an individual engaged in athletic activity. Uses include but are not limited to running races, skiing activity, basketball activity, bowling activity, boxing activity, cycling activity, golfing activity, hockey activity, rowing activity, skateboarding activity and swimming activity."

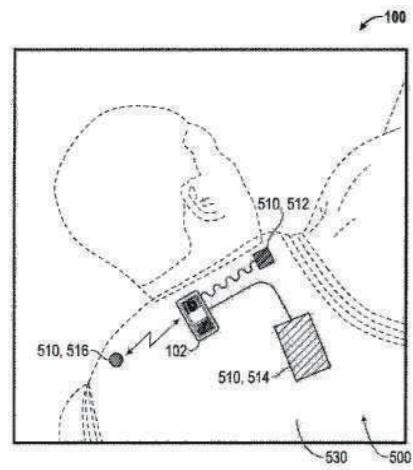


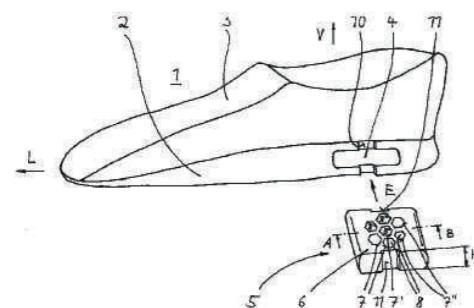
FIG. 35

Puma

Puma's portfolio of patented inventions is focused on polymer applications in footwear and sports and games equipment.

Among its patented technology is an invention to produce a sports shoe with enhanced cushioning provided by a chamber in the sole containing a damping element:

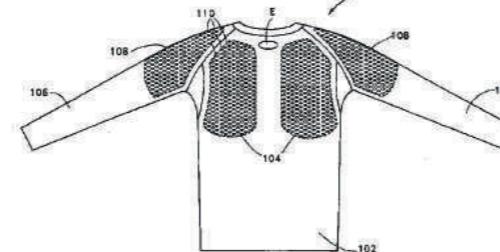
- **DE20320091U1** was published in June 2005 for a "shoe used as a sports shoe comprising a sole with a chamber containing a damping element made from a plate-like base body having recesses containing damping parts."



- The shoe (1) comprises a sole (2) with a chamber (4) containing a damping element (5) made from a plate-like base body (6) having recesses (7) containing damping parts (8).

Under Armour

Under Armour's portfolio of patented inventions is focused on sports and games equipment and polymer applications in footwear. Other clothing also features examples of this technology, including a hunting jacket, sports bras and a visor assembly for a helmet.



One of Under Armour's most significant inventions is described in US20060272071, published in December 2006 for an "athletic garment, e.g., shirt, which has several oval-shaped resin grips arranged on fabric at a location in contact with protective padding."

The garment (100) and several oval-shaped resin grips (110) are arranged on a fabric (102) at a location in contact with protective padding. The grips exert greater frictional force on padding than the frictional force exerted by the fabric on the padding, for a garment such as a shirt used by football, lacrosse and hockey players, as well as by baseball umpires. It prevents the sliding of padding during use while adding a new level of comfort and utility.

CONCLUSION

Regular exercise and participation in sports activities are well-known to increase one's overall physical fitness and provide a sense of mental well-being. The extension of technology into wearable-sports-and-fitness equipment is poised to deliver enhanced benefits to amateur and skilled athletes alike, forever changing the way we think about our physical fitness. The commercialization of innovative new technologies is driving growth in health and wellness products and economic success as well.

While we may not all be able to reach the heights of Olympic competitors, it is good to know that wearable-sports technology is being developed to help us be the best we can be. ●

*For more information, visit:
stateofinnovation.tr.com/wearable-tech*



FITNESS-BY-NUMBERS

Business Lessons from the Jawbone/Fitbit Patent Wars

By Anthony Trippe

Before 2015, not many people measured the success of their day based on the number of steps they took. Today, reaching 10,000 steps is a cause for celebration. How did this happen?

There were a few drivers. First, there was a great deal of academic research suggesting that sitting for long stretches of time can be hazardous to your health. Then came the development of the big data movement, whereby every single human interaction was accompanied by a data point that could be used to chart trends, trace patterns of behavior and project

future outcomes. Then, to tie it all together, a new generation of relatively low-priced fitness trackers was introduced to let us monitor our every movement wearing nothing but a small rubber band on our wrists.

One of these trackers, the Fitbit, came pre-programmed to vibrate repeatedly and light up when its owners reached 10,000 steps in a single 24-hour period. Thus, 10,000 steps became a new universal unit of measure for waist-watchers and athletes as a new product category began to explode in popularity.

Estimates suggest that the fitness-tracker industry is set to nearly triple to \$5.4 billion by 2019, up from \$2 billion in 2014.¹ Clearly, there is a lot of money at stake when it comes to monitoring personal fitness.

While human infatuation with individualized fitness data has continued to drive demand for these devices, a very different set of data could play a crucial role in which companies will thrive in this rapidly growing space and which will be left behind. Ultimately, the success of today's leaders in the fitness-tracker business comes down to the contents of their patent portfolios. More specifically, the manner in which they were built and leveraged in the rapid ascent of the new market holds valuable lessons for business leaders in the Fitness sector and elsewhere.

FLEDGLING FITNESS-TRACKER BUSINESS TAKES FLIGHT

Health-related monitoring devices have been around for decades, but the market for personal-fitness monitors designed to be worn 24 hours a day didn't begin until 2011. That's when Jawbone released the first version of its UP product, and Fitbit, a company that had previously made health monitors, released Ultra. Fast-forward to 2013 and the Nike+ FuelBand was also available for sale. All three products were beginning to gain traction with consumers, and it was clear that wearable personal fitness monitors were on the way to becoming a very significant business.

Meanwhile, Apple® and Samsung received jury verdicts in their patent litigation suits, and news of patent-related issues was in the headlines nearly daily. Corporate executives were getting a front-row lesson on the importance of a patent portfolio strategically aligned to the organization's goals and structured to protect its core assets and profit centers.

In April 2013, Jawbone, which files patents under the name of AliphCom, had 80 patent applications associated with the UP product filed around the world, according to data in Thomson Innovation. After removing redundant applications, a collection of 29 unique applications was associated with this brand. They covered methods of calculating health, sleep, activity and nutrition, as well as inventions related to coatings and power management. All of these documents were based on an initial application filed

in 2010 before the product went on sale, and while there was a reasonable number of applications, Jawbone needed to be concerned about whether a relatively late filing date would allow it to protect its market share.

The situation with Fitbit was even more dire. During the same April 2013 time period, Fitbit only had 13 unique US patent applications, despite being the market leader in the space. These didn't cover any of the device components or technologies used to assemble it. Instead, they only covered a generic monitoring device with and without a monitor. The pending applications were associated with activity algorithms, particular stair-climbing applications, and were being challenged at the US Patent and Trademark Office.

So, at the beginning of 2013, it could be reasonably concluded that Jawbone and Fitbit, two of the early leaders in the personal fitness-monitoring market, were exposed in terms of their existing patent portfolios. Both companies were likely considering patent-buying programs, strategic acquisitions or partnerships with tech companies that owned valuable IP in the space to address the shortcomings and recency in their own coverage. The companies were destined for trouble if patent litigation akin to the lawsuits filed between Apple and Samsung was to break out.

IF YOU CAN'T BEAT THEM, BUY THEM

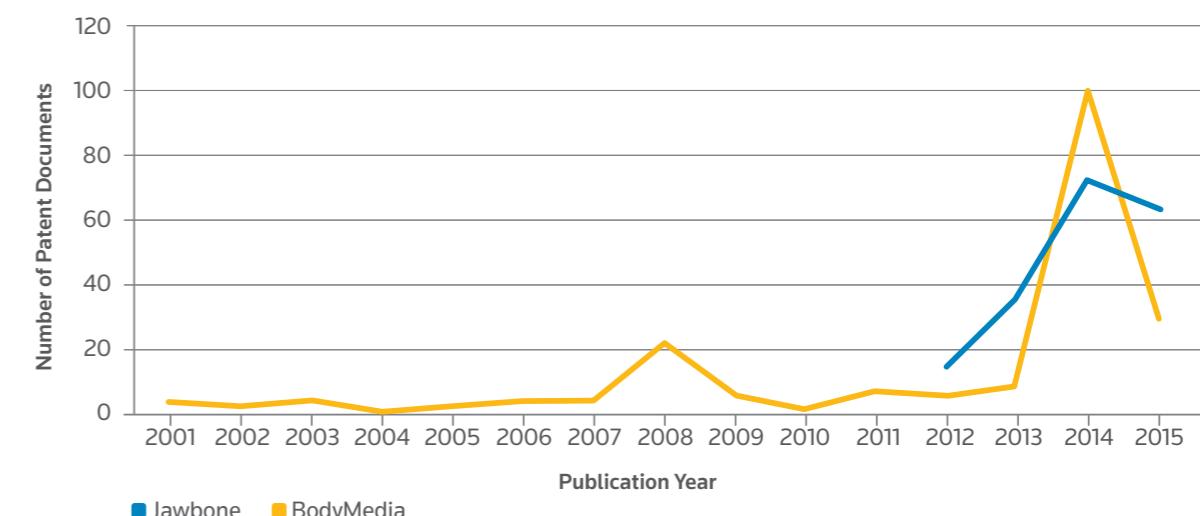
It was therefore of little surprise when, on April 30, 2013, Jawbone announced that it had acquired BodyMedia, an early pioneer in the field of fitness monitoring, for \$110 million dollars. It was reported that the acquisition was primarily driven by BodyMedia's patent portfolio,² as opposed to its marketed products. The BodyMedia portfolio was a good fit for Jawbone since it was one of the best in the area with technology depth and breadth, citations and early priority dates. It was a core asset that Jawbone could use to continue building its patent portfolio and protect its products.

Jumping ahead to 2016, the Jawbone UP patent portfolio now extends over nearly 1,000 worldwide patent documents represented by 374 unique application numbers in the US and at the World

Intellectual Property Organization (WIPO). An astounding 127 of them are based on cases originally filed by BodyMedia, taking advantage of the early filing dates and extensive technical coverage of

those documents. Figure 1 provides details on how the Jawbone portfolio has grown over time and how filings originally made by BodyMedia have contributed to that growth.

Figure 1: Jawbone and BodyMedia Patent Documents by Publication Year



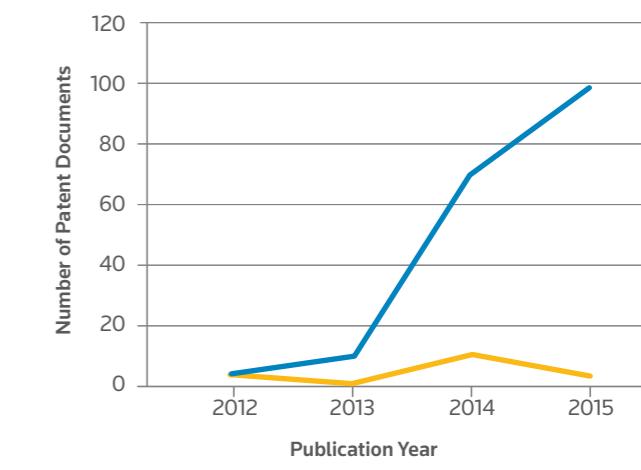
Many of the applications filed by Jawbone, based on original BodyMedia cases, focus on monitoring and presenting health, wellness and fitness data. This functionality is core to what users want from a personal fitness monitor.

Jawbone is also filing patents on coaching and behavior modification associated with health and wellness. For example, US20150294575A1 covers a system for monitoring and presenting health, wellness and fitness data with a feedback and coaching engine. It has a display device with a visual indication of suggested activity and behavior modification for the user. Similarly, US20150289812A1 has a display device with a visual indication of suggested activity and provides behavior modification based on detected data and a historical record. The earliest priority dates for these applications go back to June 2000 and could be difficult to overcome for competitors.

Fitbit has not sat idle in the area of patent development either. At the beginning of 2016, the company had more than 340 worldwide documents represented by 207 unique application numbers in the US. Fitbit tends to file patents only in the US and China, so comparisons between their worldwide numbers and Jawbone's can be misleading.

Fitbit also made an acquisition of its own, but it didn't do so with the same fanfare as Jawbone. In October 2013, it was reported that a small New Jersey start-up called Switch2Health had achieved a partial exit from its business when it sold its patent portfolio to an unidentified buyer from "the leading wearable device and activity tracking company."³ It turns out that company was Fitbit, and it has been using the 2006 priority date associated with the Switch2Health filings to continue to build its patent portfolio with new applications with earlier priority dates than what it had with its own organically grown cases, as shown in Figure 2.

Figure 2: Fitbit and Switch2Health Patent Documents by Publication Year



¹ www.wearable.com/fitness-trackers/fitness-tracker-market-to-top-dollar-5-billion-by-2019-995

² gizmodo.com/jawbones-acquisition-of-bodymedia-is-sadly-all-about-486108983

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Fitbit recently surprised analysts by releasing Blaze, an advanced fitness-monitoring device with watch features that looks like it could take the Apple Watch® head-on. This should not have been a big surprise since Fitbit filed patents on this concept that first published in 2014 including US9241635B2, describing a portable activity or biometric monitoring device including functions for a watch, pedometer, communication device, biometric analysis, environmental conditions analysis, motion data analysis and bicycle applications. The device can also be used for processing swimming and lap counting, and can put itself into "airplane" mode if it detects a sudden change in motion and pressure associated with a plane taking off.

PATENT WARS BEGIN

As 2015 began, analysts for the NPD Group reported that Fitbit controlled more than 65 percent of the market for fitness trackers, compared to a 14 percent share by Jawbone.⁴ To try to stem the tide of what looked to be a change in fortunes, Jawbone sued Fitbit for misappropriation of trade secrets just before Fitbit's initial public offering. The suit filed in May 2015 alleged that former Jawbone employees shared confidential information from their tenure with the company when they joined Fitbit. Jawbone followed up with another lawsuit in June 2015 claiming that one of its organically grown patents, and two patents based on technology acquired from BodyMedia, were being infringed by Fitbit.

Finally, in July 2015, Jawbone filed a complaint requesting that the International Trade Commission open an investigation pursuant to Section 337 claiming that six of its patents were being infringed by Fitbit. If found guilty, Fitbit would be restricted

from importing the covered products into the United States. Of the six patents used in the Section 337 investigation, three were developed originally by Jawbone, and three were developed based on patent cases acquired from BodyMedia.

LESSONS LEARNED

If Fitbit needed to rely on its own original filings, it might have had some difficulty responding to the improved Jawbone portfolio in these litigations. Fitbit took the first steps in this process by suing Jawbone for patent infringement on three occasions in the last six months, asserting nine patents from its portfolio. Two of these patents are based on filings from the intellectual property it acquired from Switch2Health. It is clear that acquired patents are playing a seminal role in protecting, or increasing, each company's current position in the field.

As the market for personal-fitness monitors heats up, two of the leading players have taken steps to make sure that the patents they have surrounding their products will be up to the task of protecting their intellectual capital, not only from one another, but against other players as the market continues to grow. It is important for companies of all sizes to think critically about patent-related matters, especially as revenues and market share increases, and to ensure that their patent portfolio covers their core products and markets. •

*For more information, visit:
stateofinnovation.tr.com/fitness-by-numbers*



⁴ gizmodo.com/jawbones-acquisition-of-bodymedia-is-sadly-all-about-4861089



— SOMETHING BIG IS ABOUT TO HAPPEN

In the US, \$2 billion is wasted every year on patents filed but not granted. New regulatory directives add to the complexity of managing your IP matters efficiently. And increasingly, everyone is asked to do more with less.

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WILL SELF-DRIVING CARS DISRUPT THE AUTO INDUSTRY?

By Kevin Chapman



Until recently, cars hadn't really changed that much over 100 or so years of research and development. Sure, they've gotten much faster, safer and more reliable, but the basic configuration of an internal combustion engine mounted out in front, four wheels down below, and a driver-manipulated gas pedal and steering wheel inside had stayed pretty much the same since Ford started mass producing the Model T in 1908.

But earlier this year everything changed. That's when the annual Consumer Electronics Show (CES) was dominated by autonomous vehicles. A total of 220,000 square feet of display space was devoted to automotive technologies at the 2016 event, with every major auto manufacturer and supplier, as well as a host of dedicated tech companies, unveiling their latest inventions that enable cars to drive themselves.

It was a seminal moment in the history of the automobile and the world took notice. Speaking in her keynote address, General Motors CEO Mary Barra exclaimed: "The auto industry will change more in the next five to 10 years than it has in the past 50."

Her sentiments were echoed by Ford CEO Mark Fields who said simply: "I predict that 2016 will be a revolutionary year in the automotive industry."

Traditional automotive manufacturers like GM and Ford were not alone in this sentiment, however. Tech-industry stalwarts that have historically claimed the lion's share of the spotlight, such as Google®, NVIDIA, Apple, Samsung, and even start-ups like Lyft and Uber, were very much a part of the autonomous-vehicle discussion, as they race to develop the sensors, data processors and new business models to help autonomous-vehicle technology go mainstream.

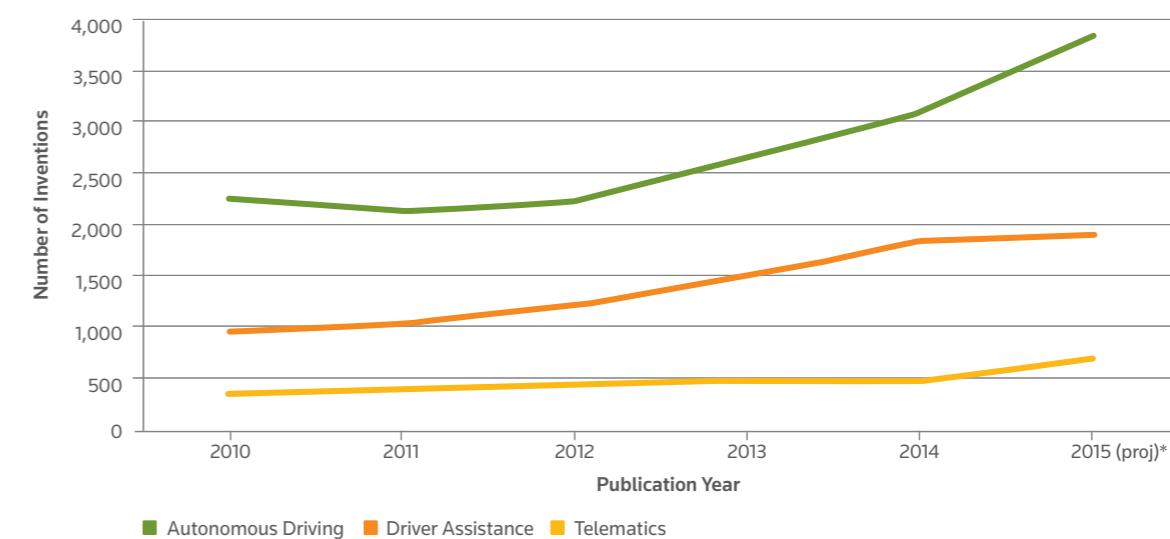
DETERMINING THE CURRENT LEADERS IN SELF-DRIVING TECH

This seismic event for the auto industry begs the question: Will self-driving cars become the great disruptor that causes the Automotive sector to change forever? Or, will it simply mark a pivotal point in the ongoing evolution of the automobile?

According to new research from the IP & Science business of Thomson Reuters, the potential for serious industry disruption at the hands of autonomous-vehicle technology is very real, but the incumbent auto industry leaders – not the Silicon Valley tech companies – are in the best position to take the new technology forward.

The report, "The 2016 State of Self-Driving Automotive Innovation," tracked global patent activity

Figure 1: Self-Driving Inventions in Three Core Technology Areas 2010-2015



Source: Derwent World Patents Index

*Institutional figures were correct as of October 2015. Subsequent updates by researchers may result in minor changes.

in the key technology areas related to self-driving vehicle development, including autonomous-vehicle technology, driver-assistance technology and telematics between 2010 and 2015, as shown on Figure 1 in prior page. All told, there were more than 22,000 new inventions related to self-driving automobiles patented during this time, with some clear leaders already emerging in the space.

TOYOTA, BOSCH, DENSO, HYUNDAI, GM LEAD THE WAY

Contrary to all of the hype surrounding tech industry players who have been quick to develop self-driving automobile prototypes, the auto industry establishment is far and away the leader in

self-driving technology development and commercialization.

Toyota is leading the charge, with over 2,000 new driverless technology inventions introduced over the last five years, double the number two player: Bosch, as shown in Figure 2. Japan's DENSO Corp., Korea's Hyundai Motor Co. and General Motors follow. Alphabet Inc.'s Google ranks 26th on the list.

JAPAN GETS A JUMP ON DETROIT AND SILICON VALLEY

America's automotive and technology epicenters in Detroit and Silicon Valley, while clearly embracing self-driving technology innovation, are lagging behind their Asian rivals when it comes to patented new

inventions. A total of five of the world's top 10 self-driving vehicle innovators hail from Japan (Toyota, DENSO, Nissan, Honda and Mitsubishi).

FIELD IS RIPE FOR PARTNERSHIP AND OPEN INNOVATION

While auto industry bellwethers dominate the self-driving vehicle patent landscape, a number of more specialized technology and research institutions have amassed a noteworthy collection of self-driving-vehicle-related patents. Among them, LG, Samsung, Google, Boeing, IBM, Amazon®, Carnegie Mellon and MIT have all contributed significant new intellectual property in the category over the last five years.

In addition, ride-sharing start-ups like Lyft, which is equally a technology company and automotive company, are worth watching as the self-driving car phenomenon unfolds. Lyft announced a breakthrough partnership with GM at CES whereby the two will develop a fleet of driverless taxis, potentially removing the driver – and the need to own a car – from the automotive equation altogether.

Other interesting partnerships include those between Microsoft® and a number of auto manufacturers that allow cars to connect with wearable devices; NVIDIA's partnership with Volvo to create car-based supercomputers; and Amazon's partnership with Ford to help vehicles connect to the home.

And who can ignore the role that Tesla plays in all of this? While everyone was busy talking about the future of autonomous vehicles at CES, Tesla already had its entire fleet of Model S luxury sedans cruising the streets on autopilot. Right after the show, the company upped the ante by introducing a "summon" feature that allows owners to park or fetch their vehicles remotely from a distance of up to 39 feet.

Tesla, of course, is also the company that famously made its patent portfolio completely open source in June 2014. The move, which was introduced as an effort to spur collaboration and innovation in the industry, effectively makes Tesla's collective patent

portfolio available to other carmakers and tech companies to develop complementary technologies.

Based on these convergent trends of feverish innovation in self-driving vehicle technology and the increasing role that strategic collaboration plays in new technology development, the researchers behind "The 2016 State of Self-Driving Automotive Innovation" theorize that there will be a groundswell of industry collaboration unfolding over the next several months. Specifically, potential partnerships between Google and Ford and between Apple and Tesla are highly probable events in the near future. Whatever form the future automobile industry ends up taking, it has become clear that successful interplay

"The auto industry will change more in the next five to 10 years than it has in the past 50."

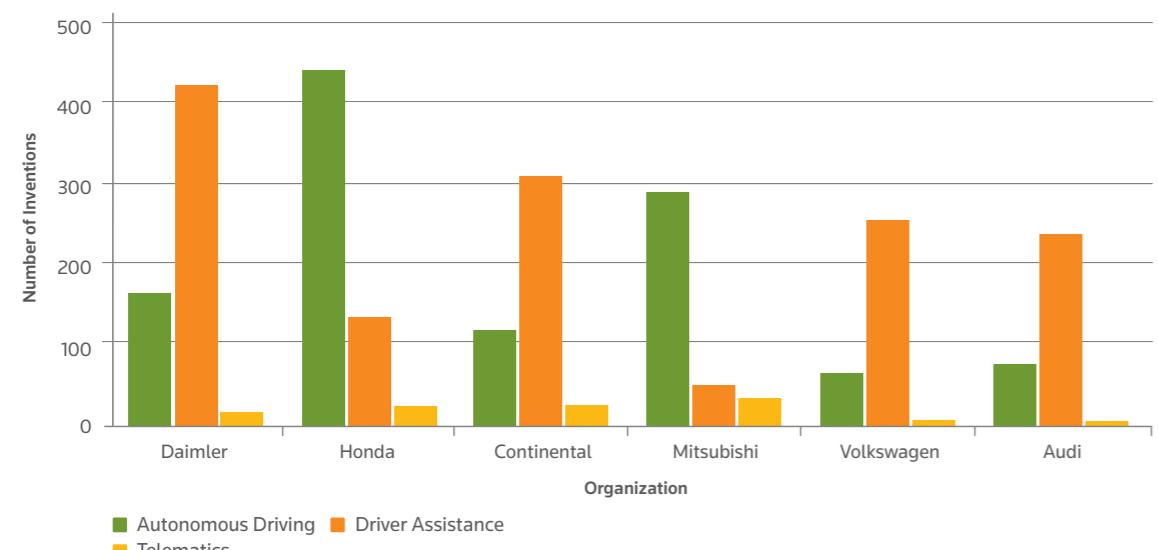
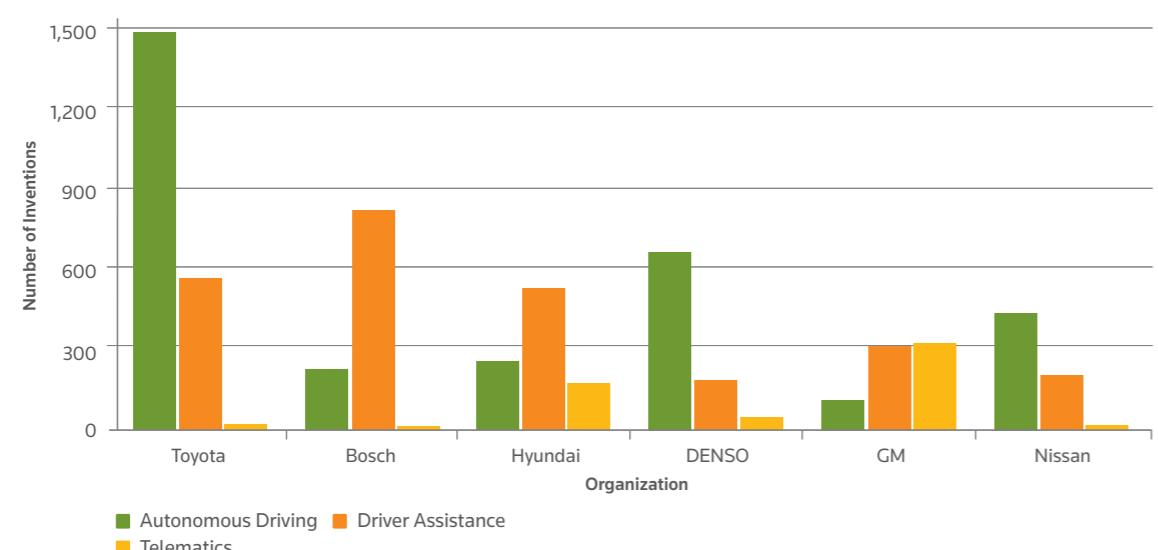
— MARY BARRA, CEO, GENERAL MOTORS

between technology and in-the-trenches automotive know-how will be critical to the recipe for success.

Will this move toward a self-driving future become a disruptor in the traditional sense of the word, ultimately causing the current industry incumbents to fall at the heels of nimble start-ups? It's not likely, based on the data we're seeing now. A more probable scenario is that self-driving technology becomes a catalyst to new ways of thinking about automotive development and strategic partnerships to create breakthrough technologies. The auto industry as we have always known it will certainly play a major role in that transformation, but it won't be alone. ●

Read the full report at
bit.ly/2016-SOI-Automotive

Figure 2: Top 12 Self-Driving Automotive Vehicle Innovators 2010-2015





DRIVING INNOVATION IN INDIA

Collaboration among Industry, Academia and Government Drives Activity

By Viji Krishnan

It's well-known that innovation is a driver of business growth and a means of keeping ahead of the competition. It is a foundational cornerstone for many political, government and business endeavors as leaders profess their prospects for the future. Consider the recent words of India's Prime Minister Narendra Modi at the 2015 Digital India event: "I see technology as a means to empower and as a tool that bridges the distance between hope and opportunity."

And US President Barack Obama's statement: "We know that the nation that goes all-in on innovation today will own the global economy tomorrow." Innovation offers hope and prosperity, and is essential to the success of a nation and its citizens.

With more than half a billion people having access to cell phones in India,¹ second only to China in the number of mobile phones in use, and approximately 9 million citizens in India getting online for the first time each month,² the opportunity for innovation as India embraces the digital age is great. But how does an entire country best capitalize on innovation to move the nation forward for the benefit of all?

In "India Innovation: Trends and Industry, Academic & Government Linkages," Thomson Reuters analysts examine India's efforts to move the needle as a leader in innovation – across all disciplines, as a country. They analyze the innovation trends across these segments based on patent publication activity, making the audience aware of the innovation landscape and showcasing best practices to enhance collaboration between industry and academia.

Innovation in India, as measured by the number of patents, has been on the rise, driven strongly by the Corporate segment with the Academia and Government contribution remaining constant. And while innovation led jointly by industry, academia and government is just beginning to show its potential, a focus on different technology areas may be delaying significant progress.

But the clearest takeaway from this review is that collaboration on innovation initiatives among the Corporate, Academia and Government segments will lead to the greatest results. In India's case, there is an increased focus on enhancing that collaboration, as demonstrated by the number of such initiatives.

Prime Minister Modi has said, "We want India to emerge as the Innovation Hub where the next big ideas emerge, driven by the power of technology." He sets the bar high and this report serves as a helpful tool for meeting that goal.

Innovation success can be measured using numerous metrics. "India Innovation" leverages patent and

publishing data, both being a more objective measure of the various metrics of innovation.³

India is emerging as a major patent destination for applicants globally, as is evidenced by the increasing number of patents published. Of the various segments, the Corporate one has contributed substantially more in driving innovation activity (based on the total volume of patents). The presence of R&D centers for various multinational corporations in India supports this observation.

KEY PATENT POINTS:

- The number of patents published by the Academia and Government segment remains steady at around 1,000 documents annually (+/-~20%), while the Corporate patenting activity has driven the highs and lows of the total patent volume.
- Innovation categories including Human Necessities and Chemistry/Metallurgy combine for 45% of total patent volume, followed by Physics, Performing Operations/Transporting and Electricity, which combine for another 45% of total published patent volume.

"INDIA INNOVATION" TRENDS: CORPORATE

Based on the number of patents published in the Corporate sector, the top 10 corporations were identified.

Tata Consultancy Services ranks first with 26% of the top 10's total patent volume. Of note, corporations in the IT/Software and Electrical industry sectors in India account for a 64% share of the total volume of patents in the top 10 organizations.

In addition, a significant number of patents have been filed in the Medicinal Preparation category where the focus has been on organic active ingredients, ointments and bougies. The Information Technology sector has also seen an increase in activity, especially related to the processing and transmission of digital data, primarily focused on processing complex database structures and natural language processing.

"INDIA INNOVATION" TRENDS: ACADEMIA AND GOVERNMENT

Following the same criterion in the Academia and Government sector, the top 10 entities were identified.

¹ www.bbc.com/news/world-asia-india-17362837

² yourstory.com/2015/01/quotes-india-digital-summit/

³ Data in the report was compiled using Thomson Innovation, Derwent World Patents Index (DWPI), Derwent Patent Citations Index (PCI), Thomson Data Analyzer and Web of Science. All are leading Patent/citation research platforms that are used by researchers and innovators worldwide.

Figure 1: The Top 10 Corporate Leaders and Their Percent Share of the Top 10's Patent Volume

Organization	Sector	% share of patent volume in Top 10
Tata Consultancy Services	Information Technology (IT) Services and Consulting	26%
Samsung India Software Operations	Software Research Development for Electronics	12%
Bharat Heavy Electricals	Electrical Equipments Manufacturer	12%
Crompton Greaves	Electrical Equipments Manufacturer	10%
Larsen & Toubro	Diversified	10%
TVS Motor Corp	Automotive	9%
Infosys	Information Technology (IT) Services and Consulting	6%
Cadila Healthcare	Pharmaceuticals	6%
Robert Bosch	Engineering	5%
Mylan Labs	Pharmaceuticals	4%

Source: Derwent World Patents Index

Figure 2: The Top 10 Research Center & University Leaders and Percent Share of the Top 10's Patent Volume

Organization	Sector	% share of patent volume in Top 10
Council of Scientific and Industrial Research	Research and Development Organization	46%
Defence Research and Development Organization	Military Research and Development Organization	13%
Amity University	Private Research University	10%
Indian Council of Agricultural Research	Government Research University	8%
Indian Institute of Technology Bombay	Government Research University	7%
Indian Institute of Science	Public University for Scientific Research and Higher Education	4%
Department of Biotechnology, India	Research and Development Organization	3%
Indian Institute of Technology Kanpur	Government Research University	3%
Indian Institute of Technology Delhi	Government Research University	3%
Indian Space Research Organization	Government Space Research Organization	3%

Source: Derwent World Patents Index

India's leading research and development organization, Council of Scientific and Industrial Research (CSIR) tops the chart with almost half the total volume. Just as in the Corporate segment, there is a major focus in the technical category on Medicinal Preparation, but here with a special focus on traditional herbal medicine. A significant number of patents have also been filed in the field of organic chemistry, especially patents that are related to acyclic and heterocyclic compounds.

Micro-Organism Composition and Food Treatment, two of the top five categories of active patenting in the Academia and Government segment, did not feature in the top five technology list of the Corporate segment. Similarly, there were two categories related to digital data featured in the top five list of the Corporate segment missing from the top five list of Academia and Government.

COLLABORATION ACCELERATES INNOVATION

"Collaboration between academia and industry is increasingly a critical component of efficient national innovation systems," according to José Guimón with the World Bank's Innovation Policy Platform.

Several corporations have actively collaborated with academic institutions to file patents – for example, Tata Steel in the field of Metallurgy, Tata Consultancy in Information Technology, FDC in Medicinal Preparations and TVS Motor in Combustion Engines.

Academic institutions active in collaboration are Indian Institute of Technology Bombay, Indian Institute of Science, Indian Institute of Technology Delhi and Indian Institute of Technology Madras, followed by others such as Panjab University and Indian Statistical Institute.

A major government research organization, Council of Scientific and Industrial Research (CSIR), has collaborated actively with corporate entities to focus on different research areas.

Progress is being made as research and development teams across India realize that working together by sharing funds, data and intelligence can bring greater strides of innovation at a more rapid pace than working in isolation. ●

*See the full white paper here:
stateofinnovation.tr.com/india-innovation-trends-industry-academic-government-linkages*



POWERING THE PLANET

The Sources of Energy That Will Power the Planet over the Next Three Decades

By Laura Gaze

In 2011, US President Barack Obama released his "Blueprint for a Secure Energy Future" where he set goals such as having 80 percent of US electricity generated from clean-energy sources by 2035. A few years later, in late 2015, the heads of state of nearly 200 countries agreed to combat global greenhouse gas emissions and contain temperatures to less than a 2-degrees-Celsius increase above the industrial era at the Conference of Parties (COP21) Paris Summit.

There's a rallying cry echoing around the world to mitigate the perils of global warming. Thomson Reuters analysts heard it and focused their sights on the future energy landscape and what the main sources of power will be over the coming decades.

THE FUTURE ENERGY MIX

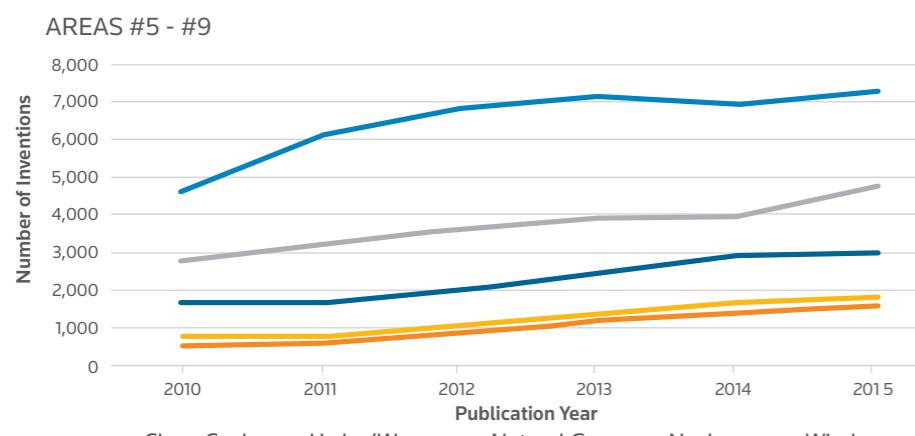
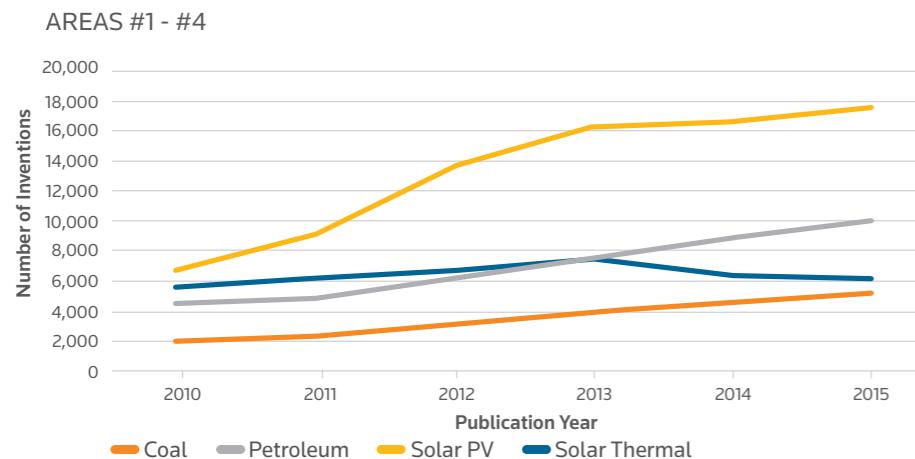
By the end of the 21st century, fossil-fuel-based energy sources will be all but dried up. In their place will be the next generation of renewables, some of which have

POWERING THE PLANET

Changes in the Major Sources of Power over the Next Few Decades

ELECTRICITY

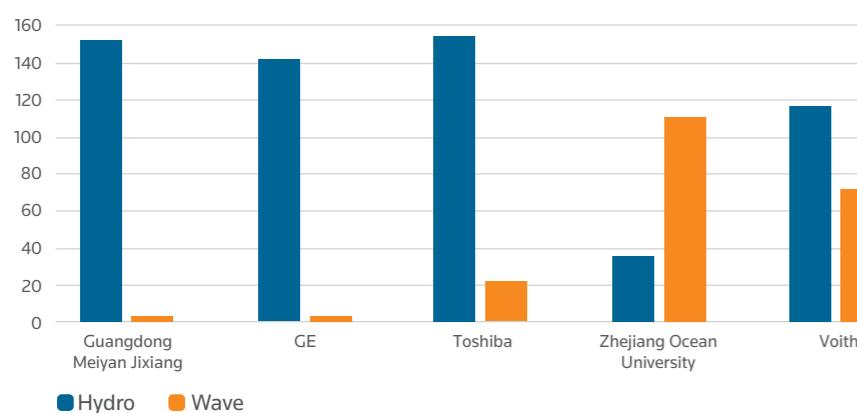
INNOVATION ACROSS TOP 9 AREAS (2010-2015)



Source: Derwent World Patents Index

HYDRO/WAVE

TOP 5 WATER-BASED POWER INNOVATORS & ACTIVITY BY TYPE (2010-2015)



Source: Derwent World Patents Index

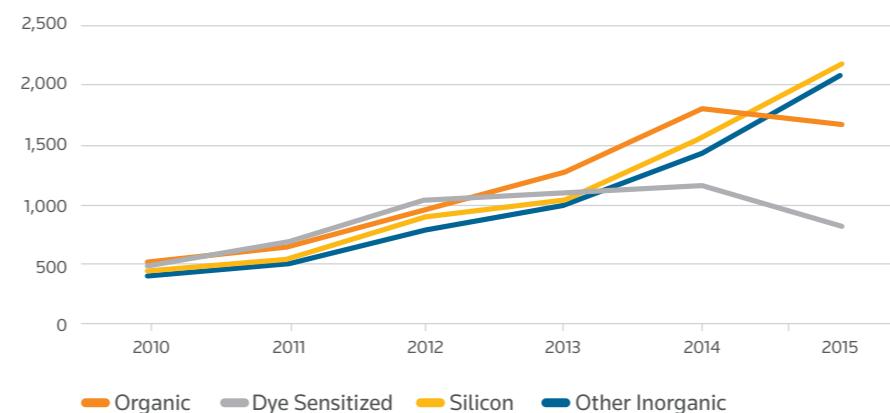
SOLAR

TOP SOLAR INNOVATORS

COMPANY	COUNTRY	RANK IN SOLAR CELL MATERIALS	RANK IN OTHER SOLAR PV COMPONENTS
Sharp	Japan	1	2
Mitsubishi	Japan	2	3
Kyocera	Japan	3	6
Fujifilm	Japan	4	7
LG	South Korea	5	1
Samsung	South Korea	6	4
Konica Minolta	Japan	7	13
Chinese Academy of Sciences	China	8	8
Merck Patent GmbH	Germany	9	19
Ocean's King Lighting Science & Tech	China	10	
Sumitomo	Japan	11	15
Sanyo	Japan	12	5
Sony	Japan	13	9
Hitachi	Japan	14	10
Panasonic	Japan	15	11
Dai Nippon Printing	Japan	16	18
IBM	US	17	
BASF	Germany	18	
Haiyangwang Lighting Tech	China	19	
DuPont	US	20	12
Canon	Japan		14
Changzhou Trina Solar Energy	China		16
Toshiba	Japan		17
Hyundai	South Korea		20

Source: Derwent World Patents Index

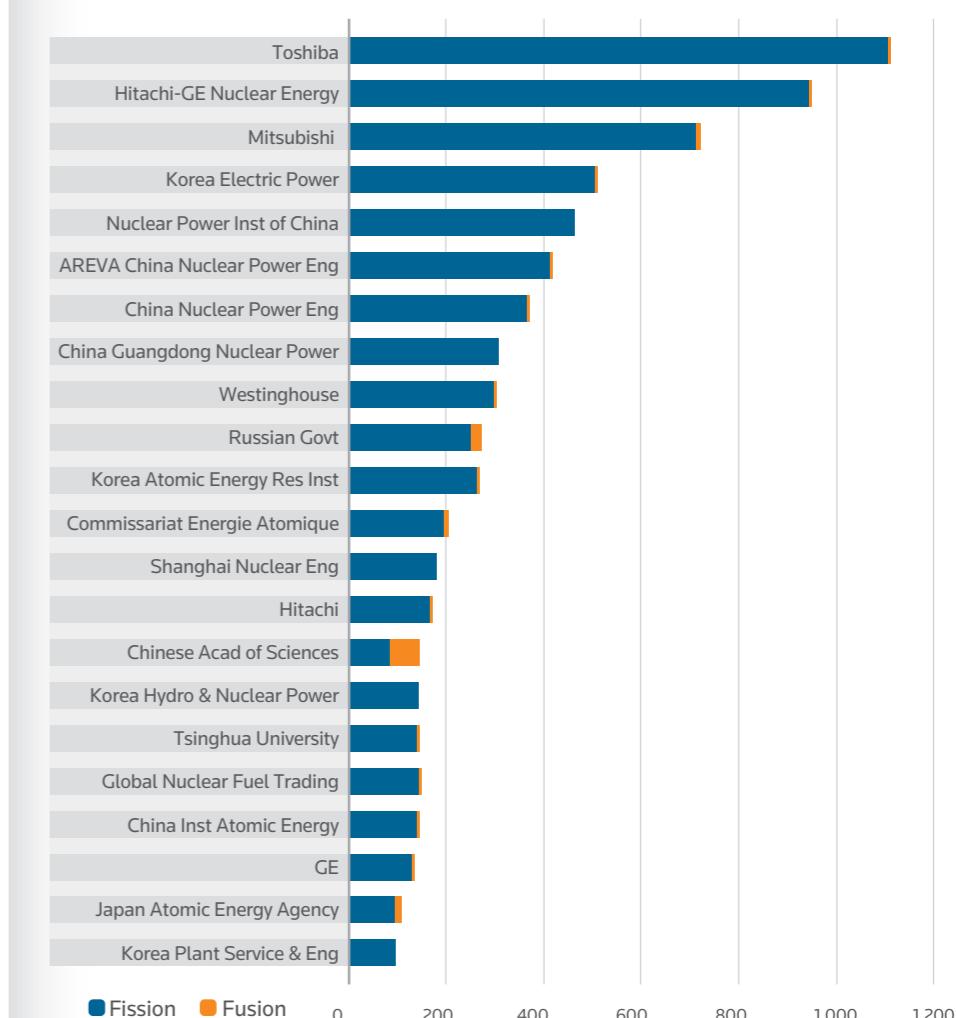
SOLAR-CELL MATERIAL INNOVATION (2010-2015)



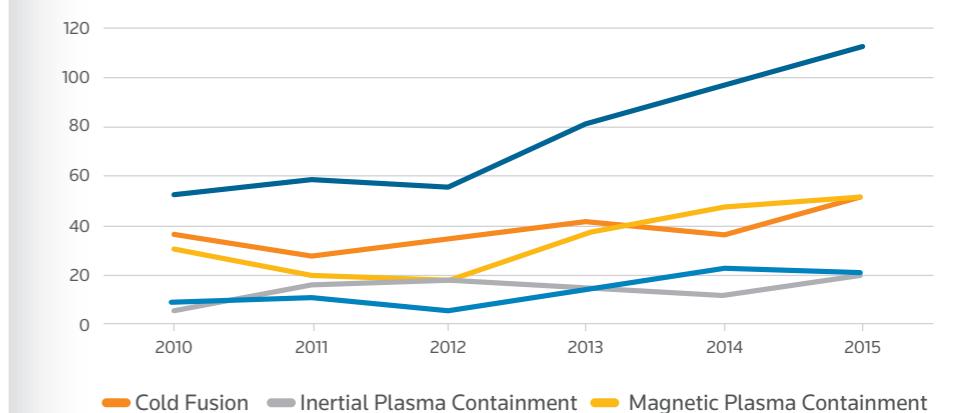
Source: Derwent World Patents Index

NUCLEAR

TOP NUCLEAR INNOVATORS



NUCLEAR FUSION INNOVATION (2010-2015)



Source: Derwent World Patents Index

an established footprint today and some of which are still to be discovered.

Thomson Reuters predicts there will be three dominant sources of energy in the next three decades:

- Hydro/wave
- Solar photovoltaics
- Nuclear fusion

Clean coal and natural gas, two other current power sources, will remain in the near-term mix; however, given their affiliation with fossil fuels and contribution to greenhouse gas emissions, among other negative environmental effects they impart, they will diminish in significance over the coming decades.

HYDRO/WAVE

Water-related innovation for generating power has been on a steady climb over the last several years, including both power secured from the movement of fluids by gravity (hydro) and oceanic/sea tidal movement (wave). The former jumped by 60 percent and the latter by 82 percent from 2010 through 2015.

Guangdong Meiyang Jixiang, GE, Toshiba, Zhejiang Ocean University and Voith are the top five organizations innovating in this space. The centerfold shows the breakout of their activity between hydro and wave from 2010 to 2015. Guangdong Meiyang Jixiang had the most recent activity, with a massive spike in 2015. The others remained fairly consistent over the six years, ending lower than their aforementioned competitor. Guangdong eclipsed them all with nearly 150 unique inventions for the same period.

SOLAR

The technology components that harness energy from the sun fall into two categories: solar cell materials and other solar PV (photovoltaic) components. While there's a lot more activity in the realm of solar PV components, it is the solar cell material that is essential for converting sunlight into electrons for energy. The photovoltaic process happens when photons from sunlight are absorbed by semiconducting materials, freeing electrons so they flow through it to produce electricity (voltage).

As shown in the centerfold table, there's a lot of overlap between the companies innovating in solar cell materials and those in photovoltaic components. Sharp is the top innovator for solar cell materials

and ranks second for other solar PV components. LG leads in terms of other solar PV components, but places fifth in solar cell materials.

Within the realm of solar cell materials, there are different approaches for capturing sunlight from solar and harnessing its energy. These include organic methods, dye sensitization, the use of silicon and other inorganics. Silicon and other inorganics lead in terms of 2015 output, whereas dye-sensitized and organic methods both declined over the last year, as seen in the centerfold.

NUCLEAR

There are two types of nuclear innovation related to energy: nuclear fission and nuclear fusion.

Fission involves the process by which uranium atoms are split, releasing energy that in turn produces steam that powers a turbine and generates electricity. Nuclear power plants can generate a lot of electricity with minimal pollution but the fission process produces radioactive waste that must be properly dealt with or it can be harmful to life and the planet.

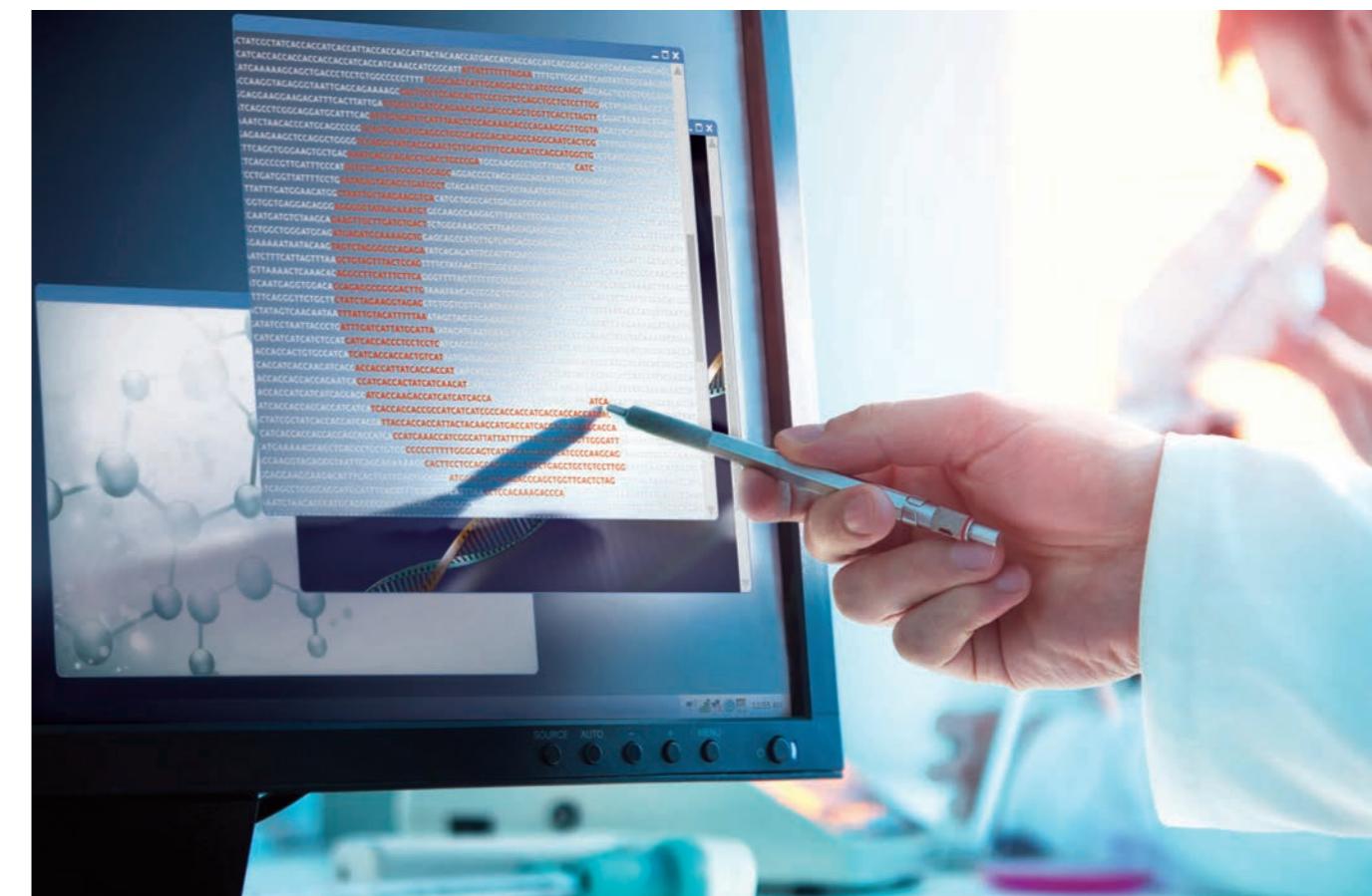
Nuclear fusion is a newer process for generating energy from nuclear activity with the potential to be more environmentally sound and cost-effective. There are several different areas of fusion activity including cold fusion, inertial plasma containment, magnetic plasma containment, fusion components and tokamak or stellarator, as shown in the centerfold. By far the most active area is that of the fusion components, followed by magnetic plasma containment and cold fusion, which have traded top spots with one another over the past few years.

The largest nuclear fusion contributor is the Chinese Academy of Sciences, which is not surprising as China is slated to have the most nuclear plants in development globally.

THE FUTURE

Renewables dominate the future energy mix, as fossil-fuel-based solutions continue to be replaced by more environmentally friendly solutions over the course of the next 20-30 years. There will be a gradual swapping out, versus the flipping of a switch, as industries, markets and citizens adjust to the new norm of the 21st century. ●

*Read the full Power the Planet report at:
stateofinnovation.tr.com/power-the-planet*



CLEARLY CORTELLIS

CORTELLIS™ COMPETITIVE INTELLIGENCE

Cortellis™ Competitive Intelligence gives you accurate and timely global information on over 61,000 drugs, 6,000,000 patents, and 44,000 deals from big pharma to biotech companies, plus breaking industry news, clinical trials, broker research and conference coverage.

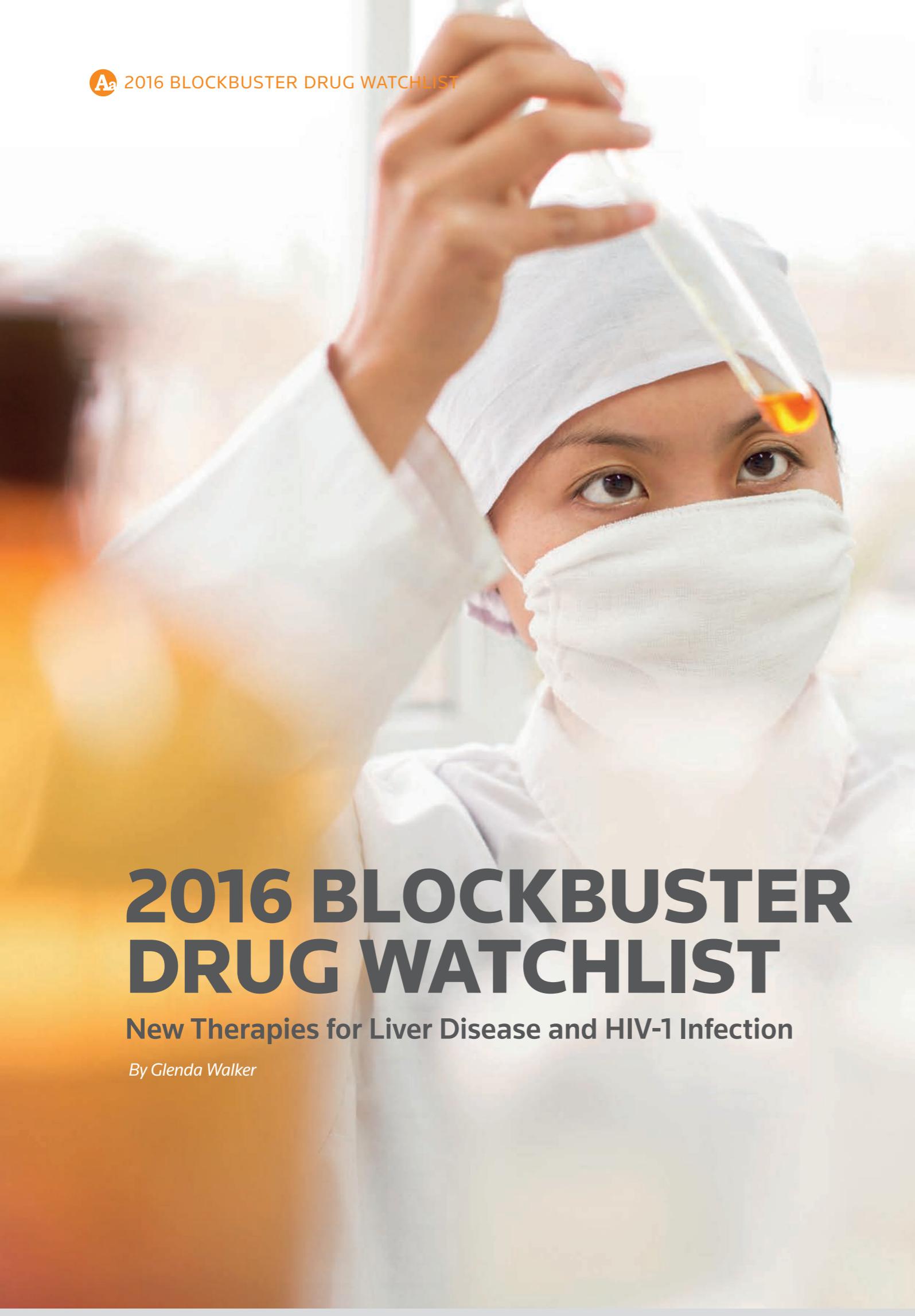
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2016 BLOCKBUSTER DRUG WATCHLIST

New Therapies for Liver Disease and HIV-1 Infection

By Glenda Walker



A wide spectrum of emerging therapeutics is highlighted in the 2016 Thomson Reuters Drugs to Watch report featuring consensus forecast data from Thomson Reuters Cortellis™. The report identifies seven new drugs expected to enter the market this year that are predicted to achieve blockbuster sales of more than \$1 billion by 2020; the majority with revenues between \$1-2 billion by that time. And remarkably, two of those drugs, Intercept Pharmaceuticals and Sumitomo Dainippon Pharma's obeticholic acid for chronic liver disease and Gilead Sciences and Japan Tobacco's fixed-dose combination emtricitabine + tenofovir alafenamide (F/TAF) for HIV-1 infection, are set to exceed \$2B.

Table 1: 2016 Drugs-to-Watch Forecast Sales & Rankings

Ranking*	Drug	Disease	Pharmaceutical Company	2020 Forecast Sales (US \$ Billions)
1	Obeticholic acid	Chronic liver diseases, primarily primary biliary cirrhosis	Intercept Pharmaceuticals and Sumitomo Dainippon Pharma	2.621
2	Emtricitabine + tenofovir alafenamide (F/TAF)	HIV-1 infection	Gilead Sciences and Japan Tobacco	2.006
3	Tenofovir alafenamide + emtricitabine + rilpivirine (R/F/TAF)	HIV-1 infection	Gilead Sciences and Janssen R&D	1.572
4	MK-5172A (grazoprevir + elbasvir)	HCV infection	Merck & Co	1.537
5	Venetoclax	Chronic lymphocytic leukemia	AbbVie	1.477
6	NUPLAZID (pimavanserin)	Parkinson's disease psychosis	ACADIA Pharmaceuticals	1.409
7	Uptravi (selexipag)	Pulmonary arterial hypertension	Nippon Shinyaku Co and Actelion	1.268

Source: Cortellis™

*Ranking by highest sales forecasts for 2020. Analysis based on data accessed on January 8, 2016.

This year's forecast reveals several key trends in the Pharmaceutical sector: the increasing focus on rare diseases, the continued development of more convenient fixed-dose combination (FDC) regimens, and the conflict between price and access to medicine. Also of note, 2016 may witness the entry of ACADIA Pharmaceuticals' NUPLAZID (pimavanserin) into the market. If successful, this agent will be the first and only drug to be approved in the US for Parkinson's disease psychosis.

THE TOP SELLER

Intercept Pharmaceuticals and Sumitomo Dainippon Pharma's obeticholic acid is ranked first on the list and is predicted to achieve sales of \$2.621 billion in 2020. If approved, obeticholic acid could become the first new treatment for primary biliary cirrhosis (PBC) in more than 20 years. Obeticholic acid is also under development for nonalcoholic steatohepatitis (NASH), and it is the larger NASH market that is anticipated to be the most lucrative. However, approval of NASH

may still be a way off as the Phase III REGENERATE study, which will form the basis of regulatory filings for NASH, is not scheduled to conclude until 2021.

RARE DISEASES

Rare or orphan diseases, disorders affecting fewer than 200,000 people in the US and no more than five in 10,000 people in the EU, have historically been a focus for niche biotechnology and pharmaceutical companies. However, this trend is changing as the pharmaceutical industry begins to recognize the financial potential of orphan drugs that address previously unmet medical needs. Obeticholic acid is one of two 2016 predicted blockbuster drugs that target rare diseases. The second is venetoclax, ranked fifth based on sales predictions for 2020, for chronic lymphocytic leukemia (CLL).

At the 2015 annual meeting of the American Society of Hematology (ASH), venetoclax was the focus of more than 40 presentations in multiple indications. Data reported at the meeting from the pivotal Phase II M13-982 trial in patients with relapsed/refractory CLL who have del17p generated much interest among delegates. Del17p is associated with highly aggressive disease and resistance to chemotherapy; individuals with this abnormality have a median life expectancy of less than five years – as such, a large unmet need in this disease remains.

FIXED-DOSE COMBINATION REGIMENS

The most frequently represented class of products in the Drugs to Watch report is fixed-dose combination regimens, which appeared three times in the forecast. Second overall is Gilead Sciences and Japan Tobacco's anti-HIV-1 infection combination emtricitabine + tenofovir alafenamide (F/TAF); third is Gilead Sciences and Janssen R&D's tenofovir alafenamide + emtricitabine + rilpivirine (R/F/TAF), also for HIV-1 infection; and fourth overall is Merck & Co.'s anti-HCV infection drug MK-5172A (grazoprevir + elbasvir). These drugs can offer significant benefits to both the patient and the developing company, including

lifecycle extension strategies and product differentiation, as well as improved efficacy and convenience. Notably, Gilead's FDC products, such as the TDF/TAF-based products described in the Drugs to Watch report have resulted in significant gains for the company in the HCV and HIV markets.

PRICING

One topic that is sure to remain in the headlines this year is that of drug access and affordability. Pricing of new branded drugs has been a prominent source of debate over the past year and the topic of a US congressional committee investigation. Several companies, including Gilead (the developer of two therapeutics appearing in the Drugs to Watch report), have faced scrutiny because of pricing strategies. New pricing initiatives, such as the success-driven pricing model tested by Novartis, with its heart-failure drug Entresto, may become more commonplace as approaches to reduce the conflict between price and access to medicine are developed.

INDUSTRY FOCUS

As the industry continues to evolve at an epic pace, the 2015 Drugs to Watch review has identified several key areas of continued focus for the pharmaceutical industry: rare diseases, FDC regimens and pricing. The year ahead is expected to be an exciting yet sometimes challenging one for the pharmaceutical industry with life-changing results. ●

Read the full Drugs to Watch report at:
stateofinnovation.tr.com/2016-drugs-to-watch

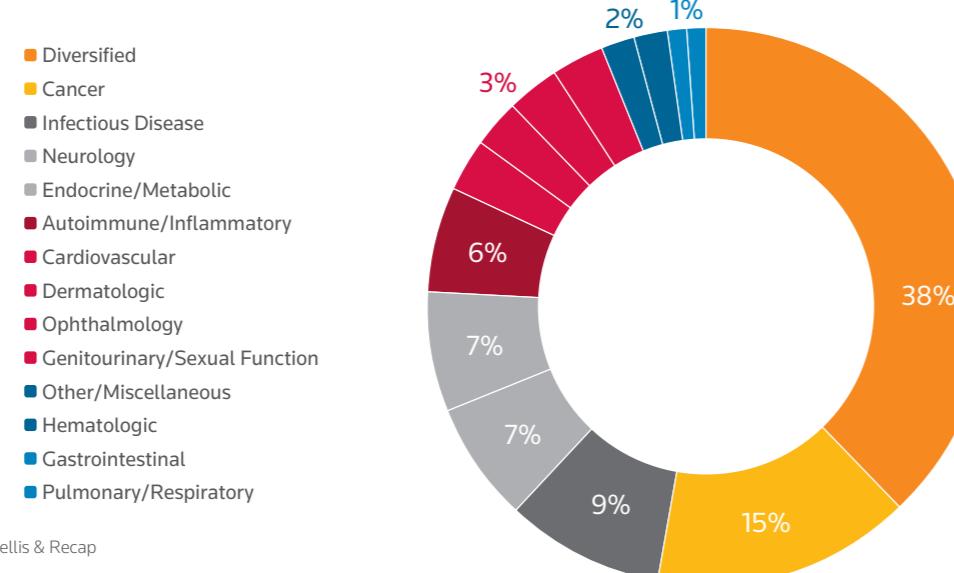


It can be categorized as a blockbuster: 2015 saw a record-setting 468 life sciences merger and acquisition (M&A) deals for a staggering value of \$513B; a 78 percent increase over 2014 and more than seven times the 2012 recession trough value of \$71B, according to the Thomson Reuters Deals Review. The year was well over the 10-year average of 320 M&A transactions and \$182B aggregate deal value per year since 2006.

2016, however, promises to be quite different. The significant contractions in the IPO market will cause various reverberations throughout the industry. Partnering, collaboration and consolidation in the industry are expected to remain strong, however, as companies band together to find programmatic and financing synergies that enable them to continue pursuing products allowing people to live longer, healthier lives.

Breaking 2015 down for a closer look, M&A activity increased globally across multiple sectors, thanks to capital readily available from low interest rates and various other optimistic factors. Therapeutics represented 123 of the year's healthcare M&As. The largest group of acquisitions (38 percent) had diversified portfolios carrying assets or platform technologies in two or more core therapeutic areas. Some of these deals encompassed generics companies with broad portfolios, while others focused on specialty pharmas where activity is perennially brisk, as shown in Figure 1.

Figure 1: 2015 M&A Activity by Therapeutic Area



1 BioWorld™ Today, Jan. 12, 2016 and Nov. 24, 2015

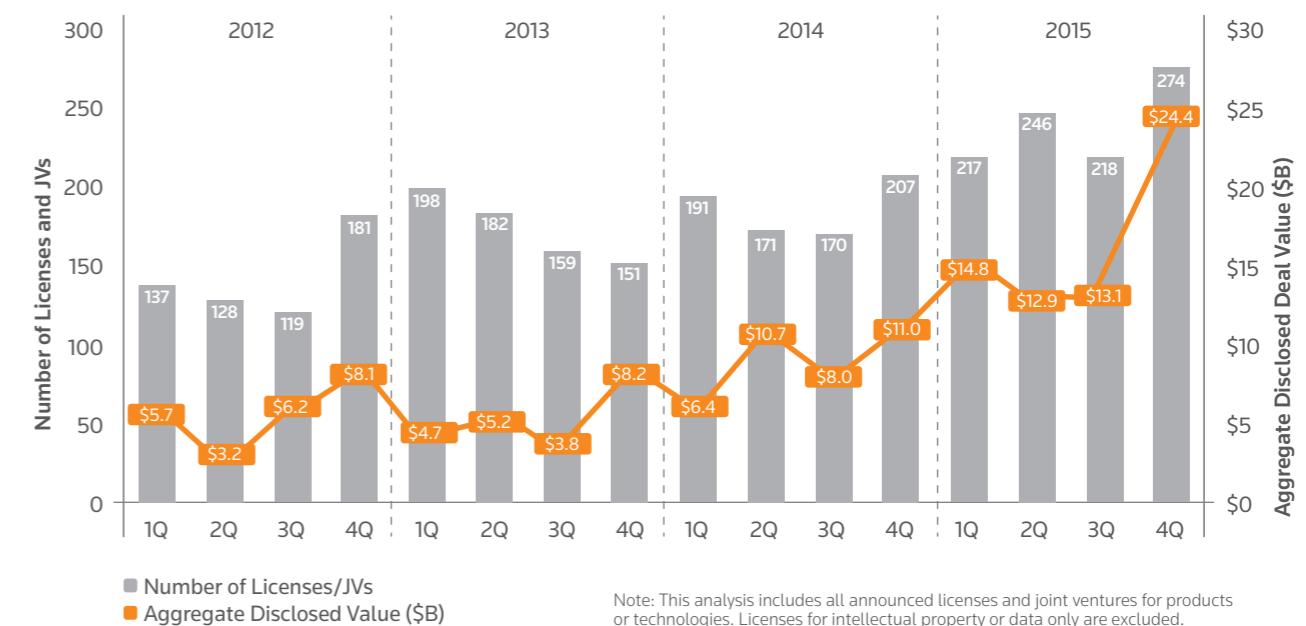
The second largest group of deals was in cancer, at 15 percent, followed by infectious disease at 9 percent, and neurology and endocrinology/metabolic disease at 7 percent each.

The overall growth in aggregate M&A dollars is the result of a rising number of large deals along with some very, very big deals. Namely, the acquisition of Allergan Plc by Pfizer Inc. of New York valued at \$160B,¹ and the recent confirmation that Baxalta Inc., of Bannockburn, Illinois, will be acquired by Shire Plc of Dublin for \$32 billion – a transaction set in motion last August.

There was also a massive increase in licensing and joint venture deals in 2015, with 955 such transactions valued at \$65.2B, compared with 739 valued at \$36.1B in 2014, a 29 percent year-over-year increase, as shown in Figure 2.

Each of 2015's top 10 licensing transactions in therapeutics exceeded \$1.5 billion, led by a potential \$4.3B diabetes deal between Paris-based Sanofi SA and Hanmi Pharmaceutical Co. Ltd. of Seoul, Korea.

Figure 2: Licenses and Joint Ventures (JVs) by Quarter



Source: Cortellis & Recap

Sanofi kicked off that alliance by making an up-front payment of \$445 million to Hanmi.²

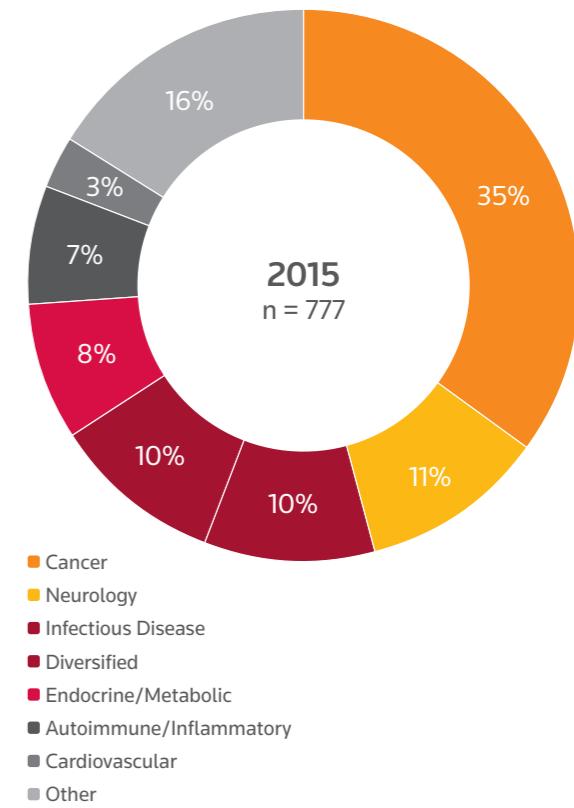
Celgene and Sanofi were at the forefront of the 2015 licensing extravaganza with four deals apiece, each with up-front payments exceeding \$50M. In general, such up-front-dollar commitments have grown significantly since 2014, reaching an average of nearly \$50M across 136 licensing deals last year, compared to a five-year average of \$33M.

Unlike the activity in M&A, diversified pipelines were the fourth most common licensing sector, with cancer dominant among therapeutic areas, as shown in Figure 3. Additionally, there was optimism over the increased rate of licenses for neurological agents in 2015.

Looking at the complete picture, combining the life sciences M&A deals with licensing/JV deals, the 2015 total of 1,422 transactions valued at \$578B is a 24 percent increase in volume and an impressive 85 percent jump in aggregate dollars over 2014 – quite an impressive increase, especially considering that 2014 was also a very strong year in life sciences deal making.

Following such a stellar couple years, all eyes are watching to see what happens in 2016. So far deal making is off to a robust start and indicators suggest the momentum will continue as the industry works to fulfill the promises of improved therapies for all. ●

Figure 3: 2015 Pharmaceutical Licenses by Therapeutic Area



Source: Cortellis & Recap

2 BioWorld™ Today, Nov. 6, 2015

TODAY'S HOTTEST SCIENTISTS AND THE RISE OF PERSONAL GENOMICS

By Christopher King

Citations provide an invaluable guide for identifying the most significant research of today and the scientists behind it. When authors cite another's work, they create a dynamic map of the unfolding network of knowledge and the currents of influence, offshoots and advancement that constantly enlarge the research ecosystem.



Citations, as tabulated in the Web of Science™, point to authors whose work has consistently been viewed by the research community as noteworthy and useful. For example, the report entitled "The World's Most Influential Scientific Minds 2015" lists more than 3,000 researchers, all of whom have produced high numbers of papers that rank among the top 1 percent most cited in their respective fields between 2003 and 2013. As discussed in the previous issue of Innovation, the "Most Influential Minds" roster directly reflects the judgments that scientists themselves make in designating the most significant research.

RECENT PAPERS, RAPID CITATIONS

In addition to listing the thousands of authors officially designated as Highly Cited Researchers based on work published over the last decade or so, the report includes a separate section, featuring a smaller selection of authors whose work over the previous two years has attracted a high rate of citations.

Researchers in this second group have contributed to a high number of Hot Papers — reports two years old and younger, which have begun collecting notable numbers of citations immediately after publication.

The latest annual collection of Hot Authors features 19 scientists, each of whom has produced at least 14 Hot Papers over the last two years. This work represents notably active fields of science, such as materials research, and the ongoing effort to develop and improve solar cells as a renewable energy source. Also prominent is genomics, the fast-moving technology for gene editing. Genomics, in fact, accounts for nearly half the scientists on the list.

BIOMEDICINE: CANCER GENOMICS

Among the authors of multiple Hot Papers in biomedicine, several names return from the previous edition of the Hot Authors collection. Topping the list, as she did last time, is Stacey B. Gabriel of the Broad Institute of MIT and Harvard. Gabriel contributed to 25 Hot Papers, notably reports from The Cancer Genome Atlas (TCGA) project, providing molecular portraits of tumors afflicting the breast and lung, among others. More recent papers to which she has contributed examine the genetic foundations of schizophrenia and Alzheimer's disease.

With many TCGA reports continuing to earn Hot Paper distinction, Gabriel is joined once again on the list by perennial Hot Author Eric S. Lander, now making his eleventh appearance in this annual survey. Gad Getz,

Matthew Meyerson, Michael Lawrence and Kristian Cibulskis also return from the previous collection. (Note: Throughout the list, the rank order of names is determined first by number of Hot Papers, then by the average number of citations per Hot Paper.)

Another TCGA contributor, whose 14 Hot Papers include reports on quantifying somatic DNA alterations in human cancers, is new to the list: Scott. L. Carter of the Dana-Farber Cancer Institute.

Also debuting as Hot Authors is a group of authors

"The World's Most Influential Scientific Minds" lists more than 3,000 leading researchers of our day.

from the University of Washington who are collaborators on the Global Burden of Disease (GBD) project, an ongoing, multinational effort to quantify the most pressing national and regional threats to health. Of these authors, Christopher J. Murray has been most prolific in the production of Hot Papers, with 22. Along with general examinations of risk factors, these reports evaluate infant and maternal mortality, as well as the effects of substance abuse and cigarette smoking.

Three of Murray's colleagues, representing the University of Washington's Institute for Health Metrics and Evaluation, join him on the list: Alan D. Lopez, an associate professor at Washington who's also affiliated with the University of Melbourne, contributed to 16 reports, as did Theo Vos. Meanwhile, Mohsen Naghavi coauthored 15 Hot Papers.

Rounding out the biomedical Hot Authors is another new name, **Feng Zhang** of MIT, one of the pioneer developers of the CRISPR/Cas method for genome editing. In recent years, this “find and replace” method for re-splicing genes has provoked a steep rise in activity – not to mention publications, with 290 Web of Science-indexed papers using the term “CRISPR” in 2013, 670 papers in 2014 and more than 1,100 through the end of 2015. Fourteen of Zhang’s papers on CRISPR officially rate as hot.

MATERIALS SCIENCE SCORES

Although biomedicine accounts for the majority of the 19 hot scientists in Table 1, seven names from the physical sciences also make the grade.

Most prolific in Hot Papers, and a name that is new to this annual survey, is **Henry J. Snaith** of Oxford University, thanks to 24 recent reports, primarily on perovskite solar cells.

Perovskite solar cells deliver another scientist to the listing for the first time: **Michael Grätzel**, of the École Polytechnique Fédérale de Lausanne, who contributed to 19 reports. Grätzel’s colleague at the Swiss institution, **Mohammad K. Nazeeruddin**, was among the coauthors on 16 of these Hot Papers, exploring

methods of using perovskite to improve the efficiency of solar cells.

With 19 Hot Papers, **David (Xiong Wen) Lou** of Singapore’s Nanyang Technical University (NTU), earns his inaugural appearance on the list. His efforts center on the development of lithium batteries, supercapacitors, and other energy-related technologies.

Another NTU researcher returns from the previous roundup: **Hua Zhang** scores with 16 recent Hot Papers on various aspects of nanomaterials, including nanosheets, metal-organic frameworks, monolayers. Zhang has also published on methods of self-assembly and self-organization of compounds used in sensing and in clean-energy applications.

Two US-based researchers complete the list of materials scientists. One is **Yang Yang** of the University of California, Los Angeles, with 15 recent Hot Papers on organic photovoltaics, work that also includes perovskite solar cells.

And returning to the list from the prior year is Stanford University’s **Yi Cui**, whose 15 Hot Papers cover various nanotechnological areas, including lithium-ion batteries and the development of catalysts for use in reactions with hydrogen.

Table 1: Scientists with Multiple Hot Papers (2013-2014)

Name	Institution	Field	Number of Hot Papers
Stacey B. Gabriel	Broad Institute of MIT and Harvard	Genomics	25
Henry J. Snaith	Oxford University	Physics/Materials	24
Christopher J. Murray	University of Washington	Global Health	22
Eric S. Lander	Broad Institute of MIT and Harvard	Genomics	21
Gad Getz	Broad Institute of MIT and Harvard	Genomics	20
Matthew Meyerson	Broad Institute of MIT and Harvard	Genomics	19
Michael Grätzel	École Polytechnique Fédérale de Lausanne	Materials	19
David (Xiong Wen) Lou	Nanyang Technological University	Chemistry/Materials	19
Alan D. Lopez	University of Melbourne	Health Metrics	16
Theo Vos	University of Washington	Global Health	16
Mohammad K. Nazeeruddin	École Polytechnique Fédérale de Lausanne	Materials	16
Hua Zhang	Nanyang Technological University	Materials	16
Mohsen Naghavi	University of Washington	Global Health	15
Yang Yang	Univ. of California, Los Angeles	Materials	15
Yi Cui	Stanford University	Materials	15
Michael S. Lawrence	Broad Institute of MIT and Harvard	Genomics	14
Scott L. Carter	Dana-Farber Cancer Institute	Genomics	14
Kristian Cibulskis	Broad Institute of MIT and Harvard	Genomics	14
Feng Zhang	MIT	Biomedical Engineering	14

Source: Web of Science

Figure 1: Web of Science Papers with Term “Personal Genomics” (2001-2014)

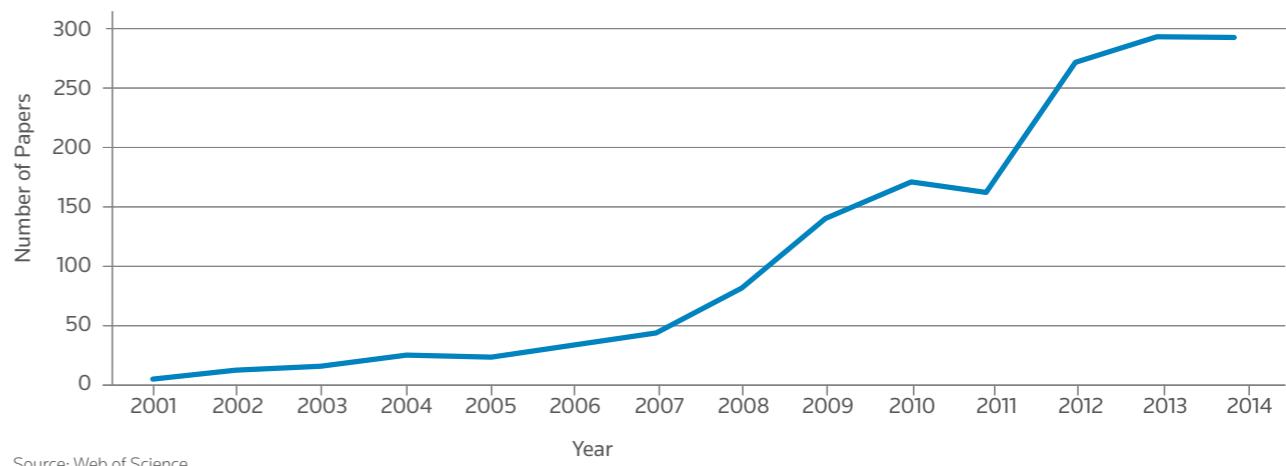


Table 2: Selected Papers Addressing Personal Genomics (2001-2015)

Citations
E.A. Ashley, et al., “Clinical assessment incorporating a personal genome,” Lancet, 375 (9725): 1525-35, 2010. 350
L.Chin, et al., “Cancer genomics: from discovery science to personalized medicine,” Nature Medicine, 17 (3): 297-303, 2011. 164
G. Ginsburg, H.F. Willard, “Genomic and personalized medicine: foundations and applications,” Translational Research, 154 (6): 277-87, 2009. 154
C.A. Hutchison, “DNA sequencing: bench to bedside and beyond,” Nucleic Acids Research, 35 (18): 6227-37, 2007. 95
S.K. Shukla, et al., “Personalized medicine going precise: from genomics to microbiomics,” Trends in Molecular Medicine, 21 (8): 461-2, 2015. 1
E.H Chang, et al., “Precision genomic medicine in cystic fibrosis,” CTS – Clinical and Translational Science, 8 (5): 606-10, 2015. -
K.S. Weber, et al., “Anticipation of personal genomics data enhances interest and learning environment in genomics and molecular biology undergraduate courses,” PLOS ONE, 10 (8): e0133486, 2015. -

Source: Web of Science

PERSONAL GENOMICS

The predominance of genomics specialists on the Hot Authors list is just one marker of the extent to which increasingly detailed knowledge of the human genome is informing today’s research. And genomics itself, of course, has been transformed in recent years. From the days of the Human Genome Project more than a dozen years ago, when the sequencing effort required an international collaboration and a budget in excess of \$3 billion, advances in the technology and analysis of gene sequencing have brought the “cost per genome” from \$100 million in 2001 to approximately \$1,000 in 2015. Commercial firms, such as 23andMe, are offering partial-genome

sequence data to individuals for the cost of a dinner for two (less than \$100).

This evolution has given rise to research that expressly examines aspects of “personal genomics.” Figure 1, which is based on a Web of Science topic search of papers including the term “personal genomics,” demonstrates that from a handful of papers in 2001, the mid-2000s saw a sharp rise in activity with more than 200 papers per year by 2012 that had an explicit mention of the term or its variants in their title, abstract or keywords.

In addition to representing fields such as genetics, pharmacology and molecular biology, these papers are categorized within the Web of Science fields of

Table 3: Prolific Journals on Personal Genomics (2001-2015)

Journal	Papers
Personalized Medicine	91
PLOS One	51
Genetics in Medicine	41
Bioinformatics	31
Genome Medicine	31
Pharmacogenomics	29
BMC Genomics	25
American Journal of Bioethics	24
Human Mutation	22
Public Health Genomics	21

Source: Web of Science

oncology, general and experimental medicine, public health and even psychiatry.

Table 2 presents a selection of papers extracted via the Web of Science topic search. All examine some aspect of personal genomics or work that is deriving from ever-expanding genomic data. The papers, including review articles, were selected at random to convey the breadth of research; some are highly cited, while others are new and, as of this writing, have not yet recorded citations.

As Table 3 shows, the journal *Personalized Medicine* actually accounts for the greatest concentration of these papers, underscoring the connection between genomic data and the ongoing pursuit of treatments precisely tailored to individual patients.

Table 4: Prolific Institutions in Personal Genomics (2001-2015)

Institution	Papers
Harvard University	133
Stanford University	88
University of California System	78
US National Institutes of Health	68
Duke University	63
University of London	51
University of Washington	44
Baylor College of Medicine	43
Yale University	40
University of Toronto	37

Source: Web of Science

And Table 4 provides a view into the institutions doing the most work related to personal genomics. It may come as no surprise that Harvard University leads this pack, followed by Stanford and then the University of California System. However, Harvard has a stronger foothold on the topic with over 50 percent more papers than its closest competitor.

Undoubtedly, research underpinned by an ever-growing genomic knowledge base will accelerate new findings, treatments and cures while adding more names to the annual listing of Hot Authors. In the meantime, we will continue to watch the evolution of this fascinating field and how it will impact and advance the future of medicine and health for generations to come. ●

For more information, visit:
stateofinnovation.tr.com/worlds-most-influential-scientific-minds-report-2015



THE INCREASINGLY INVISIBLE HAND OF HOME AUTOMATION

By Stuart Recher

In December 2000, LG Electronics introduced the world's first digital refrigerator. It was called the Internet Digital DIOS and the review published in *Appliance Design* magazine at the time noted that it could be used for Internet surfing, making video-phone calls and monitoring information about its contents, such as expiration dates.

The breakthrough innovation quickly became a punch line for jokes about technology run amok. After all, who really needs a refrigerator that connects to the Internet to tell you that your food is about to expire, especially at a time when many homes were still using dial-up modems for Internet access? Imagine calling grandma from your video phone-enabled fridge via a dial-up connection!

INTERNET OF THINGS MOVES FROM SCI-FI TO MAINSTREAM

Fast-forward 16 years and LG's idea doesn't look so silly. Suddenly everything is connected to the Internet and the term "Internet of Things" (IoT) has come to encompass a broad array of digital devices that do everything from monitoring our vital signs and beaming them to our exercise apps, to connecting our cars to our insurance companies to telling them how we're driving.

At this year's Consumer Electronics Show (CES) in Las Vegas, more than 900 companies were displaying products that fall into the IoT category. Research firm Gartner recently estimated that 6.4 billion Internet-connected "things" will be in use in 2016, up 30 percent from 2015. Some of last year's hottest holiday gifts: Apple Watches, Fitbits, gaming consoles, remote-controlled drones – and, they're all capable of telling you a lot more than just when your food is going to expire.

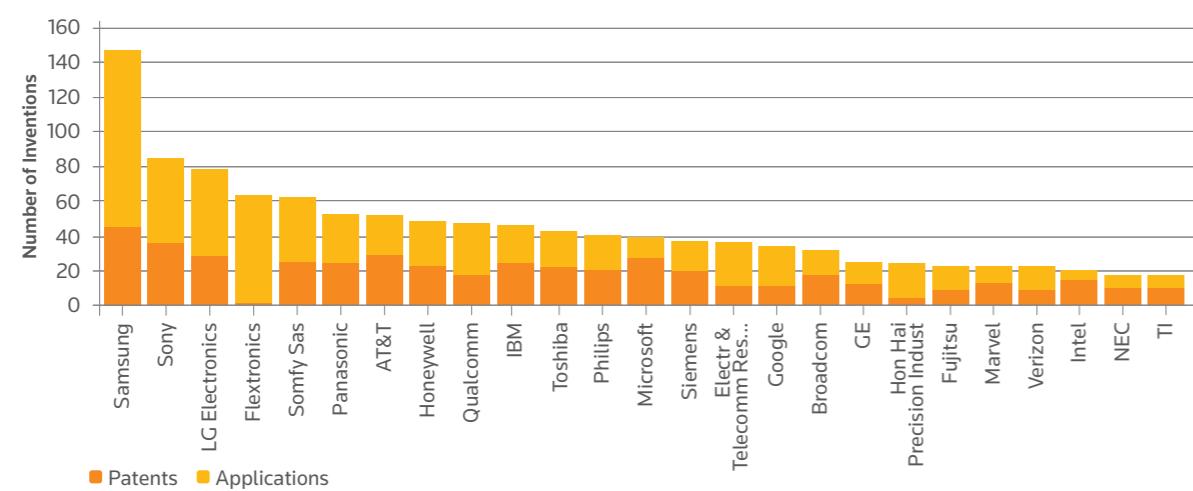
While products in virtually every consumer technology category from gadgets to automobiles are increasingly being lumped into the IoT universe, some of the most exciting developments in the field focus on home automation. More than just a vindication for LG that they were indeed onto something with their digital refrigerator, recent news like the \$3.2 billion acquisition of connected thermostat and smoke

detector developer Nest Labs by Google has made it clear that we're on the verge of an all-out technology race for control of the smart home.

SIZING UP THE IOT MARKETPLACE

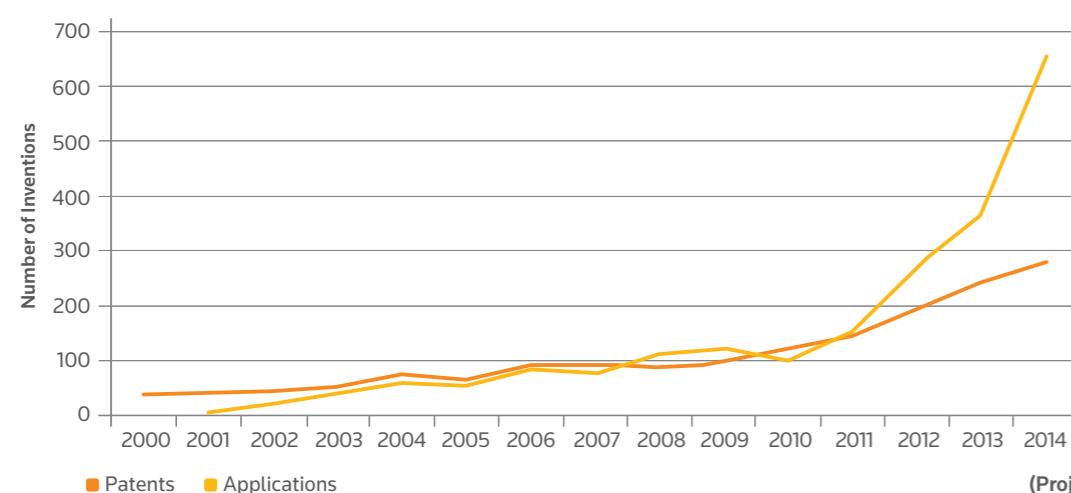
Just how do the major technology players stack up when it comes to home automation? Google and Apple have made a lot of noise in the space, but they aren't alone. In fact, according to a recent analysis conducted by the IP & Science business of Thomson Reuters, Samsung, Sony and LG are currently leading the way in overall R&D activity in the home automation space, as shown in Figure 1. Apple ranks 30th on the list with a total of seven patent applications and six granted patents.

Figure 1: Published Patents and Patent Applications in the Field of Home Automation (2010-2014)



Source: Derwent World Patents Index

Figure 2: Home Automation Published Patents and Patent Applications (2000-2014)



Source: Derwent World Patents Index

The full list of companies cranking up their innovation efforts in the field of home automation includes a wide mix of dedicated tech and electronics companies, as well as organizations more traditionally associated with home appliances, such as Honeywell and Philips. The total number of new patent applications surged 551 percent from 2010 to 2014 as the field became increasingly crowded, as shown in Figure 2.

These findings are reinforced by additional research conducted by the IP & Science business of Thomson Reuters in its 2015 State of Innovation, which identified the top companies developing new technologies in the computing and peripherals category as well as the home appliance industry.

The list of companies represented across the two categories, shown in Figures 3 and 4, paints a picture of two industries becoming increasingly convergent and that will become even more reliant on one another as they continue to develop consumer technologies.

It is noteworthy that in a world that has traditionally been dominated by brand names like Maytag, Viking and KitchenAid, the top companies investing the most R&D in the home kitchen now represent a hybrid mix

of tech and appliance players like Panasonic, LG and Mitsubishi.

US-based appliance and heating and cooling bellwethers such as Whirlpool, General Electric and Carrier are still very much in the game and lead all other US manufacturers in total patent output related to new appliance innovation, but the industry is certainly undergoing an evolution at the hands of digital connectivity.

Figure 3: Top 5 Computing & Peripherals Innovators Globally (2010-2014)

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Samsung	S.Korea	N/A	5,948	N/A	N/A
IBM	US	92,793	5,894	98,367	-6%
Canon	Japan	31,087.6	5,281	35,501.5	-12%
State Grid Corp of China	China	N/A	5,134	N/A	N/A
Ricoh	Japan	20,781.3	4,265	20,998.3	-1%

Source: Derwent World Patents Index and Thomson Reuters Eikon™

Figure 4: Top 5 Household Appliance Innovators Globally (2010-2014)

Company	Country	2014 Revenue	2014 Inventions	2013 Revenue	% Change Revenue
Midea Group	China	22,938.6	3,608	20,030.9	15%
Panasonic	Japan	71,959.8	1,631	76,140.3	-5%
Zhuhai Gree Electric Appliances	China	N/A	1,314	N/A	N/A
Mitsubishi Electric	Japan	39,986	1,081	38,348.3	4%
LG Electronics	S.Korea	53,714.9	776	53,794.8	0%

Source: Derwent World Patents Index and Thomson Reuters Eikon

THE FUTURE OF THE CONNECTED HOME

As wireless Internet-connection speeds continue to grow ever faster and more reliable, the seamless integration of connected appliances and home automation technologies is going to become almost imperceptible. Today's novelty will soon become tomorrow's must-have and next year's standard equipment. It's a progression the companies operating in this space understand.

Steven John Kuehl, principal technologist at Whirlpool, explained in the State of Innovation report, "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."

Kuehl's sentiments are already being realized as increasing numbers of Web-connected devices manage our daily tasks and help us move through our days more efficiently than ever before. While few of us are likely to ever call our grandmother on our refrigerator, the idea of our refrigerator automatically ordering new produce and milk from a grocery delivery service when our supplies are running low is not so far-fetched anymore. When will we know the future has finally arrived? When we forget that there was ever another way to do the things that our appliances will do automatically. ●

For more information, visit:
stateofinnovation.tr.com/home-automation



ONLINE COUNTERFEITING

Are You Getting the Brand You Think You're Buying?

Innovation catches up with MarkMonitor's Charlie Abrahams to take a look at what 3,450 online shoppers from around the world had to say about the risks of buying counterfeit goods online.

The surge in online shopping is a perk of the personal tech revolution, with more and more people around the world shopping for everything from groceries to clothing and hardware, from TVs to cars and gifts. For busy shoppers, in many cases it's simply easier to click and buy than to make their way to a physical retail store.

Annual figures from IMRG Capgemini e-Retail Sales Index saw online retail sales in the UK break through the £100 billion barrier for the first time in 2014 and 12% market growth was predicted for 2015.

But as the ease and volume of online shopping grows, so do the opportunities for counterfeiters. Shoppers of all age groups faced increasing risk from the sale of counterfeit goods from brand impersonators and retailers purporting to sell legitimate goods.

Innovation catches up with MarkMonitor's Charlie Abrahams to take a look at what 3,450 online shoppers from around the world had to say about the risks of buying counterfeit goods online. The research was conducted in the UK, France, Denmark, Germany, Italy, Netherlands, Spain, Sweden and the US by the market research agency Opinium.

INNOVATION: *What percentage of people have purchased a counterfeit item online?*

CHARLIE ABRAHAMS: Our research says that 24% have bought a counterfeit item online.

Infringers are becoming more and more sophisticated in their ability to display and sell counterfeit goods online and often consumers are completely unaware that the products they are buying could be fake.

In addition, the sale of counterfeit goods may increase in the coming years as younger consumers are more likely to have purchased counterfeit goods or said they would be willing to do so in the future. In the 18-34 year-old range, 39% had bought counterfeit items and 42% indicated they would purchase counterfeit goods in the future. Counterfeit fashion or footwear topped the list of the most desirable fake products.

INNOVATION: *Does online shopping behavior increase over the festive season?*

ABRAHAMS: In Europe and the US, consumers conduct 34% of their shopping online. This increases by five percentage points to 39% over the holiday period, suggesting a definite change in shopping behavior –

likely due to the hectic pace of the season. Interestingly, while 13% of consumers don't do any holiday shopping online, all consumers surveyed used the Internet for shopping during the rest of the year.

INNOVATION: *How many people conduct all of their holiday shopping online?*

ABRAHAMS: Only a small percentage, 6%, transact all of their holiday purchases online, while one-quarter (25%) do half their shopping online.

INNOVATION: *Is online security a global concern among consumers?*

ABRAHAMS: Two-thirds of consumers (64%) are worried about their online security.

Confidence levels vary by what device a consumer is using. Consumers using social media for online shopping (17%) are least confident about security and consumers shopping on a laptop – nearly three-quarters of respondents (74%) – are most confident about security. When it comes to assessing security levels online, almost half (48%) of consumers know to check site certificates, but it is troubling to see that 25% of respondents indicated they do not know how to assess website security at all. When looking at website IP addresses, those with local extensions – such as .co.uk and .de – are most trusted by consumers.

INNOVATION: *How many have found themselves on a website that sells fake goods?*

ABRAHAMS: Survey results show that 22% of consumers have found themselves on websites that sell fake goods.

Upon realizing the website was selling counterfeit products, alarmingly, 20% of this subsample (5% overall) continued with the purchase. The most popular product type – again – was fashion or footwear (53%), apparel or luggage (42%) and electronics (41%).

But encouragingly, the remaining 80% did not continue with the purchase. The overwhelming reason for not buying fake goods online was because consumers would rather buy the real product – 64% of respondents said this. Other reasons included moral grounds (48%), while only 12% of consumers cited brand loyalty as a reason.

Looking at it from a geographic perspective, Germans are the only nationality where no respondents

continued to make the purchase after learning the goods were counterfeit, followed by Denmark at 11%, France at 13% and Spain at 16%. Alternatively, 35% of respondents from the Netherlands continued with their purchase after learning the product was counterfeit.

INNOVATION: *How many have received spam emails urging them to buy counterfeit products?*

ABRAHAMS: More than half of consumers (56%) responded they have received emails encouraging them to buy counterfeit product — that is, emails purportedly from a known brand that turn out to be from another company entirely.

In fact, consumers are far more likely to have received an email that turned out to be counterfeit than to have knowingly been on a website that sells counterfeit goods. Because of the levels of sophistication that counterfeiters use when developing websites, it is becoming more and more difficult for consumers to recognize a site as fake.

Only one in 20 consumers is likely to click on a link in a counterfeit email — showing education is improving, while 39% are likely to delete it and report it as spam. The number of clicks may be low, but 5% of consumers could have been directed to websites selling fake goods as a result — where it may be less apparent whether the products on sale are counterfeit.

France had the highest percentage of consumers (67%), who had received counterfeit emails, while the lowest was Sweden at 46%.

INNOVATION: *What percentage of shopping do respondents do online?*

ABRAHAMS: One-third of all respondents' shopping takes place online — with only 6% of consumers purchasing everything online. The survey shows that 21% conduct half of their shopping online.

Looking at a regional breakdown, consumers in the US are the biggest online shoppers, doing 39% of all their shopping online, followed closely by the UK at 35%, and then Italy and Sweden, both at 33%. In the US, as many as one in 10 of those surveyed said they now do all of their shopping online — while consumers in the Netherlands and Denmark do the least online shopping; 80% in each of those countries do 25% or less of their shopping online.

INNOVATION: *How does online shopping activity differ by age?*

ABRAHAMS: Age is shown to have a slight impact on online buying behavior, but perhaps not as significant as one might expect. The generations aged 18-34, whose lives are fully entrenched in the digital world, do 40% of their shopping online — an 18% increase over the average — which jumps to 45% over the holiday period.

They are followed by 35-54 year-old consumers who do 35% of their shopping online. This figure increased by six percentage points to 41% over the holiday season. When it comes to those consumers over 55, 28% conducted their shopping online, only six percentage points lower than average. And interestingly, in keeping with the trend, this age group conducted more shopping online over the holiday season, with 31% of purchases made on the Internet.

CONCLUSION

With global consumers conducting 34% of their shopping online, it's clear that this "perk of the personal tech revolution" is cherished by consumers. Online shopping is here to stay. However, the majority of consumers are concerned about buying counterfeit goods. The challenge for manufacturers is to protect their brands and reputation, while at the same time protecting the consumers from the risks of purchasing counterfeit products online. And consumers need to stay alert to these risks as they make their way through cyberspace. ●

For more information and to download a complimentary copy of the complete Global Consumer Shopping Habits Survey, visit: markmonitor.com



Charlie Abrahams joined MarkMonitor® in 2007 to build the company's regional presence and to lead its EMEA operations and now heads up the Worldwide Sales Organisation. Through his career, Abrahams has been responsible for the leadership and expansion of major technology businesses, including Plumtree Software and Network General EMEA. He has also held the positions of UK General Manager with the Amdahl Corporation and VP and GM of its European software business.

The survey and report were compiled by MarkMonitor, the global leader in online brand protection and part of the IP & Science suite of solutions.

CONTRIBUTORS



Kevin Chapman – Will Self-Driving Cars Disrupt the Auto Industry?

Kevin Chapman is the engineering content lead for the IP & Science patent data team. Since graduating from the University of Sussex, Chapman has held various roles at Thomson Reuters with increased responsibility, editing and managing patent records (with a concentration in transportation) and the data team. Outside of work, he's an avid auto enthusiast and car club member; he's rebuilt two Westfield sports cars and upgraded a VX220.



Bob Stemberge – Wearable Technology

Based in London, UK, Bob Stemberge is responsible for liaising with customer user groups for Thomson Reuters. Stemberge joined Derwent (one of the founding components of the IP Solutions business of Thomson Reuters) in 1980 and has held various roles in editorial, marketing, sales and product development over the years. His current responsibilities include authoring specialist reports and white papers based on IP analysis and providing media background and commentary.



Christopher King – Today's Hottest Scientists

Christopher King is a scientific research analyst and content editor for the IP & Science business of Thomson Reuters. Using analytics and metrics available within the Web of Science, King reports on trends and performance in basic scientific research and other spheres of innovation. He earned his bachelor's degree from Lafayette College in Easton, Pennsylvania, and a master's degree in journalism from Temple University in Philadelphia.



Anthony Trippre – Fitness-By-Numbers

Anthony (Tony) Trippre is the managing director of Patinformatics, LLC. Trippre has been a patent information professional for more than 18 years and has spent the last 15 years specializing in technical intelligence and patent analytics. In January of 2015 he was appointed adjunct professor of Intellectual Property Management and Markets at the Illinois Institute of Technology (IIT) in their Masters of IP Management & Markets Program.



Viji Krishnan – Driving Innovation in India

Viji Krishnan is head of Emerging Markets for IP & Science and is responsible for the strategies and growth of IP & Science in GGO regions including India and all the countries in Latin America (LATAM), Middle East & North Africa (MENA), Sub-Saharan Africa (SSA) & Russia/CIS. Krishnan has worked at Thomson Reuters for over 15 years. Before joining Thomson, she held positions in varied global locations for companies including British Telecom, Barclays Life Assurance Co. in the UK, and Standard Chartered Bank and BPL in India.



Laura Vitez – Pharma Deals

Laura Vitez, senior deals analyst, Thomson Reuters IP & Science, has over 25 years of experience in the life sciences industry. She has held lead and advisory business development roles at companies including multiple small biotechs, mid-sized and top-tier pharmas, and two consulting firms. Vitez has participated in alliances generating more than \$2 billion in reported value for her clients and companies. She holds an MS in Biochemistry and a BA in Mathematics and Chemistry. She joined Thomson Reuters Recap in the fall of 2013.



Stuart Recher – The Increasingly Invisible Hand of Home Automation

Stuart Recher is vice president of IP Services at Thomson Reuters. He is responsible for professional services supporting clients across the Lifecycle of Innovation from discovery to protection and commercialization. Recher has held a number of senior management roles within Thomson Reuters, working with corporate IP departments and law firms around the world. Prior to working at Thomson Reuters, he was vice president of IP outsourcing at CPA Global. Stuart has an MBA from Duke University.



Glenda Walker – 2016 Blockbuster Drug Watchlist

Glenda Walker is a senior editor within the Thomson Reuters Cortellis Forecast team and has over eight years of industry experience. Prior to joining Thomson Reuters, Walker worked in academic-based medical research. In that capacity, she presented cutting-edge research findings at international meetings and in peer-reviewed journals, and established collaborations with both European- and US-based colleagues. She holds a Ph.D. in cell biology and genetics and an Honors degree in physiology, pharmacology and biochemistry.

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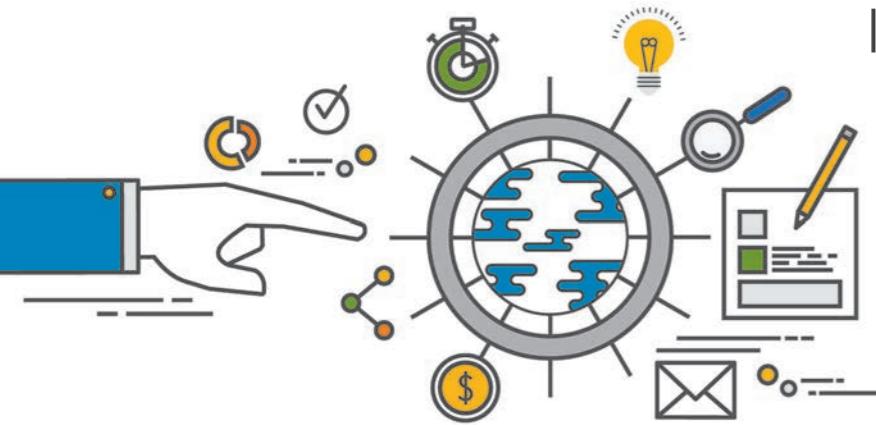
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