WORLD ECONOMIC FORUM

Technology Pioneers 2007

Innovation reinvented: a more open approach

The World Economic Forum's Technology Pioneers 2007

Technology Pioneers are a constituency of the World Economic Forum.
www.weforum.org/techpioneers

BT Group, Accel and Deloitte Touche Tohmatsu are strategic partners of the Technology Pioneers programme.

BT is one of the world's leading providers of communications solutions and services operating in 170 countries. Its principal activities include networked IT services, local, national and international telecommunications services, and higher value broadband, mobility and internet products and services. BT consists principally of four lines of business: BT Global Services, Openreach, BT Retail and BT Wholesale.
In the year ended 31 March 2006, BT Group's revenue was £19,514 million with profit before taxation of £2,040 million.

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Preface

The world is facing unparalleled challenges. How will we deal with issues such as the increasing demand for energy, ageing populations and the socio-economic challenges and opportunities brought about by advances in information technology? The key to addressing many of these challenges is and will increasingly become innovation.

The World Economic Forum's Technology Pioneers represent the cutting-edge of technological progress within the sectors of clean/renewable energy, biotechnology/health and information technology. The companies have succeeded in combining a truly innovative problem-solving spirit with sound business acumen to create transformational technologies that hold the promise to change society at large.

The theme of the World Economic Forum Annual Meeting 2007 is The Shifting Power Equation. Driving this shift is the tremendous amount of innovation taking place outside of traditional hubs. The wide geographic spread of this year's Technology Pioneers is a testament to this trend.

It is our pleasure to congratulate the Technology Pioneers 2007 on their truly remarkable achievements and welcome them to the community of the World Economic Forum. We would also like to express our thanks and appreciation to the members of the selection committee whose enthusiasm and expertise were critical in selecting the impressive group of Technology Pioneers featured in this publication.

Finally, the Forum would like to express thanks and gratitude to BT for the content and publication of this report and for their strong ongoing commitment to the Technology Pioneers programme.

The World Economic Forum

Foreword

The innovation genie is out of the bottle globally. For companies to excel they must reach out beyond the boundaries of their own payroll to find the best brains and the smartest ideas, wherever they are in the world.

This model of open innovation can capture these ideas, products and services, fusing them together with the best ideas of the men and women in your organisation. Creating the fusion between global and in-house innovation is the catalyst that will unleash an innovation chain reaction, fuelling the promise of an exciting future and bountiful success for organisations globally.

Today, organisations must innovate at the speed of life – the speed of life being your customers' lives, whether in their personal or professional lives, or their businesses. True innovation moves beyond the notion of simple invention when it enhances the quality of peoples' lives and the success of organisations. In fact, organisations that harness the innovation genie globally can ensure there is never a gap between what is possible and what they deliver, in the markets they serve. For BT, the amount of innovation we're capable of delivering is no longer defined only by the size of our R&D budget – it's as big as our global innovation network.

BT became a strategic partner of the World Economic Forum's Technology Pioneers programme because our open innovation model is transforming the way BT harnesses internal and external innovation globally for the benefit of our customers, shareholders and employees. Technology Pioneers are at the heart of this emerging global innovation marketplace.

To be a Technology Pioneer, a company must be involved in the development of life-changing

technology innovation which has the potential for long-term impact on business and society. In addition, they must demonstrate visionary leadership and be market leaders with proven technology. Previous Technology Pioneers have included Autonomy, Cambridge Silicon Radio, Encore Software, Google, Millennium Pharmaceuticals and Napster. This year's Technology Pioneers were nominated by the world's leading venture capital and technology companies. The final selection, from 225 nominees, was made by a panel of leading technology experts appointed by the World Economic Forum.

The depth, breadth and diversity of the innovation represented by this year's Technology Pioneers illustrates the unprecedented effect of globalisation both in the markets to be addressed and the collaboration established as a result of this innovation.

I have great optimism that these innovators can genuinely improve the state of the world by driving innovation at the speed of life.

Matt Bross
BT Group Chief Technology Officer

Innovation reinvented

A new, more open and flexible approach to innovation is emerging

IT HAD a good run, and it changed the world. But the old model of innovation that worked so well during the 20th century — pioneered in the late nineteenth century by Thomas Edison, whose New Jersey laboratory complex churned out inventions, turned them into marketable products and manufactured them for sale — has run out of steam. Global competition means that large firms can no longer assume that all the expertise they need is available within their own walls, or even within their own countries. They cannot always exploit new innovations effectively, or fast enough to beat their competitors to market. And the blue-sky ideas generated in the laboratory do not always correspond to what customers actually need.

So how are innovators, companies, research organisations and financiers responding? By innovating, of course — but this time around the process of innovation itself. The emerging model for the 21st century turns the 20th-century model on its head. The old closed and vertically integrated approach, in which intellectual property was generated in-house and was jealously guarded before being turned into new products, is giving way to a more open and flexible approach. This new model is based upon an ecosystem in which organisations, each with different skills, collaborate to co-develop new products and services. Such collaborations are known as innovation networks, and the new model is called "network innovation" or "open innovation".

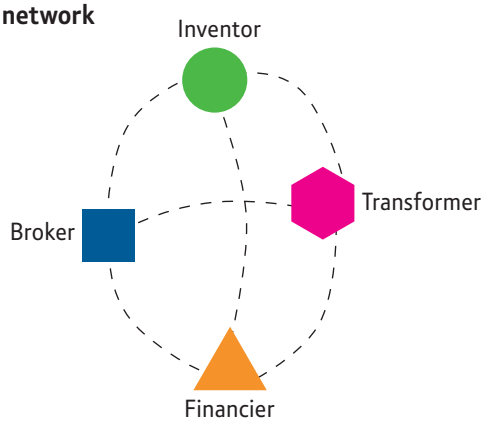
Innovation networks overcome the drawbacks of the old vertically integrated approach by co-ordinating the actions of different players, allowing them to focus on what they do best. Navi Radjou, an analyst at Forrester Research and one of the leading proponents of the idea of innovation networks, divides the actors involved into four categories: Inventors, Transformers, Financiers and Brokers.

Inventors conduct fundamental research and development, and produce new intellectual property. Examples include academic institutions, research arms of large corporations, consultancies, research institutes, design shops and start-ups. These are the fundamental sources of new innovations, but they are not always in the best position to exploit the intellectual property that they create. Researchers at Xerox Parc, for example, famously devised many of the key innovations behind today's personal computers, but the organisation was unable to benefit from their ideas.

Transformers take the novel ideas produced by Inventors and transform, package or combine them so that they become useful innovations. Examples of Transformers include consultancies and systems integrators, start-ups founded to exploit specific innovations, and large firms that concentrate on production and marketing, rather than in cutting-edge innovation. Dell, for example, does not innovate in PC technology itself, but packages together innovations from various component-makers and delivers them to customers as a working computer.

Financiers provide funding, particularly for Inventors and startup Transformers; such funding can take the form of internal funding for corporate research, or external funding from venture-capital firms and other investors. Finally, Brokers connect these actors together. This can be done by specialist firms that provide matchmaking services between Inventors and Transformers, or by specific units within companies that match innovation needs with ideas from internal and external sources. Procter & Gamble, for example, does this using an internal portal called InnovationNet, while BT has established "innovation scouting teams" in the Far East, India, Israel and the US to act as innovation Brokers, sourcing promising ideas from local universities and start-ups.

The four players in an innovation network



Source: Forrester

Wearing many hats

In many cases an individual firm or institution may play more than one of these roles, as the old "own and protect" mentality towards intellectual property gives way to a new "share and expand" model in which the doors of the research laboratory are thrown open, rather than being kept tightly locked. The traditional vertical-innovation model can in fact be regarded as a closed, internal innovation network in which a single organisation does its best to play all four roles, financing its own innovations, acting as a broker between blue-sky researchers and customer-facing product-development teams, and then transforming innovations into new products and services.

Establishing an open innovation network with links to external actors has several benefits over the old model. It allows companies to combine internal and external sources of new ideas: why reinvent the wheel if you can license an existing technology? Ford, for example, decided to license hybrid-engine technology from rival carmaker Honda, rather than spend years developing its own. Network innovation also enables companies to convert innovations into useful products more efficiently in conjunction with partners, and license non-core intellectual property to others who can make better use of it. The new model also encourages greater risk-taking, as companies mitigate the risk of speculative ventures through partnerships or spin-outs. Some firms are even integrating customers into their innovation networks to ensure that the products they develop meet their needs. IBM's "First of a Kind" programme, for example, allows forward-thinking customers to act as Inventors and Financiers alongside IBM in the development of new software. Once it is completed, the software is then offered to other IBM customers.

Much of the enthusiasm for innovation networks comes from large companies, which are interested in becoming more agile and responsive — more like start-ups, in other words. But that does not mean that the approach is only attractive to big firms. Start-ups can and do play a valuable role in innovation networks, in two primary ways. First, by plugging into a big company's innovation network, start-ups can take advantage of the larger firm's production and marketing muscle to get products to market more quickly and gain access to customers more easily. Second, big companies that develop non-core intellectual property can exploit it by

licensing it to a start-up, or by spinning off a start-up of their own.

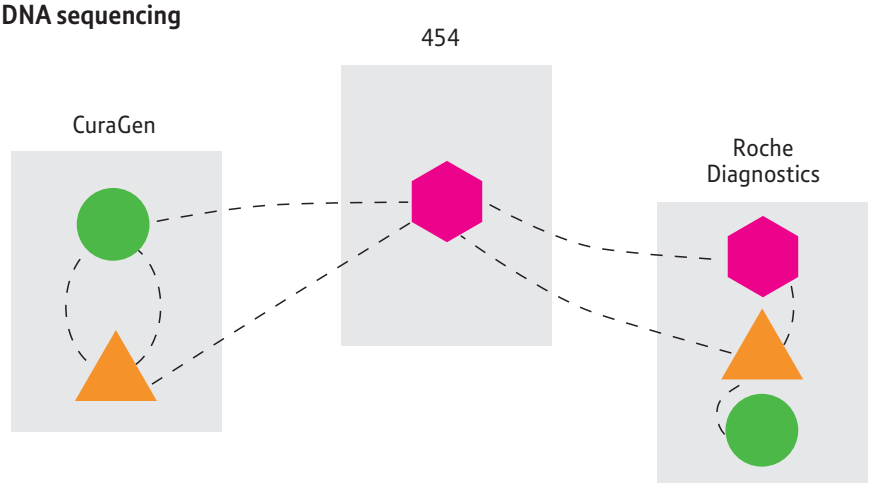
So how does all this work in practice? The following examples, drawn from this year's list of Technology Pioneers, provide some real-world illustrations of how innovation networks function, how both start-ups and established firms are taking advantage of them, and how different industries are applying the idea of network innovation in different ways.

Prescription for change

Nowhere are the limits of the old vertically integrated innovation model more apparent than in the pharmaceuticals industry, where it takes 12 years and around $800m to take each new drug from the laboratory to the marketplace. After a series of huge mergers, pharmaceuticals firms have found that the process of developing new drugs does not scale up: a small number of large pharmaceutical companies turns out to be less innovative when it comes to devising new drugs than a larger number of small ones. So they are increasingly looking beyond their own walls for new drug leads and new drug-discovery platforms, by linking up with biotech firms. For their part, small biotech firms may lack the infrastructure to conduct clinical trials, deal with regulators, or handle large-scale manufacturing, marketing and distribution of new treatments. So the logic of collaborating with an established giant is clear. Both kinds of collaboration enable large firms, small start-ups and their associated investors to mitigate risks and share rewards.

454 Life Sciences Corporation, for example, based in Branford, Connecticut, has developed a new, highly efficient method to sequence DNA. Fragments of single-stranded DNA are attached to tiny beads and deposited into tiny wells on a chip. Nucleotides, the letters of the DNA alphabet, are then repeatedly washed across the chip to rebuild the missing second strand of each DNA fragment. When a nucleotide sticks on to a fragment, a reaction produces a small amount of light. It is thus possible to determine the wells in which a particular letter has stuck during

454 Life Sciences partners with other companies to develop and distribute new technology for DNA sequencing



Source: Forrester, Economist

each step, and hence the sequence of the DNA in each well. 454's mission is to enable routine sequencing of human DNA, in preparation for an era of "personalised medicine" in which each patient's genome is analysed to determine susceptibility to disease and the most suitable treatments.

The company was established in 2000 as a subsidiary of CuraGen, a biopharmaceutical firm. It has a five-year sales distribution deal with Roche Diagnostics, which is funding further development of the technology and will market it to drugs companies for use in drug discovery. 454 is, in short, at the centre of an innovation network: it acts as a Transformer for CuraGen, the original Inventor and Financier, which has spun the company off in order to exploit the technology, rather than keeping it in-house. The spin-off also enables CuraGen to concentrate on its own core activity, namely drug development. For its part, Roche Diagnostics acts as a Financier and a Transformer as it helps 454 to commercialise and distribute the technology, which it has added to its product portfolio alongside other technologies developed in-house.

Nanomix, a firm based in Emeryville, California that was set up by two researchers from the Lawrence Berkeley National Laboratory, also sits at the heart of an innovation network. It is commercialising the use of nanotubes, tiny carbon structures that resemble rolled-up chicken wire, as chemical and biomedical sensors. The nanotubes are wrapped in molecular blankets that make them sensitive to specific target chemicals; when the target chemical is present, its interaction with the nanotube causes a change in the nanotube's electrical resistance, which can then be detected. Nanomix is aiming its sensors at the industrial-safety, process-control and biomedical markets. It has licensed related technology from the University of California Los Angeles, and has funding from several venture-capital firms and government agencies.

But Nanomix's expertise in nanotubes can be applied in many other fields beyond its initial target markets. So as well as selling its own range of sensors, respiratory monitors and detection systems, it has licensed some of its technology to DuPont, which will use nanotubes in a new type of flat-panel display. DuPont gains access to the technology without having to develop it itself, and Nanomix gains access to a new market without having to compromise its focus on detection and analysis.

Innovation networks need not always be this complex. Aresa, a biotechnology firm based in Copenhagen, Denmark, has developed a genetically modified form of a common weed, Thale cress, that can be used to detect landmines and other explosives. The weed's leaves turn red in the presence of explosive chemicals in the soil, so that sowing a large area with the weed reveals the location of buried mines. The idea was first developed by a researcher at Copenhagen University, who set up Aresa with funds from Seed Capital, Denmark's largest venture fund, and an angel investor. The technology has since been tested in conjunction with the demining unit of the Danish Army.

Putting the pieces together

A different approach to innovation networks is taken in the field of information technology, where start-ups typically provide building-block technologies that are snapped together by large firms to facilitate deployment of innovative products and services. It is no longer possible for a single firm to build everything in-house, whether a next-generation telecoms network, a mobile handset or a new type of computer. In telecoms, large firms already source more than half of their new product and service ideas externally. Bharti Tele-Ventures, an Indian telecoms operator, has gone further still: it does no internal research and development at all, relying on a network of suppliers, including Ericsson, Nokia and IBM, to source innovative products and services.

As telecoms operators around the world rush to deploy new "converged" networks and services, they are finding that the standards are still immature and not all of the technology can be bought off-the-shelf. This leaves them with two options: assemble all the pieces themselves and develop the necessary software glue in-house, or ask a large equipment-maker to do so on their behalf. All of this has opened up new opportunities for specialist start-ups with expertise in emerging fields such as voice-over-internet telephony, fixed-mobile convergence and television over broadband. The result is a global innovation bazaar as large firms seek out small start-ups or other Inventors with the right technologies to meet their needs.

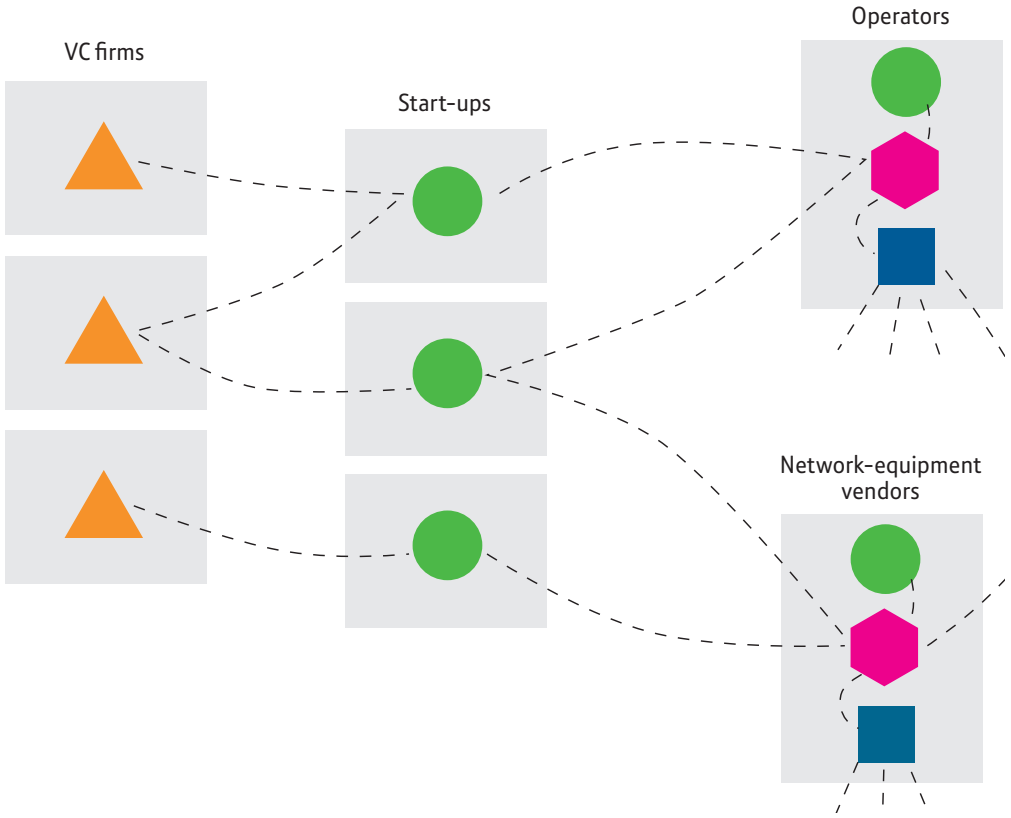
BridgePort Networks, based in Chicago, Illinois, is a specialist in the field of fixed-mobile convergence, a new service that enables mobile phones to hop seamlessly between a mobile network when outdoors and a fixed-line network when in the home or office. The handover from one network to another involves switching the phone from a cellular connection when outdoors to a short-range wireless connection, based on Wi-Fi, when indoors. The call is then carried over a broadband internet connection using voice-over-internet technology. Co-ordinating the handset with the fixed and mobile networks to ensure that all of this happens smoothly and reliably requires a lot of software behind the scenes, which is BridgePort's speciality. Its software has been trialled by several operators including China Unicom and Bell Canada. Another firm working in this area is Cicero Networks, based in Ireland; its technology has been adopted by operators in Ireland, Norway and Italy. HelloSoft, a firm based in San Jose, California, provides technology to enable handsets to support fixed-mobile operation. Handset-makers using its technology include RIM, the maker of the BlackBerry e-mail device.

In each case these start-ups are Inventors, supplying their technology to operators who act as Transformers by combining building blocks from multiple vendors, large and small, to deploy new services. Operators also often invent their own technology to glue the pieces together, and act as Brokers as they source ideas from Inventors for use in the development of new services. And they generally source some technology from larger vendors, which often combine their own technology with that of small firms. By making use of technology from start-ups, operators and equipment vendors can improve their time-to-market; in the process, they create new opportunities for fast-moving start-ups. It is not hard to see why the idea of a single vendor developing everything in-house is now so unfeasible. Innovation in the network business depends, appropriately enough, on innovation networks.

Like communications networks, computers also consist of a combination of many innovative technologies from different firms. Transitive, a British start-up spun out from the University of Manchester, played a crucial behind-the-scenes role in the development of Apple's new range of Macintosh computers, which are based on Intel microprocessors, rather than the PowerPC chips used in previous Macs. Apple was attracted by the high performance and efficiency of Intel's new processors — but how could it ensure compatibility with existing software, written to run on PowerPC chips? Transitive's software, developed with Intel's assistance, provided the answer. It converts software written for one chip so that it can run on another chip, and does so on the fly, like a simultaneous translator. By licensing the software, Apple was able to launch its new computers quickly; for its part, Transitive gained access to a new market. And by collaborating with Transitive, Intel helped expand its market too.

The field of open source software provides what is arguably the most extreme case of an innovation network. Such software is made available free on the internet, and anyone who downloads it can then

An innovation network in the telecoms sector



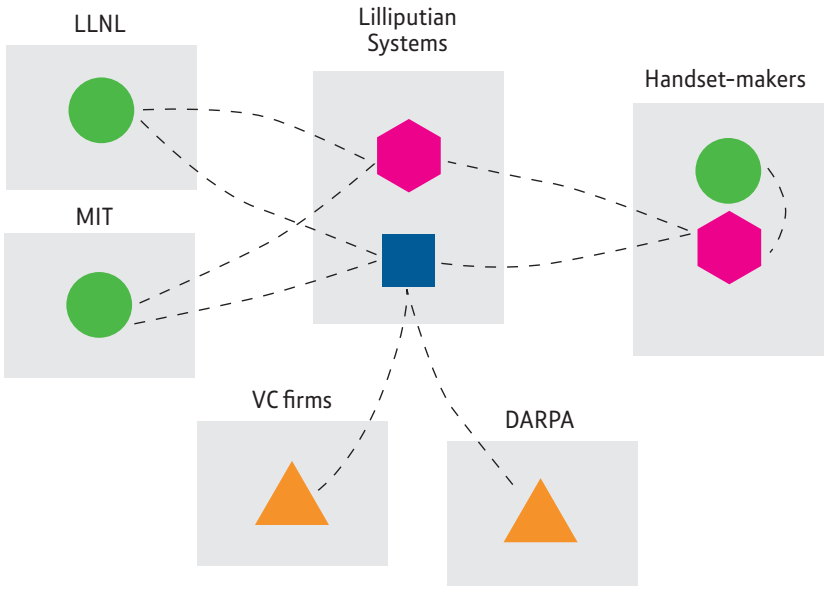
Source: Forrester, Economist

modify it and improve it, provided they make such improvements available to others. Users are also invited to help test the software, find bugs, translate it into new languages and suggest new features, thus bringing them into the innovation network. One of the best known examples of open source software is the Firefox web browser, which is maintained by the Mozilla Foundation. It is the last vestige of Netscape, the pioneering browser firm that was defeated by Microsoft and later purchased by AOL. Today Mozilla is a non-profit organisation, spun out of AOL with a $2m grant. With its vibrant ecosystem of in-house and volunteer programmers, enthusiasts who develop additional plug-ins and evangelical users who have helped Firefox to establish a 15% market share, Mozilla is a striking example of how new technology need not simply flow from the laboratory to the customer; innovation is a two-way street.

Risky business

High oil prices, concern over global warming and the march of ever more sophisticated handheld devices all mean that energy has become one of the hottest new fields of technology. But it is still very early days for many new energy technologies such as fuel cells, solar panels and energy-storage systems.

Lilliputian Systems is at the centre of a complex innovation ecosystem



Source: Forrester, Economist

Hundreds of start-ups are competing in each field, and large companies are hedging their bets by forming alliances with them. As in biotech, in other words, start-ups provide a means for larger firms to outsource research and development and mitigate the risks associated with unproven new technologies. Indeed, 22% of R&D is outsourced in energy, more than in any other industry. (The figures are 14% in pharmaceuticals and 11% in information technology, according to Forrester.)

Given the relative immaturity of the field, the resulting innovation networks are less elaborate than in biotech, where start-ups and large firms license each other's ideas and buy each other's technologies. Instead, innovation networks in the field of energy allow large firms to participate at arm's length, by funding particular start-ups or signing licensing agreements to gain access to promising technologies once they have been validated. Such tie-ups help to keep small firms afloat; but many such firms also sell their products directly as they validate their designs and establish market credibility.

Lilliputian Systems, a spin-out from the Massachusetts Institute of Technology, is developing a tiny solid-oxide fuel cell to power portable electronic devices. A fuel cell is a chemical battery that combines a fuel with oxygen from the air to generate electricity. Lilliputian Systems' fuel cell is based on technology developed at MIT and the Lawrence Livermore National Laboratory, with funding from DARPA and several venture-capital firms. It has agreements with leading handset-makers, who are looking for new ways to power high-end multimedia smartphones as they become

ever more elaborate and energy-hungry. Handset manufacturers are unwilling to take on the risk of developing such technology themselves, so they are relying on start-ups to do it for them; in return, they will provide access to a vast market if and when the technology matures. Portable fuel cells have notoriously been two years away from commercialisation for the past five years, but many observers believe they are now finally poised to make a breakthrough.

Another technology that shows potential but has yet to deliver on its promise is that of thin-film solar panels. Traditionally, solar panels are based on silicon wafers, but the resulting panels are expensive and fragile, and high demand has led to a shortage of silicon which has pushed prices up even further in recent years. Thin-film panels have higher efficiencies and use little or no silicon. But despite some promising prototypes, scaling thin-film technology up has proved difficult, and low yields mean that thin-film solar cells are still only marginally cheaper than silicon cells. What is needed is improved manufacturing techniques to increase yields and reduce costs.

One company working to solve this problem is Nanosolar, based in Palo Alto, California. It has developed a method to print thin-film solar-panel technology in a continuous process, and is now building the world's largest thin-film solar factory, which it hopes will be able to produce 200m solar panels a year. Nanosolar is backed by venture-capital firms and an array of technology luminaries, including the founders of Google. It is working with Conergy, a big alternative-energy systems integrator, to bring its products to market. Flisom is a rival firm, spun out of the Swiss Federal Institute of Technology, that is also developing a "roll-to-roll" process for printing thin-film solar panels. It is commercialising technology originally developed at ETH Zurich, the Swiss Federal Institute of Technology. Funding has come from venture-capital firms, and initial trials have been conducted with the Swiss Army. Flisom plans to target the emergency-response market initially, before moving on to low-cost solar panels for buildings.

ClimateWell, a Swedish firm, has developed a solar-powered air-conditioning system. This makes sense because the demand for air-conditioning is greatest on hot, sunny days. Thermal collectors gather sunlight and use it to dry an absorbent salt that strongly attracts water from its surroundings. This salt can then be used for cooling, by placing it in a vacuum with a vessel of water. The water evaporates and is absorbed by the salt, but as it does so it cools. This cooling effect can then be used to provide air-conditioning. The technology was originally developed by ChemCool, a Finnish firm, which spun it off into a separate subsidiary. It then merged with Solsam Sunergy, a Swedish firm, and money was raised from venture-capital investors and via a share offering. The technology has been tested in conjunction with Spanish utility firms, and ClimateWell is now building a factory in Spain. It will sell its products through utility firms and to property developers for inclusion in new homes.

Dedicated start-ups, in short, are a good way to mitigate the risks of developing potentially revolutionary energy technologies: large firms can strike deals with many start-ups following different strategies, rather than having to back a particular horse themselves. Those start-ups, in turn, may rely on technology from many different fields of research. Innovation networks are a natural way to connect all these various actors together.

Network effects

Early adopters of innovation networks are benefitting as a result, says Forrester's Mr Radjou. Procter & Gamble, for example, increased its product hit rate from 70% in 2001 to over 90% by acting as a Transformer and providing market access for innovations from

external Inventors, as well as those developed in-house. IBM, once the very model of a vertically integrated innovator, now generates $2 billion a year licensing its innovations to other firms, a model many other companies are now striving to emulate.

Embracing the new model is not a simple process, particularly for large companies that are used to controlling every stage in the innovation cycle. To succeed, they must first decide which roles to play: this involves identifying the areas where a company has a particular advantage as an Inventor, and being prepared to partner with other firms elsewhere. That in turn means ditching the "not invented here" mentality to ensure that in-house researchers are prepared to open up to external sources of innovation, and encouraging in-house innovators to consider the possibility that another organisation might be best-placed to exploit some of their ideas. In the new environment, the ability to select and successfully manage the right partner relationships is just as important as the ability to come up with bright ideas in the labs. Inevitably, open innovation gives rise to other new challenges – for example, how to protect intellectual property while sharing it with other players in the innovation network.

Companies must also make organisational changes if they are to exploit innovation networks to the full, in particular by ensuring that their computing infrastructures support efficient collaboration and sharing of information throughout the organisation. Finally, innovation networks depend on the recognition that innovation need not come only from the research laboratory, but from other sources, both internal and external, too. That does not just mean academics, other firms or consultancies: it also includes overlooked sources of innovation within a company. Sales and marketing divisions, for example, are closer to the customer than the research department and may have a better idea of what customers actually need. Whether it involves a suggestions box or an intranet portal, innovation networks must also tap into these internal sources of ideas; and that in turn requires a shift in corporate culture, so that every part of the company is regarded as being involved in the innovation process.

None of this is easy. But already, thanks to a few pioneering firms, the outlines of a new model for 21st-century innovation are becoming apparent. It is a model designed for today's world of global markets, accelerating product cycles and vigorous competition. Being connected to an innovation network could soon prove to be just as important as being connected to the power grid or the internet. To prosper in this new environment, companies both large and small must get themselves plugged in as quickly as possible.

Technology Pioneers 2007

Forty-seven companies have been chosen as Technology Pioneers in 2007. They come from three categories: biotechnology, energy/environmental technology and information technology. Candidates are nominated by members, constituents and collaborators of the World Economic Forum. Candidates are reviewed by an external Selection Advisory Committee comprising technology experts in a variety of fields; the World Economic Forum takes the final decision.

The pioneers are chosen on the basis of six selection criteria:

Innovation The company must be truly innovative. A new version or repackaging of an already well-accepted technological solution does not qualify as an innovation. The innovation and commercialisation should be recent. The company should invest significantly in R&D.

Potential impact The company must have the potential to have a substantial long-term impact on business and society.

Growth and sustainability The company should have all the signs of a long-term market leader and should have well-formulated plans for future development and growth.

Proof of concept The company must have a product on the market or have proven practical applications of the technology. Companies in "stealth" mode and those with untested ideas or models do not qualify.

Leadership The company must have visionary leadership that plays a critical role in driving it towards its goals.

Status The company must not currently be a Member of the World Economic Forum.

Technology Pioneers Contents

BIOTECHNOLOGY

454 Life Sciences

Dr Jonathan Rothberg, Founder/Chairman
LOCATION Connecticut, USA
NUMBER OF EMPLOYEES 151
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

454 Life Sciences has developed a technology which dramatically reduces the time and cost of DNA sequencing. Its technology allows one individual to prepare and sequence a single genome, a process which has up to now been extremely labour-intensive and time-consuming. Its instrument uses the patented 454 sequencing chemistry to produce over 100 million nucleotide bases per seven hour run.

The speed and ease of 454's system means that it is now possible to get data for large genome organisms (human or animal) that were previously inaccessible, due to cost or throughput considerations.

The company has made its technology commercially available via its Sequencing Center, which offers sequencing services to clients worldwide. Its Genome Sequencer FLX System and related products are also sold worldwide by Roche Applied Science, and 454 has also this year initiated a Neanderthal Genome Project.

Why the company is a pioneer

The company's innovative technology is expected to accelerate the push toward genome-specific or "personalised" medical care. The company's five-year exclusive agreement with Roche for the marketing, sale, and distribution of its system brought the first new sequencing technology to market since Sanger and Gilbert won the noble prize for DNA sequencing in 1980 and has provided a strong platform for commercialising its technology.

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BIOTECHNOLOGY

Ambit Biosciences

Scott Salka, CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 80
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Ambit Biosciences is focused on the development of small-molecule kinase inhibitors for the treatment of cancer. The company has developed a kinase inhibitor, AC220, for the treatment of Acute Myeloid Leukaemia (AML), the most common form of blood cancer in adults, and is expected to begin clinical trials of AC220 in late 2006.

AC220 was identified using KinomeScan, the company's proprietary kinase profiling platform. KinomeScan uses the company's amplifiable fusion protein (AFP) system to make protein kinases—which are vital targets for the treatment of cancer—easier to produce and isolate. KinomeScan is both fast and accurate, enabling profiling and kinase-binding quantification to be completed in less than a week.

Ambit Bioscience is also currently testing three other inhibitors independently and in collaborative programmes with Bristol-Myers Squibb and Cephalon.

Why the company is a pioneer

There are at least six kinase inhibitors that are currently approved and dozens more under FDA trials, and this protein class may prove a fertile area for therapeutic drug development. The KinomeScan technology, being both fast and reliable, is expected to make a major contribution to the identification and optimisation of small molecule kinase inhibitors, with significant potential for improving clinical treatment of cancer.

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BIOTECHNOLOGY

Amorfix Life Sciences Ltd

Dr. George Adams, CEO
LOCATION Ontario, Canada
NUMBER OF EMPLOYEES 25
YEAR FOUNDED 2004
ORIGINS Entrepreneurial start-up and now publicly traded (TSXV: AMF)

Amorfix aims to become a world leader in the diagnosis and treatment of Aggregated Misfolded Protein (AMP) brain diseases. These include transmissible diseases, such as Transmissible Spongiform Encephalopathies (TSE), and degenerative conditions such as Alzheimer's disease, Amyotrophic Lateral Sclerosis and Parkinson's.

One major problem in detecting AMPs is that, when present in peripheral blood, they are outnumbered at least one million to one by normal proteins. To get around this, the company uses chemical modifying agents that alter epitopes (that part of the molecule recognised by the immune system) accessible on normal proteins, but not those in AMPs. The unaltered epitopes in AMPs can then be identified by highly sensitive immunodetection procedures, using standard reagents. This procedure has already been shown in samples with TSEs (human vCJD and sheep scrapie) and Alzheimer's.

Why the company is a pioneer

The company's work could have major implications for protection of the food supply (by detecting TSE in live animals) and protection of the blood supply (as it is now known human TSE can be transmitted by blood transfusions). There is also an urgent need for AMP screening to support early diagnosis and treatment of Alzheimer's, Amyotrophic Lateral Sclerosis and Parkinson's diseases.

Amorfix Life Sciences Ltd
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BIOTECHNOLOGY

Aresa

Jarne Elleholm, President/CEO
LOCATION Copenhagen, Denmark
NUMBER OF EMPLOYEES 14
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

Aresa is a biotech company that has developed a biosensor to enable detection of landmines or other unexploded ordinance. The biosensor, RedDetect, is a genetically-modified plant which can detect nitrogen dioxide (which is released during the evaporation of explosive elements) when growing in soil, and changes colour from green to red when growing on or close to landmines.

Field testing was done in conjunction with the Danish army in 2005, and a new test site has been established in Croatia. The aim now is to see how the chosen plant, derived from a common weed, responds in different climatic conditions.

Commercialisation of RedDetect is expected to begin in 2008. The product may also be used to clear disused firing ranges, and could have other uses if developed to detect different substances in soil.

Why the company is a pioneer

Unexploded landmines kill some 15-20,000 people a year, and constitute a particularly significant threat to health in developing countries. Conventional mine detection systems are slow, expensive and often dangerous. The company's technology has the potential to improve mine detection and help reduce many deaths of innocent civilians every year. The company's chosen plant—thale cress—is prevalent around the world and has a short growth cycle, making it a robust platform for Aresa's technology.

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BIOTECHNOLOGY

BrainsGate

Avinoam Dayan, CEO
LOCATION Ra'anana, Israel
NUMBER OF EMPLOYEES 20
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Stroke can result in heavy damage to brain tissue. Some of this damage is reversible, if blood flow to the brain can be restored, but existing therapies for treating acute ischemic strokes (those which occur when the blood supply to the brain is interrupted or diminished, usually by a blood clot) are available only to a few patients, and need to be administered quickly.

BrainsGate has developed a system whereby a miniature electrode is implanted in the roof of the mouth which stimulates a parasympathetic centre controlling blood supply to the central nervous system, to encourage the flow of blood to the brain. The system can be administered up to 24 hours after the stroke and greatly increases the chances of recovery.

Apart from treating stroke, the company hopes its technology will have much wider uses in transmitting drugs to the central nervous system—which is at present difficult, because of the so-called "blood brain barrier" (BBB) by which the body prevents most substances from reaching the brain via the bloodstream.

Why the company is a pioneer

BrainsGate's innovative but simple technology represents a breakthrough in the treatment of stroke. It also means less need for invasive operations on the brain, and could open the door to many other central nervous system treatments.

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BIOTECHNOLOGY

CyGenics

Steven Fang, Group CEO
LOCATION Melbourne, Australia
NUMBER OF EMPLOYEES 94
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

Stem cells are unspecialised cell types, which can renew themselves and give rise to specialised cell types. They can already be used to treat 72 diseases, and could be useful in many more. But such adult stem cells are in short supply, and are difficult to collect directly from a human body in sufficient amounts.

CyGenic's Cytomatrix subsidiary is focused on getting stem cells to grow outside the body, while retaining their regenerative characteristics. Importantly, Cytomatrix's technologies do not use cytokines, which can reduce the quality of stem cells and limit their use in areas such as recovery from radiotherapy or chemotherapy. Cygenics is also involved in the production of human T-cells, a critical component of the human immune system.

The company has also become a leading player in the blood banking business in Asia.
CordLife is one of only eight blood banks outside the US to have been accredited by AABB, an international association of blood banks.

Why the company is a pioneer

Experts predict a surge in cell-based treatments and CyGenic's technology will help resolve one of the major obstacles to growth in this area. This will widen the range of treatments for which stem cells can be used. The company's T-cell work is expected to reduce significantly the cost and time it takes to get vaccines to market.

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BIOTECHNOLOGY

Given Imaging Ltd

Nachum (Homi) Shamir, President/CEO
LOCATION Yoqneam, Israel
NUMBER OF EMPLOYEES 400
YEAR FOUNDED 1998
ORIGINS Entrepreneurial start-up

Given Imaging pioneered the field of capsule endoscopy and is redefining the way physicians visualize and detect diseases of the gastrointestinal tract. The PillCam platform includes the PillCam video capsule, a disposable, miniature video camera contained in a capsule which is ingested by the patient, a sensor array, a data recorder worn around the patient's waist which captures the images and RAPID software which allows a physician to review the images on a PC-based workstation.

Over 400,000 people worldwide have already undergone PillCam capsule endoscopy. Capsules are commercially available for the entire small intestine and for the oesophagus, and the company is focused on expanding its use to other parts of the digestive tract. A colon capsule is undergoing multi-centre clinical trials in Europe and the U.S.

Why the company is a pioneer

PillCam capsule endoscopy provides a simple, patient-friendly and highly cost-effective way of diagnosing a wide range of gastrointestinal disorders. The great advantage of PillCam capsule endoscopy is that it is non-invasive, unlike traditional endoscopy—the patient simply swallows a pill. The system helps detect a range of conditions, such as Crohn's and coeliac diseases, unexplained bleeding, small bowel tumours, gastroesophageal reflux disease, oesophageal varices, and colon polyps.

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BIOTECHNOLOGY

HealthSTATS

Ting Choon Meng, Chairman/CEO
LOCATION Singapore
NUMBER OF EMPLOYEES 30
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

A person's blood pressure varies considerably over a 24-hour period. This is something that conventional clinic-based devices cannot monitor. On the other hand, current ambulatory blood pressure monitoring (ABPM) devices (that require an inflatable cuff to be worn over the arm) are inconvenient and expensive.

HealthSTATS' BPro is a watch-like device that profiles blood pressure fluctuations and pulse variations over a 24-hour period for clinical analysis and characterisation. Based on the company's evidence-based blood pressure (EVPB) technology, it harvests signals from the radial artery, which are converted to blood pressure readings and for waveform analysis. The company works with authorised BPro ABPM clinics to make this device easily accessible to the end-users. The EVBP technology is used in other applications as well, such as the Avidenz System, which monitors a patient's blood pressure non-invasively during surgery or while under intensive care.

Why the company is a pioneer

The incidence of hypertension and related illnesses continues to rise worldwide, despite improved treatment guidelines and new drugs. HealthSTATS' ABPM device, the BPro, provides clinicians with a more complete assessment of a patient's hypertensive condition. This makes it easier to prescribe individualised treatment, with the promise of arresting the progression of the hypertensive condition and subsequent reductions in its related illnesses.

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BIOTECHNOLOGY

Lentigen

Boro Dropulic, Founder/CEO
LOCATION Maryland, USA
NUMBER OF EMPLOYEES 22
YEAR FOUNDED 2004
ORIGINS Entrepreneurial start-up

Rising concerns about the potential spread of avian flu and other pandemics have put enormous pressure on the vaccine development industry to come up with ways of averting potential world health crises.

Lentigen, established in December 2004 by former Johns Hopkins University researcher Boro Dropulic, has developed a technology called Lentimax, a lentiviral vector, which provides stable and efficient gene delivery. LentiMax allows for the rapid production of virus-like particles (VLPs), greatly speeding the vaccine production process (which currently relies primarily on eggs as incubators for vaccine stocks). Lentigen's technology is well-suited to deal rapidly with a potential influenza pandemic.

In addition LentiMax technology can be used to generate other therapeutic proteins, potentially paving the way for rapid generation of counter-measures against other agents that could be used in bioterrorism.

Why the company is a pioneer

Lentimax provides a safe, efficient and stable gene delivery technology. The technology holds particular promise for accelerating the development and production of vaccines, potentially obviating governments' need to develop and hold massive stocks, and other therapeutic proteins. It also has a wide range of potential applications in biodefence, biotechnology, and medicine.

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BIOTECHNOLOGY

Nanomix

Dr Marvin L Cohen, Co-founder/CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 40
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Nanomix develops point-of-care handheld detection devices, which use its Sensation technology—a combination of a random network of one nanometre-wide carbon nanotubes and proprietary chemistries—to detect a range of microscopic substances. This allows for multiple detection devices on a 2x2mm chip and uses little power, meaning that testing and detection of viruses, dangerous gases, and even explosives and biological warfare agents, can be moved out of the laboratory and done on-site via the company's small, automated devices.

The technology has several advantages. Electronic detection avoids the need for labelling chemistries or optical equipment and can be undertaken at room temperatures. Wireless integration also allows easy deployment and transmission of information in real-time – particularly important for medical and military uses. The company's technologies also allow manufacturing scalability—over a million detection devices have been manufactured to date.

The company foresees three basic uses for its technology—industrial applications, medical breath-testing and biomolecule detection. A hydrogen (H2) sensor was brought to market in late 2005, and a respiratory monitoring (CO2 sensor) device will be unveiled in 2007.

Why the company is a pioneer

Nanomix's technology will increase the use of nanotechnology in detecting biowarfare agents. It also has a range of commercial applications and promises to enable point-of-care medical information for diagnosing and treating disease.

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BIOTECHNOLOGY

Oxford Medical Diagnostics

Roy Johnson, Executive Chairman
LOCATION Oxford, UK
NUMBER OF EMPLOYEES 6
YEAR FOUNDED 2004
ORIGINS Spin-off from the University of Oxford

Human and animal breath contains hundreds of gases and volatile organic compounds, some of which are characteristic markers for disease. For example, doctors already identify stomach ulcers by monitoring the amount of carbon dioxide produced by bacteria in the breath.

Oxford Medical Diagnostics is developing laser-based analytical techniques to allow the better detection of trace quantities of gases and volatile organic compounds. The company is currently focusing its technology on the immediate market opportunities in industrial process monitoring and clinical diagnostics and hopes, ultimately, to integrate its breath-analysis technology into a cost-effective desktop module for the point-of-care setting. The aim is to produce equipment that is highly portable, unlike existing bulky or lab-based systems.

The overriding benefit of Oxford Medical Diagnostics' technology is that it can be "tuned" to a range of molecules, the detection of which has application across a wide range of different markets.

Why the company is a pioneer

The speed and sensitivity of the company's technology could have a major impact on doctors' ability to diagnose diseases at the point of care, as well as having a range of applications in both medical and industrial process monitoring, once the technology is effectively integrated into a cost-effective desktop or mobile device.

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BIOTECHNOLOGY

Renovo

Professor Mark Ferguson, Co-founder/CEO
LOCATION: Manchester, UK
NUMBER OF EMPLOYEES 140
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Renovo is a biopharmaceutical company that is developing drugs to prevent and reduce scarring at multiple body sites and to accelerate healing. The company has now reported four statistically and clinically significant Phase II trial results for its lead drug candidate, Juvista, in the UK. Three other drugs, Juvidex, Prevascar and Zesteem are also undergoing Phase II trials; a further four of its products are currently in advanced pre-clinical stages; and nine more are pre-clinical candidates.

Juvista is a therapeutic application of human recombinant TGF_3, which is present at high levels in developing embryonic skin and in embryonic wounds that heal with no scar, but by contrast, is present at low levels in adult wounds that scar.

Whilst the company's approach is to investigate the effect of its drug candidates in the skin first, it also investigating their potential for preventing and reducing scarring at other body sites and treating fibrotic disorders.

Why the company is a pioneer

Renovo aims to be the first company to market a pharmaceutical drug to prevent and reduce scarring—none are currently available in the US or Europe. In the longer term its products are also expected to have wider application in neurosurgery, sports medicine, treatment of burns, and treatment of fibrotic disorders such as liver cirrhosis.

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BIOTECHNOLOGY

Strand Life Sciences

Vijay Chandru, Co-founder/CEO
LOCATION Bangalore, India
NUMBER OF EMPLOYEES 83
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start up

Strand Life Sciences is a technology company that applies algorithms and other computer-based technologies to aid the discovery and development of new drugs.

Its capabilities fall into three main categories. First, it provides informatics tools and solutions for research biologists for gene expression data analysis, visualisation, image analysis and information management systems. Second, the company builds models to assist in the development of new drugs, for example predicting the drug-relevant properties of molecules using computer software. Finally, Strand partners with other research companies, which enables it to offer services from compound library design to lead generation.

The company's data mining platform—avadis—can be applied to the analysis of gene expression (the process by which a DNA sequence is converted into the structures and functions of a cell), proteomics, preclinical and clinical data analysis and many other applications. The platform offers powerful data visualisation tools and several probe summarisation and machine-learning algorithms.

Why the company is a pioneer

Strand offers a range of products allowing the effective application of bioinformatics to drugs development. The technology can be used to help scientists predict pharmacokinetics (the way in which a body responds to drugs) and cardiotoxicity (the effect of drugs on the heart).

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ENERGY/ENVIRONMENT TECHNOLOGY

Advanced Diamond Technologies

Neil Kane, President
LOCATION Illinois, USA
NUMBER OF EMPLOYEES 8
YEAR FOUNDED 2003
ORIGINS Entrepreneurial start-up

Diamond is the hardest known substance on Earth. It has a low coefficient of friction, is inert, repels water and is an outstanding electrical insulator. But, because of the difficulty of integrating diamond with other materials, its industrial use has been generally limited to cutting applications or abrasives.

Advanced Diamond Technologies has developed a method of converting natural gas into ultrananocystalline diamond (UNCD). This can then be deposited on other materials, such as silicon, thereby transferring the exceptional properties of diamond to the other material.

ADT's UNCD Aqua Series products, the first family of such thin diamond films to be marketed, are mirror-smooth but vary in terms of thermal and electrical conductivity. UNCD Aqua can be used in a range of industrial and medical applications, including micro-electrical mechanical systems (MEMS), resonators used in mobile phones, biosensors, non-stick surfaces and wear-resistant coatings (e.g., in orthopaedic devices). Another application is a protective coating for an artificial retina implant, to treat macular degeneration.

Why the company is a pioneer

ADT's innovative process for synthesising diamond in the form of a mirror-smooth thin film, which can take place at low temperatures, has a wide range of applications, from the manufacture of semiconductors to the strengthening of medical devices.

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ENERGY/ENVIRONMENT TECHNOLOGY

Advent Solar

Russell R. Schmit, President/CEO
LOCATION New Mexico, USA
NUMBER OF EMPLOYEES 150
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

Solar cells are currently made to a basic design that is almost 20 years old and still offers no or only marginal economic gains to many consumers. Advent Solar has developed a new technology, called Emitter-Wrap-Through, which it hopes will reduce the cost of solar cells by means of simplified assembly, higher energy output and the use of ultra-thin silicon wafers.

Unlike traditional panels, Emitter-Wrap-Through cells do not have electrical contacts on the front of the cell, which block sunlight. Instead, laser-drilled holes enable electric power to flow to the back of the cell. By eliminating a front-to-back connection step, Emitter-Wrap-Through cells are cheaper to assemble and offer higher output, because they do not have the front grid that usually obscures cells. Collecting current on the front emitter also allows much thinner silicon to be used, which makes Advent Solar less vulnerable to swings in prices and availability of silicon. The company plans to make modules available through distributors in early 2007.

Why the company is a pioneer

To date, the take-up of solar power has been limited, largely because cells are both expensive to produce and relatively inefficient. Advent Solar's innovation addresses both these problems by reducing the quantity of silicon used in cells, thereby reducing production costs, and increasing the amount of sunlight that can be converted into electricity.

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ENERGY/ENVIRONMENT TECHNOLOGY

ClimateWell

Göran Bolin, Chief Technical Officer
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NUMBER OF EMPLOYEES 20
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

Heating and cooling of buildings accounts for one-third of global energy consumption and is often done using old and inefficient technology. ClimateWell supplies high-efficiency solar air conditioning equipment, which can efficiently store extracted energy.

The company's products are based around a unique technology called triple state absorption. The sun's energy is first used to dry a salt. That energy can then be extracted, either as heating or cooling, by mixing water with the salt. While it has long been possible to store energy in a solid salt, salt's poor heat conductivity means that it has few practical applications. ClimateWell's system gets around these problems by a proprietary method of heat exchanging using highly saturated salt solutions, which in turn enables it to run an absorption process with a fluctuating energy source like the sun. The technology surmounts two major solar thermal energy problems: efficient energy storage, and the need to convert heat into cooling in summer.

Why the company is a pioneer

Unlike a conventional heat pump, ClimateWell's innovation allows building systems to run on an abundant, free energy source like the sun, without using electrical compressors or refrigerants, and without producing any carbon dioxide emissions. The system could also be applied in the automotive sector to use waste heat energy from combustion engines for air-conditioning.

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ENERGY/ENVIRONMENT TECHNOLOGY

DeepStream Technologies

Mark Crosier, Founder/CEO
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NUMBER OF EMPLOYEES 45
YEAR FOUNDED 2003
ORIGINS Entrepreneurial start-up

DeepStream designs and manufactures intelligent sensors that can be embedded in a wide range of products. One immediate application could be to replace conventional single function circuit-breakers, with new DeepStream-enabled digital multi-function circuit breakers – offering unparalleled levels of electrical network information and protection. Other applications include the use of embedded metering, enabling households or companies to get very detailed energy bills that itemise consumption by individual electrical circuits or sockets. The technology can identify where energy is being consumed and help homeowners or businesses to take steps to increase efficiency.

By embedding sensors in household appliances, the company hopes to improve performance and efficiency while also sending valuable feedback to manufacturers, enabling prognosis of problems and providing feedback on performance and usage for future product development. For example, washing machines could be fitted with communicative motor and load sensors, while further uses could include intelligent lighting systems, and lower-cost medical monitoring devices, such as those used in cardiac care or 'in-home' care monitoring solutions. Sensors could also help to ensure secure power by monitoring batteries and motors.

Why the company is a pioneer

DeepStream can enable significant reductions in household and industrial energy usage. The company's technology can also be used to monitor devices and send back information to manufacturers for new remote service offerings.

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ENERGY/ENVIRONMENT TECHNOLOGY

EnerNOC

Tim Healy, Chairman/CEO
LOCATION Massachusetts, USA
NUMBER OF EMPLOYEES 90
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

EnerNOC is a US-based energy management company that works on behalf of utilities to help manage periods of peak demand. EnerNOC's Capacity on Demand programme addresses the problem of peak demand for electrical power primarily by encouraging customers to reduce consumption, rather than building new capacity.

Energy utilities have previously tried to do this with their largest customers, but EnerNOC has taken the idea a stage further, involving smaller businesses through what it terms a "negawatt network" – a network of customers that offers to reduce consumption during periods of peak demand to ensure overall grid stability. So, when an electrical grid approaches capacity, EnerNOC gets customers to scale back on consumption, or switch to emergency generation, thus avoiding blackouts. Customers who can reduce consumption in this way receive payments from EnerNOC, as well as advance notice of power supply issues. Detailed energy use data also allows them to identify areas where long-term economies can be made.

Why the company is a pioneer

It can be increasingly difficult to meet increasing energy needs by developing new local supply, due to economic, political and environmental considerations. This puts additional pressures on existing energy grids, threatening reliability and increasing price volatility. EnerNOC's technology allows a highly collaborative approach to power supply management that reduces the need for extra capacity construction, saves customers money and can ultimately benefit the environment.

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ENERGY/ENVIRONMENT TECHNOLOGY

Fiberforge

Dr Jon Fox-Rubin, President/CEO
LOCATION Colorado, USA
NUMBER OF EMPLOYEES <20
YEAR FOUNDED 1998
ORIGINS Entrepreneurial start-up

Fiberforge is developing a new, more cost-effective process for the production of advanced composite structures. At present, advanced composite structures—those that are made using high-strength fibres such as glass, aramid and carbon and then held together in a matrix of either thermoplastic or thermoset resin—are costly to make and therefore rarely used in volume applications. The process employed by Fiberforge enables advanced composites to be manufactured more economically. This means that they can become an alternative to steel and light metals for high-volume, manufactured structures as well as offering improvements in stiffness, corrosion resistance, weight and recyclability.

The Fiberforge process is centred around proprietary conversion software and an automatic assembly system, which allows products to be designed and produced to a customer's specification with little labour input and minimum waste. Applications for Fiberforge's production process are in aerospace, and the technology has already been licensed to a manufacturer of aircraft seat components. The process could also be used to manufacture lighter cars, which could enable large energy savings.

Why the company is a pioneer

Fiberforge's new process, which combines an innovative approach to both design and production, will dramatically lower the cost of manufacturing in industries that use advanced composites. Because they combine low weight and high strength into a single material, advanced composites offer greater durability and reduced energy usage.

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ENERGY/ENVIRONMENT TECHNOLOGY

Enfucell

Jaakko Happonen, CEO
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NUMBER OF EMPLOYEES 9
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

Founded after a decade of research on power sources for low-power applications at the Helsinki University of Technology, Enfucell has developed a thin, flexible battery based on traditional paper printing and lamination technology. The resulting SoftBatteries, which are between 0.3mm and 0.7mm in thickness, can be used in a range of applications such as cosmetic and drug delivery patches, smart cards, RFID tags and electronic greeting cards.

SoftBatteries use paper containing the electrolyte as the separator between anode and cathode. Zinc powder is printed on one side of the paper; manganese oxide on the other. These "printable" batteries have a number of advantages over traditional batteries: they are flexible, low-cost, environmentally friendly and disposable in household waste. The battery output is stable over a wide range of temperature and humidity conditions, and different voltages can be realised by applying more layers within the batteries, or applying the batteries in series. In future, the technology should be easily adaptable to different materials, or to fuel cell technology.

Why the company is a pioneer

There is increasing demand for batteries for small-scale, lower-power and disposable applications, such as for use in RFID tags. SoftBatteries offer an economical and environmentally-friendly alternative to traditional batteries used for this purpose. In future, the company also hopes to use its technology to develop enzymatic fuel cells.

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ENERGY/ENVIRONMENT TECHNOLOGY

Flisom

Anil Sethi, Founder/CEO
LOCATION Zurich, Switzerland
NUMBER OF EMPLOYEES 6
YEAR FOUNDED 2005
ORIGINS Spin-off from ETH Zurich

Flisom was founded to commercialise renewable energy research. Its main product is a flexible and extremely lightweight solar cell, which is based on a semiconductor compound, called Copper Indium Gallium Diselenide (CIGS), which is extremely efficient at absorbing light. Instead of using glass as a substrate to support the assembly, Flisom uses a plastic foil which enables it to be manufactured using low-cost, roll-to-roll technology.

Flisom's polymer-based cells use only small amounts of energy and materials in their construction. They are thinner than a sheet of paper and are extremely lightweight. In addition, they are highly flexible and can be applied to bent surfaces or rolled up. The cell absorbers are intrinsically stable, and degrade very little during use. The low cost of production of these flexible cells could help make solar power directly competitive with conventionally-generated electricity.

The cells' characteristics may prove particularly important for portable applications, such as mobile phones. The homogenous, dark appearance of the cells – and their light weight – could also make them suitable for use on buildings.

Why the company is a pioneer

Flisom's plastic-based cells offer the prospect of flexible, extremely lightweight solar cells. Manufactured using tiny amounts of material and energy, the cells are not only highly economical to produce, they also provide extremely high light-to-electricity conversion rates.

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ENERGY/ENVIRONMENT TECHNOLOGY

Lilliputian Systems Inc

Kenneth Lazarus, CEO
LOCATION USA
NUMBER OF EMPLOYEES 50
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

Solid oxide fuel cell technology has long been known to have a high fuel to electrical energy conversion ratio. It can use any hydrocarbon-based fuel source and is effective in a range of environmental conditions. An important drawback, however, is that the cells operate at very high temperatures (800-1000 °C) and this has so far limited their use to a few high power applications, such as powering buildings.

Lilliputian Systems miniaturises solid oxide fuel cells so that they can fit on and are integrated into a chip, thus opening up the enormous power market for portable devices. These miniaturised cells offer volumetric energy density much higher than competing fuel cells and are the only fuel cells that can outperform rechargeable batteries in low-power, small form-factor applications. (They have an energy density 10 times greater than a lithium-ion rechargeable battery.) Problems associated with the cells' high operating temperature are resolved by a leak-free, high-temperature silicon, silicon-based seals, innovative chip-based thermal insulation and other advances.

Why the company is a pioneer

The company believes that Lilliputian Systems' fuel cell on a chip technology could both meet the energy needs of today's portable electronic devices and facilitate the wireless world of tomorrow. Prototype cells have been demonstrated, and the plan is to have systems available for consumer evaluation in mid-2007.

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ENERGY/ENVIRONMENT TECHNOLOGY

Nanosolar

Martin Roscheisen, CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 60
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

Although thin-film solar cells have now been around for a decade or so, they remain relatively expensive to produce. Nanosolar has developed a range of technologies that promise to improve dramatically the cost-efficiency, yield and production throughput of such cells.

Nanosolar has developed technology that makes it possible to roll print (or solution coat) such cells, rather than use vacuum coating. This is made possible by a Copper Indium Gallium Diselenide (CIGS) absorber layer that is one-hundredth the thickness of a conventional absorber. The company's rapid thermal processing uses only a short burst of heat to make the cell, reducing the cell's energy "pay back" period from several years to one month. The new printing technology then allows much lower-cost substrates than the stainless steel necessary for conventional cell manufacturing techniques.

Why the company is a pioneer

In March 2006, Nanosolar announced that its research and development team had produced cells with world-record efficiency—a finding that was later certified by the National Renewable Energy Laboratory. The company's potential for low-cost, high-throughput production of solar cells make it a leader in its field.

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ENERGY/ENVIRONMENT TECHNOLOGY

OTB Group

Ron Kok, Founder and President
LOCATION Eindhoven, the Netherlands
NUMBER OF EMPLOYEES 200+
YEAR FOUNDED 1994
ORIGINS Entrepreneurial start-up

OTB designs, engineers, develops and manufactures in-line production equipment. The company has patented technologies in the areas of ultra-fast deposition of thin film, injection moulding, inkjet printing and in-line automation. These technologies can then be integrated into tailor-made manufacturing solutions.

OTB has three main divisions. OTB Display offers integrated equipment for the manufacture of full colour organic light-emitting diode (Oled) displays which, through the integration of thin film encapsulation and the elimination of the need for a clean room, reduce labour input and other costs. OTB Solar offers solar cell manufacturing equipment, which includes a breakthrough process for depositing a silicon nitrate anti-reflective coating on the emitter side of the cell. Finally, OTB Engineering looks at possible new businesses: one such area is ophthalmics, where the company's high-precision injection moulding processes may make it possible to mass produce lens-adjustable spectacles at a low price—with particular benefits for children in poorer countries.

Why the company is a pioneer

OTB applies a range of technologies to offer customers much more efficient manufacturing processes across a number of different sectors. These allow higher volume, lower cost, and more consistent output, thereby opening up new markets and applications.

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ENERGY/ENVIRONMENT TECHNOLOGY

Pentadyne Power Corporation

Mark E. McGough, President/CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 50
YEAR FOUNDED 1998
ORIGINS Entrepreneurial start-up

Flywheels have been used to store and regulate power flows for many years. Pentadyne has revitalised this proven technology, providing a long-lasting, low-maintenance, lightweight and environmentally friendly alternative to commonly used lead-acid batteries.

A flywheel is in effect a "mechanical battery" that stores energy kinetically in the form of a rotating mass. Pentadyne's patented technology reduces friction, the usual source of flywheel mechanical energy loss.

The system is small and low-maintenance and has a number of other advantages over batteries: the state of charge is known at all times, recharge is rapid, and the system's life is unaffected by the number of discharges. The company claims that the system will have paid for itself by the time of the first battery replacement in a battery-based uninterruptible power supply (UPS) system. The company's product was commercially launched in 2004, and has already been integrated into a large number of UPS systems of diverse market-leading manufacturers.

Why the company is a pioneer

Pentadyne's flywheel systems provide an appealing alternative to the use of batteries for power applications. One major use of a flywheel-based system will be to help energy utilities and end-users to ensure power quality and continuity in periods of power disruption. Other emerging applications include hybrid-electrical vehicles and energy recycling.

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ENERGY/ENVIRONMENT TECHNOLOGY

PowerGenix

Dan Squiller, CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 45
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

The theoretical advantages of nickel-zinc batteries have been known for some time. They can be up to 35% lighter than conventional nickel-cadmium or nickel-metal hydride batteries and up to 30% smaller. They are also more powerful, non-toxic and easily recyclable. However, problems associated with the instability of zinc have hampered their development. Previous batteries of this type have had problems with dendrite formation (a zinc outgrowth within the battery than can lead to short circuits) and also from changing electrode shapes over multiple charges and discharges.

PowerGenix has solved the technical problems associated with nickel-zinc batteries, allowing their practical use in a number of applications. Using both a patented electrolyte and a patented electrode composition, PowerGenix has eliminated issues of dendrite formation and shape change of the zinc electrode. The result is a small battery with low internal resistance and higher voltage than nickel-cadmium batteries, enabling significant space and cost savings. Obvious applications include power tools, high-drain military equipment, consumer 1.5v alkaline battery alternatives and emerging light electric and hybrid vehicles.

Why the company is a pioneer

PowerGenix has addressed the problem of zinc instability in conjunction with performance optimisation, whilst retaining the fundamental advantages of the nickel-zinc battery. PowerGenix has also managed to adapt nickel-cadmium/hydride battery manufacturing techniques to suit nickel-zinc batteries.

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ENERGY/ENVIRONMENT TECHNOLOGY

Seahorse Power

James Poss, President/CEO
LOCATION Massachusetts, USA
NUMBER OF EMPLOYEES 13
YEAR FOUNDED 2003
ORIGINS Entrepreneurial start-up

Rubbish collection and disposal is an expensive, energy-consuming activity. Seahorse uses solar cells to produce a cordless system enabling rubbish compaction at the point of collection. This reduces the frequency with which rubbish needs to be collected by a factor of four or more.

The BigBelly system—which looks like a mailbox with its legs cut off—can be deployed anywhere, eliminating the need for wiring associated with conventional compaction technology. Solar cells charge a 12v battery in the unit, providing compaction in any weather conditions and a reserve that can last a couple of weeks without sunlight. It is easy to remove the rubbish bag from the bin, and the unit is sealed to prevent smells.

The system is low maintenance: the battery will probably need to be replaced and recycled only once every four years. It is made of galvanised steel to protect the solar panel from impact, vandalism and graffiti. In future, it will be possible for the bin to send a text or wireless message indicating when it is full, enabling further route and scheduling efficiencies.

Why the company is a pioneer

The BigBelly system uses an innovative approach to enable significant savings to be made in the frequency and cost of rubbish collection, with associated environmental benefits.

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ENERGY/ENVIRONMENT TECHNOLOGY

Ultra Motor Company (UMC)

Joe Bowman, CEO
LOCATION Liverpool, UK
NUMBER OF EMPLOYEES 35
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

UMC develops and manufactures electric vehicle solutions based on the company's proprietary technology—so-called "ultra motors", electric motors that can be integrated into the hub of a wheel. These motors can be interconnected to provide power to two, three or four-wheel drive vehicles without the use of complex sensors and controls.

The Ultra Motor technology is based on a new approach of DC motor design, which uses a built-in mechanism to convert direct current into alternating current without using electronic circuits. Effectively the motor receives direct current from the EV battery supply but operates as an AC synchronous polyphase electric motor. Additional centripetal forces captured by the design, which places the electromagnets at the edge of the circumference of the hub motor, contribute to torque amplification during starting and gradient-negotiation operations. The first ultra motors have been designed for use in bicycles and low-power scooters. The company has concluded a manufacturing and marketing agreement with Hero Cycles of India, the largest bicycle manufacturer in the world. Other ultra motor-powered products are under development, including a three-wheel commercial vehicle.

Why the company is a pioneer

Demand for cleaner and more efficient vehicles is rising fast. Ultra-motors offer the prospect of reliable, low-cost electric vehicles, reducing petrol consumption and benefiting the environment.

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INFORMATION TECHNOLOGY

Alfresco

John Powell, President/CEO
LOCATION Maidenhead, UK
NUMBER OF EMPLOYEES 40
YEAR FOUNDED 2005
ORIGINS Entrepreneurial start-up

Firms need to manage their electronic content. Enterprise content management (ECM) systems collect, manage, store and publish content from across organisations. Such systems also provide audit and review controls for regulation and compliance purposes.

Alfresco is unique in producing a full ECM system based on open source software. This provides an integrated suite of document management, records management, image management and web content management. The advantages of using an open source software approach are manifold. Most obviously, open source enables the system to be continuously tested by the on-line community and distributed at a very low price.

Alfresco has also introduced a modern, leaner, "aspect-oriented" style of architecture to ECM systems that allows greater performance, reusability and ease-of-use. The system is as simple to use as a shared hard drive, with underlying rules that govern how documents are stored, handled and audited.

Why the company is a pioneer

Alfresco's open source model provides an innovative and cost-effective approach to the growing enterprise content management market, enabling more rapid development at a much lower total cost of ownership than proprietary systems. Alfresco already has a number of major clients for its ECM system, including eTrade, the US Department of Homeland Security, the UK Ministry of Defence, McGraw Hill, Boise Cascade and two top ten global investment banks.

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INFORMATION TECHNOLOGY

BridgePort Networks

Mike Mulica, President/CEO
LOCATION Illinois, USA
NUMBER OF EMPLOYEES 55
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

BridgePort Networks is a specialist in the field of fixed-mobile convergence, a service that enables mobile phones to move seamlessly between a mobile network when outdoors and a broadband network when in the home or office.

The company's NomadicONE software product provides single-number service over multiple types of access networks—cellular, cable, DSL and Wi-Fi. Applications include dual-mode handover, whereby ongoing voice calls can be transferred between circuit-switched cellular and Wi-Fi access networks. Designed to enable users to place and receive calls and messages from their PC or laptop using their mobile phone numbers, the MobileSTICK application is housed in a USB key, contains an embedded SIM card, and can be branded by the service provider. It links back to the NomadicONE software in the core network which converges the mobile network with the internet.

In May 2006, BridgePort launched a developers' programme. A particular focus is the testing and the certification of the interoperability of cellular/WiFi converged handsets.

Why the company is a pioneer

BridgePort's NomadicONE product enables easy integration of conventional mobile phone and voice over IP (VoIP) services. Mobile subscribers can receive mobile services over a broadband connection and integrated providers can offer converged services that bring together mobile and VoIP services in one bundled offering.

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INFORMATION TECHNOLOGY

Cicero Networks

Ross Brennan, Co-founder/CEO
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NUMBER OF EMPLOYEES 22
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

The proliferating number of wireless networks, combined with the increased use of VoIP systems, makes possible the delivery of a new range of wireless-based voice and media services. Cicero Networks supplies wireless VoIP solutions enabling telecommunication service providers to deliver fixed mobile convergence services.

With a single mobile device, Cicero users can use public hotspots not only to make low-cost calls, but also to connect to their office networks. They can also connect to their office phone systems and make voice calls over their domestic broadband systems.

Two products make this possible. CiceroPhone is a converged softphone that supports VoIP, Fixed, Cellular and PBX calls on a single mobile handset. When the customer makes a call, CiceroPhone registers with a network, authenticates the user, and then uses this ID and that of the person being called to select the most appropriate gateway for the call. CiceroController, the server-side product, enables seamless in-call roaming across Wi-Fi and Cellular networks.

Why the company is a pioneer

Cicero offers an easy way for customers to make calls cheaply using wireless networks, and for operators to increase revenues by offering new converged services. Uniquely, CiceroController does not require access to a Mobile Switching Centre (MSC) to deliver converged services.

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INFORMATION TECHNOLOGY

comScore Networks

Magid M Abraham Co-founder/CEO
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NUMBER OF EMPLOYEES 360
YEAR FOUNDED 1999
ORIGINS Entrepreneurial start-up

More than ever, companies need reliable information on how consumers use the Internet. comScore supplies such digital market intelligence through massive proprietary databases built up by continuously monitoring a panel of around 2m Internet users who have given comScore permission to capture their browsing and transaction behaviour, including online and offline purchasing.

comScore has been innovative in both how it collects data and how it uses it. Panellists were rewarded with free software gifts rather than cash incentives, greatly reducing the costs of building up the survey size. Patented software allows the capture of necessary information from secure web pages. Use of modular generic servers has allowed a massive, low-cost "data warehouse", now ranked amongst the world's 15 largest databases. New and innovative statistical methodology has also eliminated possible biases from the non-random panel recruitment.

Why the company is a pioneer

With more than 2 million participants under continuous measurement, the comScore panel is the largest consumer panel of its kind. It allows comScore to provide a unique view of global Internet usage trends. comScore's Internet measurement service is now complemented by a range of other web services, many with powerful predictive abilities.

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INFORMATION TECHNOLOGY

Drishtee

Satyan Mishra, Managing Director
LOCATION Uttar Pradesh, India
NUMBER OF EMPLOYEES 148
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

India is still a rural country: around two-thirds of its population live in 600,000 villages, accounting for around one-third of GDP. This important future market for consumer goods and essential services is difficult to reach, however, thanks in part to problems with information flows.

Drishtee is a rural network for delivering information and services to villages, using an electronic information kiosk, or Drishtee Soochnalaya. The kiosks are run by locally-selected entrepreneurs who charge residents for access.

The kiosks are designed to be easy to use and have multiple applications. For example, a farmer in dispute or waiting for a response from any government department can make his complaint through the Drishtee system. Other uses abound: the kiosks can provide computer literacy and usage programmes to villagers, or give local artisans better market access through Drishtee's e-commerce portal, for example.

The kiosks have multilingual content and allow data modification at the user end. They have applications centralised on the server (thereby avoiding installation problems) and administration mechanisms allowing usage and quality monitoring.

Why the company is a pioneer

Drishtee both simplifies the provision of information to inaccessible villages and provides new commercial opportunities to rural entrepreneurs. So far the company has installed more than 1,000 kiosks in nine different Indian states.

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INFORMATION TECHNOLOGY

Dust Networks

Joy Weiss, President and CEO
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NUMBER OF EMPLOYEES 50
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

The next wave of the information revolution—wireless sensor networks—promises to have a profound impact on our interactions with the physical world by enabling more extensive monitoring and control.

Sensors and actuators are already widely used in industrial and building automation applications to measure physical parameters such as temperature, pressure, and occupancy. To date, however, the deployment of sensors and actuators has been limited by the cost of installing, connecting, and commissioning sensors. Wireless sensor networking technology reduces the cost of acquiring sensor data by as much as 90%.

Dust Networks provides ultra low-power, reliable wireless mesh networking system-on-chip (SoC) products to companies bringing sensing and actuating solutions to market. Commercial applications enabled by Dust Networks' technology include industrial automation (such as wirelessly monitoring temperature, pressure, and tank levels in an oil refinery), energy management (retrofitting a commercial building to monitor temperature and daylight levels to save energy, for example), environmental management (wirelessly monitoring pollutants in smokestacks), and security.

Why the company is a pioneer

Dust Networks' wireless technology is the first to remove all of the principal barriers to the widespread deployment of cost-effective wireless sensor networks, enabling truly battery-operated wire-free operation while providing wire-like reliability.

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INFORMATION TECHNOLOGY

HelloSoft

Krishna Yarlagadda, President/CEO
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NUMBER OF EMPLOYEES 170
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

HelloSoft offers voice over IP (VoIP) technology for running multi-mode communications devices on converged networks. As well as improving battery life (most importantly for energy-hungry dual-mode phones, which switch between cellular and Wi-Fi networks), the company's software allows for low-cost IP phone designs, high voice quality, good overall quality of service, and efficient call-switching.

The company's approach is to allow the whole VoIP stack to run on single RISC processors. Because of this RISC-based approach, HelloSoft's VoIP software suite manages to provide a wide range of features whilst having the industry's smallest "footprint" in terms of memory and processing resources.

HelloSoft's VoIP is available for a range of operating systems, and is operating system "agnostic". The technology is field-proven and licensed by major semiconductor manufacturers and ODMs/OEMs. HelloSoft also provides software for VoIP gateways, and a device framework that allows for the rapid development of new revenue generating services (like voice call continuity) on both wired and wireless devices. In October 2006, Wistron licensed HelloSoft's VoIP technology to provide the first commercially-deployable GSM/WiFi dual mode phone.

Why the company is a pioneer

HelloSoft's single RISC processor based technology results in functional and flexible VoIP communications devices which consume energy more efficiently and can be delivered to market quickly and at low cost.

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INFORMATION TECHNOLOGY

IceMobile

Ralph Cohen, Founder/CEO
LOCATION Amsterdam, the Netherlands
NUMBER OF EMPLOYEES 25
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

IceMobile creates, develops and distributes mobile entertainment services, and develops technology and concepts to allow mobile phones to broadcast video images live to TV, the web, or other mobiles.

The company already publishes mobile entertainment content on the portals of over 30 European mobile operators, and also makes its mobile-marketing experience available to firms. The company is now developing its Videocall2 technology, which allows a mobile phone user to make 3G video calls in real time. The technology is particularly well suited for TV broadcasters, as it allows viewers, commentators and reporters to broadcast live video to TV directly from their mobile phones. Videocall2 also provides a two-way service (for example, the caller can see the TV studio).

The first application of Videocall2 has been in the entertainment industry: the Black Eyed Peas used the system to make videos of their recent tour and broadcast live to their website. The technology could also be used for mobile news reporting, and also has possible healthcare and social support uses (for example, a helpdesk that uses the technology to guide a blind person holding a phone).

Why the company is a pioneer

IceMobile's Videocall2 technology uses mobile phones to change the way in which people interact. It enables broadcasters to create TV shows around user-generated content, while a "pay per minute" billing function could also create new revenue streams for the entertainment industry. In addition, there are a range of potential social applications.

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INFORMATION TECHNOLOGY

MobiTV

Dr. Philip Alvelda, Chairman/CEO
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NUMBER OF EMPLOYEES 200
YEAR FOUNDED 1999
ORIGINS Entrepreneurial start-up

The demand for mobile television is growing fast—downloads of branded content in the US may grow by 60% this year, and the numbers visiting user-generated video sites (such as MySpace) are rising dramatically.

MobiTV allows a phone, PC or mobile device to become a portable TV. The service operates through the customer's wireless carrier or broadband provider, and offers a range of popular channels. The service already has more than 1m paying subscribers in the US, Canada, UK, Latin America and elsewhere. Most content is live network content, while some pre-recorded clips or highlights are packaged and delivered in a linear or streamed format. The technology promises to improve interaction between broadcasters and consumers, and will also boost m-commerce, voting and other useful interactive features.

MobiTV supports a range of technologies, including DVB-H, WiMAX and mobile WiMAX. The company has already demonstrated that HDTV can be transmitted over WiMAX. MobiTV is also involved in trials of mobile TV provided through TDTv technology, which can use mobile operators' existing infrastructure.

Why the company is a pioneer

MobiTVs approach will allow highly targeted viewing and commercial content to be sent direct to the mobile user, and could also act as a gateway to other media devices.

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INFORMATION TECHNOLOGY

Mozilla

Mitchell Baker, President and CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 70
YEAR FOUNDED Aug. 3, 2005
ORIGINS Non-profit start-up

Mozilla Corporation makes two well-known products, which are available free-of-charge for Windows, Mac and Linux users in more than 35 languages. The Mozilla Firefox web browser is used by tens of millions of people worldwide, and has reinvigorated competition and innovation in the web browser industry. Mozilla Thunderbird is an e-mail client that has set the standard for cross-platform communications, with advanced junk mail filtering and other capabilities.

Mozilla does not see itself as a company in the traditional sense, but rather as a "global community and public benefit organisation". It works through a transparent and co-operative process as a wholly-owned subsidiary of the not-for-profit Mozilla Foundation.

The Firefox web browser now holds around 15% of the browser market. Firefox 2, released in October 2006, offers improved tab browsing (the ability to run multiple websites within one browser window), better searching and web feeds, and improved security features. Firefox 2 can also be easily customised.

Why the company is a pioneer

Mozilla is one of the most successful exponents of open source software, an approach that enables the company to leverage ideas and contributions from thousands of volunteer programmers and end-users.

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INFORMATION TECHNOLOGY

netomat

Alan Gershfeld, CEO/Co-founder
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NUMBER OF EMPLOYEES 18
YEAR FOUNDED 2001
ORIGINS Entrepreneurial start-up

netomat was originally conceived as a network based art project by Maciej Wisniewski, and was seen by close to a million people in more than 80 countries. The company was formed to build upon the conceptual vision and underlying technology of the art project, with the goal of enabling people to be easily connected to information and people regardless of network, device or location.

For businesses, netomat offers a platform enabling the rapid deployment of a wide variety of content and community services including rich media social networking, blogging, public/private groups, RSS syndication, messaging, presence, asset management, notification, polling, trivia, community and advertising—all of which work seamlessly across the web and mobile devices. Sample clients include the global game maker Electronic Arts, which is using the netomat platform to power a series of next-generation mobile/web/console content and community offerings.

For individuals, the netomat hub service offers content creators (e.g. bloggers or bands) the ability to quickly and easily make their content mobile, to monetise their content through advertising and transactions, and to build community around their content.

Why the company is a pioneer

netomat is committed to breaking down barriers to communication and enabling people to be connected to each other regardless of network, device or location.

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INFORMATION TECHNOLOGY

Omnibase Logic

Luther Hendrix, President/CEO
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NUMBER OF EMPLOYEES 5
YEAR FOUNDED 2005
ORIGINS Entrepreneurial start-up

Electronic circuits are still designed around binary logic—they are on or off. But there are advantages in using other bases or number systems; mainly because higher bases can represent a given number with fewer digits. While binary logic requires 8 places to represent 256 states, ternary (base 3) logic needs only 6 places to represent 729 states. Circuits that can support this kind of multiple-valued logic (MVL) provide higher data density and also need much less power. Other advantages that result from the use of MVL are higher performance, enhanced security, smaller chip sizes, lower production costs, and greater data storage and transmission capabilities. Sandisk, Intel and others already produce multiple level memories, but MVL exists only at the core of these systems – the data is immediately converted into binary. Omnibase believes that it is possible to implement a full MVL system, and is developing technology that enables enhanced logic elements to co-exist with binary logic elements in the same system.

Why the company is a pioneer

Omnibase offers the world's first MVL system for electronic circuits. The company's technology offers the prospect of smaller and more efficient electronic circuits,enabling the demands for higher chip performance and functionality to be met with existing process technology.

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INFORMATION TECHNOLOGY

Ruckus Wireless

Selina Lo, President/CEO
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NUMBER OF EMPLOYEES 57
YEAR FOUNDED 2004
ORIGINS Entrepreneurial start-up

Ruckus Wireless develops wireless customer premise equipment (CPE) for broadband operators specifically designed to extend reliably next generation digital (triple play) broadband services throughout the home. Its innovative MediaFlex NG product is currently the only system capable of supporting the distribution of emerging multicast IPTV and high definition TV throughout the home over standard 802.11a/b/g technology.

Consumer-based Wi-Fi systems radiate signals in all directions and simply focus on enabling faster data speeds. Ruckus technology focuses on increasing the reliability and range of Wi-Fi. Its Beamflex technology points Wi-Fi signals toward end-points, proving a stronger signal that can reach three to four times further than conventional Wi-Fi systems and can be automatically steered around interference as the environment changes. Other patented technologies allow better traffic handling and remote service management.

Ruckus is working with a number of consumer electronics companies who are integrating the technology in their own multimedia products, and has developed a partnership with NETGEAR, which is licensing the technology. In the last year, Ruckus Wireless has signed up some 50 broadband operators around the world. Ruckus products are now installed in over 100,000 subscribers' homes.

Why the company is a pioneer

Ruckus Wireless's MediaFlex NG system provides a more reliable and powerful way of distributing multimedia content wirelessly throughout the home.

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INFORMATION TECHNOLOGY

Sling Media

Blake Krikorian, Co-founder/CEO
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NUMBER OF EMPLOYEES 100
YEAR FOUNDED 2004
ORIGINS Entrepreneurial start-up

Despite growing demand for multimedia in the home, accessing services still requires consumers to learn how to use new and often complex technology. Sling Media's approach to this problem uses the device already at the centre of every home—the TV—to make access to multimedia simpler and more cost effective.

Sling Media's Slingbox is a device that allows consumers to access their living room domestic TV from any location (internet connected computers, PDAs or smartphones) when used in conjunction with the SlingPlayer PC or SlingPlayer Mobile software packages. SlingLink adapters allow consumers to easily connect a Slingbox to a home network should the TV and Internet connections be in separate rooms.

In order for the system to work effectively, the SlingPlayer software monitors bandwidth availability and capacity and also replicates the home TV experience in terms of controls, sound-effects and so on. The Slingbox is relatively cheap (US$179-$249) and operates completely independently of home computers. Slingbox has been shipping since mid-2005.

Why the company is a pioneer

The Slingbox is an easy to use, affordable consumer device that could help change the way that consumers access media. By enabling users to access multimedia through a familiar TV interface, Sling Media's approach promises to make multimedia services available to a broader, less technology-savvy audience.

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INFORMATION TECHNOLOGY

Technorati

David L. Sifry, Founder/CEO
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NUMBER OF EMPLOYEES 35
YEAR FOUNDED 2002
ORIGINS Entrepreneurial start-up

Online blogging, and other forms of "citizen media", is experiencing explosive growth, but ensuring that user-generated material can be found easily on the web is not easy. Bloggers and other producers of citizen media may not need conventional publishers, but they still need electronic assistance to ensure that their output is discovered, seen and shared.

Technorati is a real-time online search engine that monitors blogs (it is currently tracking more than 59 million) and ensures that blog posts, and other forms of citizen media, can be found instantly. Users are put in charge of their own data and content distribution. By using tags to assign categories, the technology makes citizen media shareable and easier to access on the web.

Technorati provides its users with up-to-the-minute information about the topics and publishers that most interest them. Firms can use the system to find out quickly exactly what is being said about them on the web.

Why the company is a pioneer

With over 175,000 new blogs and 1.6 million posts appearing on the web each day (along with many more videos, podcasts and the like) there is a growing need for a powerful tool to track and organise citizen-generated media. Technorati helps bring order to user-created material on the web to the benefit of firms and individuals alike.

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www.technorati.com

INFORMATION TECHNOLOGY

The MicroOptical Corp

Mark B. Spitzer, Founder/CTO
LOCATION Massachusetts, USA
NUMBER OF EMPLOYEES 40
YEAR FOUNDED 1995
ORIGINS Entrepreneurial start-up

Head-up displays (as used by fighter pilots) are an appealing concept, but making them practical and affordable for other applications has previously proven difficult. MicroOptical has succeeded in producing eyeware that incorporates LCDs, audio and electronics and that enables users to see a video display within glasses, all at a price of around US$299.

To make this possible, MicroOptical has developed a technique to mould optical plastic into unusual forms. This makes it possible to bring an image to the eye from the eyewear "temple", which is situated to the side of the glasses so it does not impede vision. The solid optical relays used to do this are transparent and lightweight, giving them two great advantages over the tubes used in previous attempts at glasses.

The technology has both consumer and professional uses. A surgeon could use these glasses to provide a read-out of vital information during an operation, without having to move his head, or a teenager could use them to provide a larger image from small consumer LCD screens.

Why the company is a pioneer

MicroOptical's technical advances could make head-up displays an affordable consumer reality. By incorporating LCD and audio into lightweight eyeware, the company's technology could also vastly improve the way consumers and professionals enjoy multimedia content in a mobile environment.

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INFORMATION TECHNOLOGY

ThingMagic

Yael Maguire, Co-founder
LOCATION Massachusetts, USA
NUMBER OF EMPLOYEES 60+
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

RFID (radio frequency identification) tags have long been touted as the next great innovation in stock control. But problems with the tags' cost, and worries about RFID systems' upgradeability and other factors, have so far held back take-up of this technology.

ThingMagic develops RFID readers, sensors and computing technologies worldwide. The company's Mercury4 readers are used widely, and a Mercury5 fixed reader is due to be launched soon. The company's RFID tags are unique in that they are remotely upgradeable for any future RFID standards. They are also programmable by any user, use TCP/IP natively and fully support a range of network technologies. Such "agile readers" (versus the standard "dumb terminals") ensure a low total cost of ownership and remove the risk of obsolescence. The system is highly reliable, even in difficult environments with multiple interference sources.

ThingMagic has already won a large contract from the UK retailer Tesco. Products are supplied through manufacturing licensees, OEM partners, resellers and integrators.

Why the company is a pioneer

ThingMagic's smart "agile readers" are already improving industry take-up of RFID products. The remote upgrade feature will allow companies to keep pace with emerging RFID standards, without the expense of having to replace RFID readers and technologies.

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INFORMATION TECHNOLOGY

Transitive

Robert B Wiederhold, Chairman/CEO
LOCATION California, USA
NUMBER OF EMPLOYEES 80
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Computer software tends to last longer than hardware: it has a lifecycle of perhaps 10 or even 20 years, compared with 1-2 years for hardware. This causes headaches in the IT industry: computer software has to be "ported" (adapted) for new hardware. But this is expensive and time-consuming, with the result that much software is left to run on out-of-date hardware.

Transitive can instantly translate software for operation on another hardware platform. The system works with a Dynamic Binary Translator that can read and operate the source code before generating code for the target processor, an operating system mapper and an Integration FUSE used to build bridges between translated code and that code already running on the target platform.

QuickTransit is now shipped with all Apple Macintosh computers (as part of Apple's strategic redesigning of its computers to use Intel chips) and with Silicon Graphics Prism visualisation systems and Altix supercomputers. Transitive has also partnered with IBM, and a new series of QuickTransit products has been announced for the enterprise IT server market.

Why the company is a pioneer

QuickTransit will allow companies to insulate software from major changes in computer hardware with minimal disruption. The technology removes the need to rewrite applications for new hardware environments, and therefore significantly reduces the cost and effort of migration.

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INFORMATION TECHNOLOGY

Truphone

Alexander Straub, Co-founder
LOCATION Kent, UK
NUMBER OF EMPLOYEES 23
YEAR FOUNDED 2000
ORIGINS Entrepreneurial start-up

Truphone has developed a software infrastructure that allows normal, GSM mobile phones with WiFi to make calls and send text messages using just WiFi and the Internet. When a phone is out of WiFi range it then switches back automatically to the mobile network.

This makes Truphone the world's first software-only network operator. The system is built almost entirely on open source technology, and open standards. The SIP (session initiation protocol) system uses a real time transport protocol to deal with address translation used by firewalls, and to deal with transmission to public switched telephone networks.

In addition to offering the prospect of free VoIP calls, Truphone also provides communication where traditional cellular coverage does not work. The WiFi technology may also allow new services to be delivered to mobiles.

Truphone aims to be available on the widest possible range of handsets. First deployments are on Nokia's N-series consumer phones and E-series for enterprise users, with other mass market WiFi phones soon included.

Why the company is a pioneer

Truphone's software-based approach makes it easy for customers to enjoy the benefits of Voice-over-IP, with normal mobile networks as a back-up. In particular, by routing calls over the internet rather than via traditional mobile operators, Truphone can save users money on mobile calls.

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The Technology Pioneers programme is run by the World Economic Forum with guidance from BT, Deloitte Touche Tohmatsu and Accel Partners. BT Group Chief Technology Officer, Matt Bross would like to recognise these two strategic partners. "Organisations can stay ahead in a crowded fast moving market place by harnessing innovation globally to create new products and business efficiency."

"The Technology Pioneer programme is critical to the continuing vitality of the World Economic Forum. Given the rapid rate of technology change on a global scale, it is important to all members to have a view of what is changing. The Technology Pioneers represent the best of this change. To keep this in perspective it is important to remember that when the Forum itself was started, today's technology leaders such as Microsoft, Dell and Cisco were not yet in business themselves. We know that this year's representatives do have the ability to help improve the state of the world," said Joe Schoendorf from Accel Partners, USA.

Deloitte Touche Tohmatsu proudly supports the Technology Pioneers Program of the World Economic Forum and is honored to have professionals from the Deloitte member firms participate in the identification and selection of Technology Pioneers. Over the years, the quality and vision of these companies has been impressive.

"It's easy to assume that most of the important innovation happens here, in North America," explains Ed Moran, Director of Product Innovation in DTT's Technology, Media & Telecommunications Group and a Firm Director with Deloitte Services LP. "But one only needs to look at the winning companies to realize that innovation is exploding in all corners of the globe."

Deloitte.

ACCEL

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