INNOVATION HOT SPOTS

IP MARKET REPORT

MINING PATENT DATA FOR TOMORROW'S BREAKTHROUGHS

THOMSON REUTERS

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Biofuels Based on Algae, Cell Phone Data/Wireless Network Roaming and Lab-on-a-Chip Nanotechnology Show Strong Growth Through Q109

Overview

If Ben Braddock, Dustin Hoffman's character in the movie "The Graduate," were returning from college this year, the advice would be a little different than it was in 1967. A lot has changed in the last four decades. "Plastics" isn't a sure-fire way to success anymore. Likewise, the financial and automotive industries hold much different prospects than they did then. And, as the world wrestles with a severe recession and the pillars of many industries continue to lose their luster, we are all looking to innovation as the economy's savior. What areas are hotbeds of inventive activity and will be tomorrow's big innovations?

To find out, the IP Solutions business of Thomson Reuters tracked hot spots of innovation through the first quarter of 2009, analyzing global patenting activity in fields that have shown significant growth over the past several years. By tracking the total numbers of unique inventions in published patent applications and granted patents from 2003 to 2009, researchers were able to identify segments of the R&D landscape that are receiving growing attention from inventors even in the midst of a worldwide recession.

The following IP Market Report summarizes the findings of that research, and shows areas of the sharpest growth to include biofuels based on algae, cell phone data/wireless network roaming and lab-on-a-chip nanotechnology.

Method

Data for this IP Market Report were aggregated using *Derwent World Patents Index*® (*DWPI*℠) database from Thomson Reuters to identify global patenting activity in the fields of biofuels, telecom and bio-related nanotechnology. Patenting activity is being used as a benchmark for innovation. Thomson Reuters analysts selected areas identified as hotbeds of inventive activity over the last five years based on their observation of increased patent activity. Within each category, researchers analyzed the total number of unique inventions issued in published patent applications and granted patents in 2003 and 2008 through the first quarter of 2009. Results from both time periods were then compared to determine the overall growth trend over the last five years.

Both granted patents and published applications were included in the analysis in order to address the time delay between an invention being accepted as a valid application and the granting of the patent. The lag time between a patent application date and patent issuance can be as long as 4.5 years; by including both published applications and granted patents, Thomson Reuters researchers were able to get a more accurate reading of true innovation within the select categories studied.

Biofuels Based on Algae

Few categories of innovation have received as much attention as "green" energy. Within that broad category, which includes everything from wind turbines to hydrogen-powered vehicles, the field of biofuels – solid, liquid and gas fuels derived from recently living organisms – has evolved as a hotbed of growth among biotech innovators. While the first generation of biofuels made from sugar, starch, vegetable oil or animal fats were criticized for diverting food sources away from the human food chain, newer biofuel initiatives have focused on using more sustainable materials. Second-generation biofuels, for example, use waste biomass from non-food crops such as stalks of wheat and corn cobs. But the real breakthroughs are occurring in the so-called third generation of biofuel development: algae fuel.

Algae are low-input, high-yield biofuels, capable of producing 30 times more energy per acre than land crops such as soybeans. Who are the biggest innovators in the algae fuel space and what are they working on?

Following are the results of the Thomson Reuters analysis of biofuels based on algae:

Category Growth

Time Period	Total Biofuel Patents	Total Biofuel from Algae Patents
Jan - Dec 2003	341	3
Jan - Dec 2008	1,878	63
Jan 2008 - Mar 2009	2,466	92

Most Active Countries (Jan 2008 - Apr 2009)

Ranking	Country/Authority of Origin	No. of Documents	% of Documents
1	WIPO	39	42.39%
2	United States	34	36.96%
3	China	8	8.7%
4	EPO	3	3.26%
5	Germany	2	2.17%
5	Great Britain	2	2.17%
5	Japan	2	2.17%
6	Brazil	1	1.09%
6	France	1	1.09%

Most Active Companies (Jan 2008 - Apr 2009)

Ranking	Patent Assignees	No. of Docs	% of Docs	Country of Origin
1	Alternative Fuels Group Inc	2	2.17%	United States
1	Arisdyne Systems Inc	2	2.17%	United States
1	Gen Atomics	2	2.17%	United States
1	Ouro Fino Participacoes & Empreendimento	2	2.17%	Brazil
1	Sartec Corp	2	2.17%	United Kingdom
1	Solix Biofuels Inc	2	2.17%	United States
1	Univ. Colorado State Res. Found.	2	2.17%	United States
2	Afton Chemical Corp	1	1.09%	United States
2	Air Liquide SA	1	1.09%	France
2	Albemarle Corp	1	1.09%	United States
2	Algepower LLC	1	1.09%	United States

Observations

1. Innovation in biofuels in 2003, as represented by global patenting activity measured in *DWPI*, was a small area (only 341 patents) and was led by Japanese companies (70% patented by Japanese companies in top 13 patenting companies; 31% of patents were filed in Japan).
2. Five years later, in 2008, patenting activity had risen by 550% to 1,878 patents.
3. In the latest period (January 2008 to April 2009) the number of biofuel patents was 2,466. China has moved in significantly (31% of patents were filed in China); China shared top position with Japan (three companies) in the Top 10 patenting companies.
4. There has been a lot of controversy in the media in the past five years about the social and environmental impact of using arable crops (sources of human food) for biofuel. Amongst the hot topics in the past year, green developers are looking at harnessing algae as an alternative source for biofuel production. In 2003 there were only three such patents. By 2008 there were 63. In the latest period, January 2008 to April 2009, there were 92 patents.
5. In 2008 - 2009, the Top 11 companies (seven share 1st place and four share 2nd place) patenting in the area of biofuels based on algae are led by US firms (8 of the top 11 company name assignees) with one Brazilian, one UK and one French. Chinese, German and Japanese firms do not appear in the Top Assignee list for biofuels based on algae.

Cell Phone Data/Wireless Network Roaming

If there is one word to describe the future of tech and telecom innovation it is convergence. In 2003, there were a total of 8,705 patents focused on the convergence between telecoms and computing, e.g. mobile phones with common Internet access features that enable the use of both cellular and wireless access networks via gateways and the like. By 2008, that number increased 290% to 25,283 patents. Into the first quarter of 2009, the activity seems to be showing no signs of letting up. Within that category, cell phone data/wireless network roaming is showing particularly strong growth.

The following data outlines innovation activity in the telecom-computing convergence space:

Category Growth

Time Period	Total Telecom-Computing Patents	Total Cell Phone/ Wireless Patents
Jan - Dec 2003	8,705	5,043
Jan - Dec 2008	25,283	21,827
Jan 2008 - Mar 2009	30,520	26,415

Most Active Countries (Jan 2008 - Apr 2009)

Ranking	Country/Authority of Origin	No. of Documents	% of Documents
1	United States	11,523	43.62%
2	Japan	5,009	18.96%
3	WIPO	3,542	13.41%
4	Korea	2,851	10.79%
5	China	1,672	6.33%
6	EPO	1,019	3.86%
7	Great Britain	227	0.86%
8	Germany	207	0.78%
9	France	163	0.62%
10	Canada	44	0.17%

Most Active Companies (Jan 2008 - Apr 2009)

Ranking	Patent Assignees	No. of Docs	% of Docs	Country of Origin
1	Samsung Electronics Co. Ltd.	1,041	3.94%	Korea
2	Microsoft Corp	534	2.02%	United States
3	Nokia Corp	515	1.95%	Finland
4	LG Electronics Inc	513	1.94%	Korea
5	NEC Corp	464	1.68%	Japan
6	Qualcomm Inc	445	1.68%	United States
7	SK Telecom Co Ltd.	434	1.64%	Korea
8	Res In Motion Ltd	433	1.64%	Canada
9	Kyocera Corp	418	1.58%	Japan
10	Motorola Inc	412	1.56%	United States

Observations

1. Innovation in Telecom-Computing convergence in general in 2003, as represented by global patenting activity measured in *DWPI*, was already well-established and significant (8,705 patents) and no one country dominated (top assignee Nokia from Finland held ~3% of the patents).
2. Five years later, in 2008, patenting activity had risen by 290% to 25,283 patents, showing how hot this area had become.
3. In the latest period (January 2008 to April 2009) the number of 'telecom-computing convergence in general' patents was 30,520. China has not moved in significantly (no Chinese company listed in top assignee list); Japan and the US dominate in terms of top assignees and top countries for filing patents.
4. There has been a lot of discussion in the past five years about the development of cellular/wireless network roaming on cell phones and we can see that the volume of patents being issued has risen by 520%, higher than the rate for telecom-computing convergence in general. In 2003 there were 5,043 patents. In the latest period, January 2008 to April 2009, there were 26,415 patents.
5. In 2008 to 2009 , the Top 10 companies patenting in the area of cell phone/wireless network roaming are dominated by US, Korean and Japanese firms along with Nokia (FI) and Research in Motion (CA).

Lab-on-a-Chip Nanotechnology

One of the more exciting areas of innovation showing growth in the current environment is the fusion of nanotechnology with genetic engineering to develop lab-on-a-chip systems. These devices integrate one or several lab functions on a single chip of only millimeters in size. The technology has the potential to become a critical tool to improve global health. Particularly in developing nations which often have the drugs necessary to treat infectious diseases but lack the diagnostic equipment necessary to identify them properly, lab-on-a-chip technologies allow for comprehensive analysis using minimal equipment and specimen samples.

Among the important trends in lab-on-a-chip innovation, Thomson Reuters identified the following:

Category Growth

Time Period	Total Bio-Related Nanotech Patents	Total Lab-on-a-Chip Patents
Jan - Dec 2003	4,611	766
Jan - Dec 2008	7,399	1,353
Jan 2008 - Mar 2009	9,842	1,682

Most Active Countries (Jan 2008 - Apr 2009)

Ranking	Country/Authority of Origin	No. of Documents	% of Documents
1	Japan	480	28.54%
2	United States	383	22.77%
3	WIPO	357	21.22%
4	China	216	12.84%
5	Korea	85	5.05%
6	EPO	62	3.69%
7	Germany	34	2.02%
8	Taiwan	21	1.25%
9	France	16	0.95%
10	Great Britain	11	0.65%

Most Active Companies (Jan 2008 - Apr 2009)

Ranking	Patent Assignees	No. of Docs	% of Docs	Country of Origin
1	Seiko Epson Corp	311	18.49%	Japan
2	Nikon Corp	86	5.11%	Japan
3	Toppan Printing Co. Ltd.	41	2.44%	Japan
4	Samsung Electronics Co. Ltd.	33	1.96%	Korea
5	Canon KK	30	1.78%	Japan
6	Konink Philips Electronics NV	22	1.31%	Netherlands
7	Konica Minolta Medical and Graphic Inc	17	1.01	Japan
9	FujiFilm Co. Ltd.	12	0.71%	Japan
10	Asahi Glass Co Ltd	11	0.65%	Japan
10	Sangyo KK	11	0.65%	Japan
10	Sumitomo Bakelite Co. Ltd.	11	0.65%	Japan

Observations

1. Innovation in bio-related nanotechnology in 2003, as represented by global patenting activity measured in *DWPI*, was a small but well-established area (4,611 patents) led by US companies (70% patented by US companies in top 10 patenting companies; 48% of patents were filed in the US).
2. Five years later, in 2008, patenting activity had risen by 160% to 7,399 patents.
3. In the latest period (January 2008 to April 2009) the number of bio-related nanotechnology patents was 9,842. China has not moved into the space significantly (only one Chinese company, listed 20th in top assignee list) but it is clearly seen as an important country to seek patent protection in (16% of patents were filed in China). Japan and the US lead in terms of top assignees and top countries for filing patents.
4. There has been a lot of discussion in the past five years about the development of lab-on-a-chip technology and we can see that the volume of patents being issued has risen by 220%, higher than the rate for bio-related nanotechnology in general. In 2003 there were 766 patents. In the latest period, January 2008 to April 2009, there were 1,682 patents.
5. In 2008 to 2009 the top 12 companies patenting in the area of lab-on-a-chip are led by Japanese firms (over 80% of the top company name assignees) with one Dutch and one Korean.

Conclusion

Some of the most noteworthy innovations in history were born out of periods of dire economic downturn when it was arguably hardest for companies to invest in the level of research and development necessary to achieve these milestones. The 1930s saw the development of the television, nylon and photocopies, to name a few. The early 1970s saw the rise of the Japanese automobile industry and the birth of the personal computer. The early 1990s brought the Internet, and the game-changing iPod grew out of the rubble of the dot-com collapse.

Investments made in these areas boosted the economy, created jobs and generated cash for those wise enough to make them despite what was happening in the larger economy. What's next? It's impossible to know with the certainty of "The Graduate's" well-wishing advisor, but the evidence does exist to paint a fairly detailed picture of what's to come.

The Obama administration, on May 5, 2009, announced its "increased commitment to advance biofuels research and commercialization." It also acknowledged the growing debate in scientific, environmental and corporate circles about how much help or harm biofuels can have on the climate. It may be that tomorrow's most successful innovators will be those who push the boundaries of technological development within the current economic and environmental context.

Whether it is biofuel from algae with its low impact on food shortages and climate change, low-cost lab-on-a-chip diagnosis technology to improve world health, or some other emergent innovation, the companies which innovate with cost and environmental impact in mind are the ones most likely to reap the big rewards in future.

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