

Printed electronics

IDTechEx finds that the market for printed and potentially-printed electronics, including organics, inorganics, and composites, will rise from \$1.92 billion in 2009 to \$57.16 billion in 2019. The majority of the market in 2009, 71 percent, is for electronics which are relatively mature—conductive inks (for membrane keyboards, flex connectors, etc.), sensors (disposable blood glucose sensors) and Organic Light Emitting Displays (OLEDs) which are on glass substrates and not printed as yet, but have significant potential for printing.

In the last twelve months there have been significant developments. For example:

- Work on thin film transistors is shifting from mostly organic based materials to a more even balance due to the high performance that inorganics can achieve.
- East Asia has significantly broadened its scope of work in printed electronics, most notably in Japan followed by Korea. For example, the display giants in East Asia are researching the full gamut of printed electronics chemistries for display backplanes' transistors.
- Photovoltaics such as CIGS, DSSC, and OPV account for a market of \$0.41 billion in 2009. However, CdTe and aSi photovoltaics, a substantial market in rigid, non-printed form, have both been successfully made in flexible and/or printed forms.
- The number of new companies getting into printed electronics is quickly increasing. At least 2,250 organizations are working in this area of technology. This includes academic institutions as well as companies—roughly a 50-50 split.

Of the total market in 2009, 35 percent of these electronics will be predominately printed. Initially photovoltaics, OLEDs (on glass), and e-paper displays will grow rapidly, followed by thin film transistor circuits, flexible OLEDs, sensors, and batteries. By 2019 the market will be worth \$57.2 billion, with 76 percent printed and 73 percent on flexible substrates.

The market for front plane e-paper displays will be \$80 million this year for the material, but the value of the products that use the technology is much higher—to date displays have been used in over \$1 billion worth of products. With 14 e-readers now

available and successes such as the display on Esquire magazine cover in 2008, interest in this technology is booming.

In some sectors commercialization is still embryonic. More applications are sought for thin film batteries to repeat the success of the Estee Lauder skin patch, which incorporated a battery and sells millions yearly. Here the selling point is flexibility since the price is still one magnitude higher than the more powerful and ubiquitous coin cell batteries. As other thin film components commercialize, the ease of integration will change and new applications will emerge.

Most developers of thin film transistors have missed target commercialization dates, but this year we see the first products being sold; PolymerVision, launched flexible displays based on organic transistors and Kovio launched RFID tags using a printed inorganic semiconductor.

Currently there are two main ways the technology is being applied. Some companies intend to compete on cost by replacing the silicon chip in an RFID tag to lower prices to allow a much larger number of items to be tagged. Others compete on benefits such as flexibility or robustness, such as those involved in flexible e-book readers that intend to sell these as a premium over rigid versions.

Printed electronics know-how is being used in conventional electronics manufacture to reduce the cost. Inkjet printing of conductors, for example, enables smaller circuits than etching.

IDTechEx's report "Printed, Organic & Flexible Electronics Forecasts, Players & Opportunities 2009-2029," assesses the opportunity for all of printed and potentially-printed electronics.

DID YOU HEAR?

- The 2009 National Directory of Catalogs counts a total of 12,524 catalogs. The number of online catalogs continues to grow, but catalogs with print versions are still vital (OxbridgeCommunications).
- A provider of advertising call measurement solutions has released data demonstrating that many consumers visit a business' website after viewing their print Yellow Pages ad, proving that traditional media drives online leads (Telmetrics).
- The North American market for transpromotional applications printed in full digital color represented 1.7 billion impressions in 2007. By 2012, the number of impressions is expected to reach 12.8 billion (InfoTrends).
- Results of the second annual (2009) survey of Top Marketing Trends find customer satisfaction and customer retention remain the marketing concepts rated most interesting and relevant to marketing executives (Marketing Executives Networking Group).
- According to a new forecast, consumers will receive more than 9,000 e-mail marketing messages a year by 2014. This equates to about 25 messages a day, more than double the daily average that consumers receive today (Forrester Research).
- A poll shows that most Americans are concerned about what is being done with their personal information online. According to the poll, 82 percent of consumers are concerned about their credit card numbers being stolen online, while 72 percent are concerned that their online behaviors are being tracked and profiled by companies (Consumer Reports National Research Center).
- Total communications spending is predicted to decline one percent in 2009 to \$882.6 billion, but grow 3.6 percent per year over the next five years (Veronis Suhler Stevenson).

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SHORT TAKES

According to the U.S. Local Media Annual Forecast, 2008-2013, by BIA Advisory Services and its Kelsey Group, current and foreseeable economic conditions will reduce overall local advertising spending through 2013. BIA/Kelsey forecasts U.S. local advertising revenues will decline from \$155.3 billion in 2008 to \$144.4 billion in 2013, representing a negative 1.4 percent compound annual growth rate. Only the local interactive segment will show growth throughout the forecast period. All other local media will experience marginal to rapid declines in the next 18 to 36 months, says the report. A small number of traditional media will rebound with a revived economy beginning in 2011, though most traditional media will continue to decline at a slower pace. According to the forecast, the interactive segment (mobile, Internet Yellow Pages, local search, online verticals and classifieds, voice search, e-mail marketing, and other interactive revenues generated by traditional media players) will grow from \$14 billion in 2008 to \$32.1 billion in 2013. The traditional segment (newspapers, direct mail, television, radio, print Yellow Pages, non-digital out of home, cable TV and magazines) will decrease from \$141.3 billion in 2008 to \$112.4 billion in 2013.

The Vertical Search (B2B) Report 2009, published by Econsultancy and sponsored by Convera, based on an online survey of more than 500 media and Internet professionals, shows that the need to find information quickly is the main advantage of vertical search engines from the perspective of business users. 67 percent of the respondents say that quicker to find desired information is a major benefit of vertical search; 65 percent say more relevant information; 64 percent feel that focus on specific business interests and workflow is a significant benefit. 47 percent of respondents are more likely than last year to be using widgets (desktop or in-browser) that provide customized internet marketing and business information, compared to 35 percent of internet marketing professionals a year ago. More than half of survey respondents report that their businesses are using SaaS for email (77 percent), web hosting (74 percent), sales and marketing (62 percent), CMS (59 percent), file and assets storage (57 percent), search (57 percent) and ad serving (51 percent). Business-to-business marketers say they plan to increase spending on online performance-based ads in 2009, at the expense of traditional display ads, as they seek clearer, more measurable returns during the economic downturn.

According to research from Webvisible and Nielsen, reported by Marketing Charts, 63 percent of consumers and small business owners turn to the Internet first for information about local companies and 82 percent use search engines to do so, but only 44 percent of small businesses have a website and half spend less than 10 percent of their marketing budget online. The research finds an accelerating trend toward online media for local search. However, the report says the study uncovers a significant disconnect between the way small business owners act as consumers vs. the way they market their businesses online.

Ninety-two percent of searchers say they are happy with the results they get when using search engines, though 39 percent report frequently not being able to locate a particular known business. This means, says the report, searchers may choose to contact a similar business with a stronger online presence. Webvisible found that online search and e-mail newsletters are the only forms of traditional media that are becoming more popular with consumers who wish to locate local products or services. Compared with two years ago, respondents report they use search engines and email newsletters more, while they use newspapers, magazines, direct mail and radio less:

Despite the growing use of online media for local searches, only 41 percent of small businesses report turning to online search engines first, and 31 percent turn to Yellow pages directories first. In addition, only 44 percent of small businesses have a website. When using a search engine to find a business they know exists, only 19 percent of survey respondents report never or rarely encountering trouble locating that business online and 39 percent say they routinely have difficulty. Over the past two years, 43 percent of small businesses say they have increased use of search engines in their marketing efforts. In contrast, use of traditional small business advertising mediums is on the decline.

THE PAST AND FUTURE OF MEDIA

Veronis Suhler Stevenson (VSS), has revised its media forecast downward in response to the current economic downturn. Overall media spending is forecast to decline by 0.4 percent in 2009, after an increase of 2.3 percent in 2008. The revised forecast is down from a previous estimate of 5.4 percent growth for the year. The figure for 2009 represents the lowest industry growth rate, and only the second decline, in the three decades that Veronis has been collecting data. The hardest-hit media segments, according to the new forecast, are newspaper publishing, projected to decline by 16 percent (following a 13.5 percent decline in 2008), and broadcast television, forecast to be off by 9 percent (following a decline of 0.5 percent). Consumer magazine publishing, projected to decrease 8.5 percent, and broadcast and satellite radio, down 7.2 percent, are also among the segments facing the steepest declines. Advertising spending is projected to fall off by 7.4 percent in 2009.

James Rutherford, Executive Vice President and Managing Director at VSS, notes that, "This mid-term forecast will present investors with a helpful guidepost in a challenging environment... (though) the media, information, and education industries have been negatively impacted. As a whole, the communications industry has performed better than many other sectors of the US economy and the media industry has outgrown GDP growth in all of the periods of economic expansion analyzed since the Second World War."

According to the VSS Mid-Term Forecast, leading the downward trend are:

- Newspaper Publishing segment estimated to contract by 16.2 percent in 2009 (vs. -13.5 percent in 2008)
- Broadcast Television projected to decline by 9 percent in 2009 (vs. -0.5 percent in 2008).
- Consumer Magazine Publishing is expected to decrease by 8.5 percent (vs. -6.8 percent in 2008)
- Broadcast & Satellite Radio projected to drop by 7.2 percent this year (vs. -5.8 percent in 2008).

The communications industry segments that will decline in 2009 are traditional media segments that have seen an increase in competitive alternatives which offer stronger proof-of-performance and ROI metrics at lower price points.

Marketing services, including segments such as direct marketing, promotions, and branded entertainment, will decline 1.3 percent, dropping to the second largest communications sector in 2009.

Advertising spending will drop 7.4 percent in 2009, following a decline in 2008, for the first two-year decline in 75 years. Steep reductions in traditional advertising spending such as newspapers, television, and consumer magazines are being driven by fragmentation of target consumers and brand strategies which are increasingly applied across multiple venues and platforms.

The original 2008 forecast—that only three of the 20 individual segments of communications spending would register declines in 2008 (broadcast and satellite radio, consumer magazines and newspapers), was revised to include five other segments, with an additional two segments also declining in 2009.

John Suhler, Co-Founder and General Partner of VSS says,

"The downturn in our economy has added pressure to the secular trends already present and has accelerated the down pressure on traditional consumer advertising and marketing services sectors; however, the newer alternative segments of both sectors continue to experience positive growth in 2008 and 2009 and the end user sectors, both consumer and institutional have been revised to show slower but positive growth, also in both years."

Communications segments that will drive growth are those supported by institutional and consumer end-users seeking necessary data and information, says the report: The Pure-Play Internet & Mobile Services segment is still growing, albeit the growth rate is slowing down considerably. Previously expected to grow by 15.5 percent in 2009, VSS now projects an increase of only 9.1 percent for 2009, down from 11.6 percent in 2008.

Mobile content and videogames will continue to be in demand and record double-digit growth (34.2 percent and 19.5 percent respectively), however at significantly lower percentages than originally predicted. The institutional end-user sector, in particular the professional and business information segment, will remain the fastest growing of the four communications sectors in 2009. Various alternative communications segments included in both consumer and institutional end-user sectors, such as branded entertainment, digital out-of-home, and professional business information services, are also growing faster than other communications segments and the broader economy.

Ways You Can Help Support EDSF

1. Donate

No one has been more affected by the current economic problems than students. With other sources of financial aid disappearing or diminishing, many of them cannot return to school without help. More than ever before, you can make a difference in developing the creative and influential young minds that will lead our industry in the future. Every donation, no matter what the size, is deeply appreciated. To donate, visit www.edsf.org.

2. Volunteer

EDSF is fortunate to have the support of many volunteers around the world who give selflessly of their time and expertise. Without their contributions EDSF would not be able to accomplish all that it does. If you would like to get involved on an EDSF committee, please contact Brenda Kai at brenda.kai@edsf.org.

3. Register for an AIIM Online Certificate Course

EDSF, in partnership with AIIM, is pleased to offer AIIM's online Certificate Programs to EDSF supporters. EDSF supporters can now take these courses at the AIIM Professional member price (\$600 instead of \$750—a savings of \$150!). A portion of the registration fee will go to support EDSF scholarships. To register, visit www.aiim.org/training and use EDSF Discount Code EDSF9HB.

For more information about EDSF, visit www.edsf.org or contact Brenda Kai at brenda.kai@edsf.org.

PRINTED ORGANS

Researchers at Missouri-based Organovo are printing entire organs for transplant patients. The research published by this federally-funded project founded by Dr. Gabor Forgacs, a researcher at the University of Missouri, indicates that the company is first working on printing fully functioning blood vessels and arteries. Organovo claims that printing blood vessels from the patient's own cells will enable a transplant, like a bypass surgery, to work better. There is little or no chance of the patient rejecting the cells, as they are autologous.

Another advantage of the bioprinting system is that there is no need for the plastic scaffolding used in some bio-printing, which is said to cause inflammation and reduce the effectiveness of the transplant. The concept behind the printing system is that the organ is printed layer by layer.

A printer, using cell globules as ink, places them down onto a bio-degradable sheet of paper, where the cells naturally fuse together to create a small piece of the organ. A piece of bio-paper is put between each layer of the organ and, after all of the cells in the same layer are fused, the paper disintegrates and allows the different layers to fuse to each other. Eventually, after many layers, the blood vessel will materialize and be fully functional.

Although the website's generic mission statement alludes to being able to print whole organs, like hearts or kidneys, that technology is quite a long way off.

PRINTED BATTERIES

U.S. engineers have found a way to make lithium batteries that are smaller, lighter, longer lasting, and capable of recharging in seconds. The researchers believe the quick-charging batteries could open up new applications, including better batteries for electric cars. A team from Massachusetts Institute of Technology reported in the journal *Nature* that the batteries could be available for sale in two to three years.

Current rechargeable lithium batteries can store large amounts of energy, making them long-running. But they are less efficient in releasing their power, making them discharge energy slowly and this consequently requires hours to recharge. Scientists traditionally have blamed slow-moving lithium ions, which carry charge across the battery for this sluggishness. However, about five years ago, Gerbrand Ceder and a team at MIT discovered that lithium ions in traditional lithium iron phosphate battery material actually move quite quickly.

Ceder and colleagues discovered that lithium ions travel through tunnels accessed from the surface of the material. If a lithium ion at the surface is directly in front of a tunnel entrance, it can quickly deliver a charge. But if the ion is not at the entrance, it cannot easily move there, making it less efficient at delivering a charge. They remedied this by creating many smooth "nano" tunnels in the material that allow the ions to slip in and out easily. The result was a small battery that could be fully charged in 10 to 20 seconds.

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