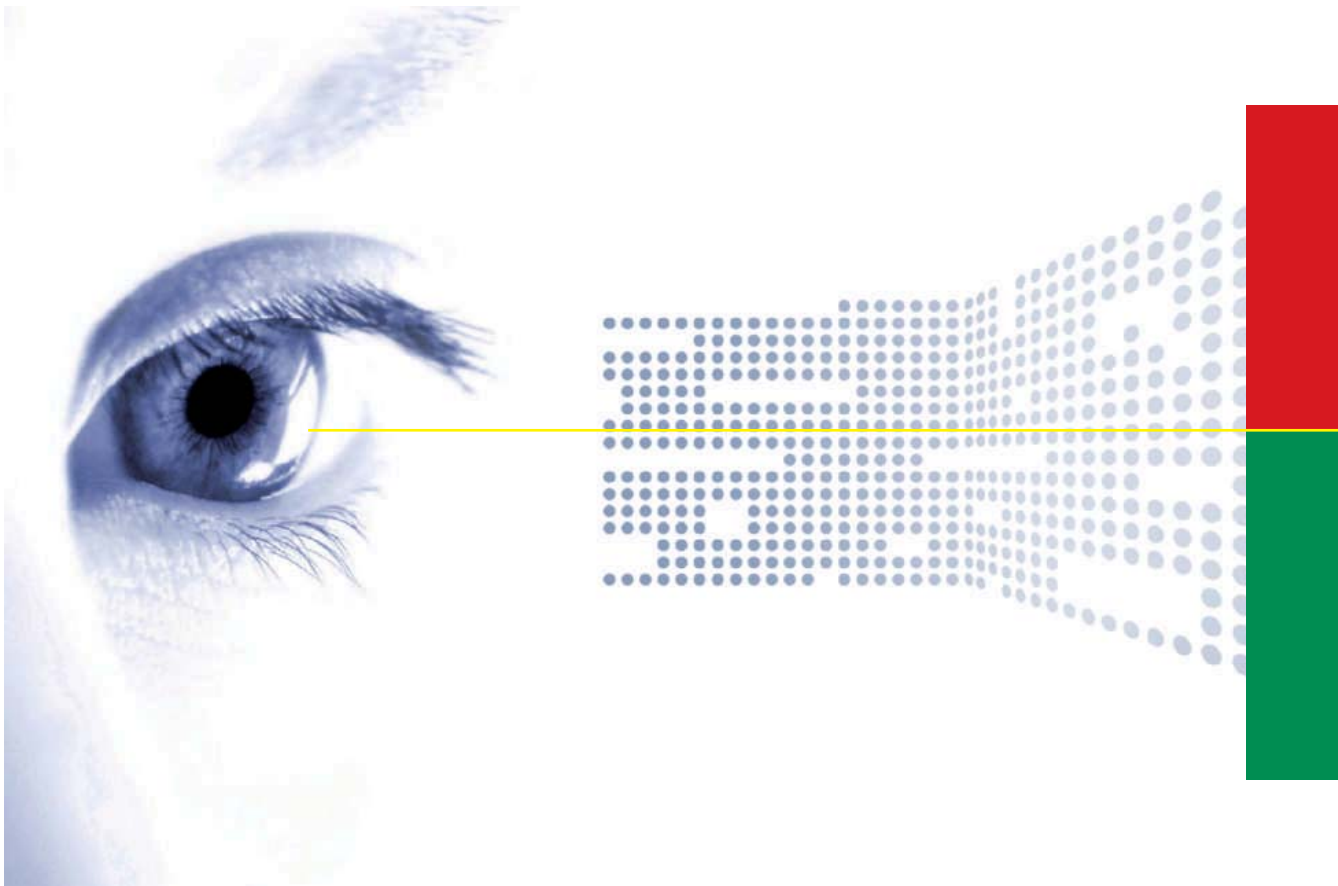


# Brains at work



## Portugal in the age of technology

**AS ITS ECONOMY MATURES, PORTUGAL IS INCREASING EXPENDITURE IN R&D TO UNLEASH CREATIVITY. A TECHNOLOGY PLAN AND AN INVENTIVE PRIVATE SECTOR HAVE GIVEN THE COUNTRY A NEW COMPETITIVE EDGE.**

In economics, accounting for technological inputs can be eminently unscientific. The stylized mathematics of Total Factor Productivity (TFP) considers the functions of labor, capital and technology. Economists tend to lump non-quantifiable factors into the 'technology' part of the equation: R&D, innovation strategy, creativity, patent registration, managerial know-how. Politicians then bandy the word around to trumpet their modernity. But in the world of international economics, where push comes to shove, technology hovers behind all indicators in the national accounts. For a small country like Portugal (pop. 10.4 million), the objective is to implement it at all levels.

Part of the formula will consist in cleaning up unresolved structural problems in the economy. Number one will continue to be budget deficit reduction to free up financial resources for R&D. The government has so far brought the excess down from 6% to 3.9%, which represents a new kickoff stage for hitching technology in top industries like petrochemicals, paper, tourism or renewable energy. Creating synergies around high-tech parks produces knowledge networks that eventually lead to business models. The next step is training the workforce from grade school to state labs. So far, policymakers see their role as enablers, aligning the best conditions at science parks, educational centers and markets for venture capital.

There is no doubt that this is a market-led initiative. Basilio Horta, president of the Agência para o Investimento e Comércio Externo de Portugal (AICEP) already has it down to a science.

“First we support investment in transnational goods. Second, we strengthen the innovative process. Third, we foster technology transfer. Fourth, we focus on educating the workforce. And fifth, we develop the small regional companies,” says Horta. The former OECD ambassador is conscious of the need to mobilize society and for him it is not so much a matter of political will as much as time lags. In the short-run, AICEP’s goal is to turn the country’s SMEs into international players. Horta says that about 90% of Portuguese companies are technically SMEs and he thinks 2,500 of them are already mature for globalization. Everything else points to a plain truth: Portugal is changing its habits.

“This is a very small country, a bit like Ireland. You must

itiveness ranking by the World Economic Forum (WEF), Portugal placed thirty-fourth out of 125 nations.

“For many years, our competitiveness was related to low costs. In a globalized economy, this has changed drastically. If we want to stay competitive we need to develop capabilities and sources of competitiveness that go beyond the old paradigm,” says Fernando Teixeira dos Santos, Minister of Finance. The domestic economy is already showing upbeat signs. Last year, exports began to increase sharply and for the first time there was a marked shift away from low-tech production to higher market niches. Real GDP, according to an IMF forecast, will rise to 1.8% in 2007, up from 1.3% last year. Inflation will continue its downward trend to 2.2%. VAT revenue is up and there has been a freeze on the automatic progression of salaries.

This is also the first time economic actors have aligned their interests in R&D. The new owners of capital speak perfect English and boast a global mindset. Foreigners are struck by the move away from traditionalist behavior. “I’m impressed by the way this government approaches the challenge. It’s a huge gambit for a country to swing around from practices entrenched over decades,” says Charles Buchanan Jr., the administrator of the Luso-American Foundation (FLAD). A former private-sector specialist with the US State Department, Buchanan thinks sealing official cooperation agreements with the likes of MIT, Carnegie Mellon and the University of Texas will bring technology closer to civil society. “It encourages people to think on their own, about what can be done at research centers here. In places like Minho and Aveiro huge efforts are being made to connect R&D with local business,” says Buchanan.

As President of COTEC, a non-profit business association that promotes innovation strategies, Artur Santos Silva believes that a more level playing field will prevent the crowding out of ideas in a country used to top-down approval. Also Chairman of leading bank BPI, he cannot help but think that taking decisions directly to



*A view of Lisbon from Parque Expo*

think in micro terms and economic size. For example, when we have investors coming in we deal with them on a very personal basis, a tailor-made approach that is not possible elsewhere. With five successful reforms and 20 business success stories, you can turn Portugal around,” says Manuel Pinho, the Minister of Economy and Innovation. For US firms, Lisbon can serve as the new gateway to Europe and Africa, as well as a triangulating entry point for the 190-million strong Brazilian market. Pinho wants to create the image of a country with a zest for innovation. “We have money for technology investments and export infrastructure. Globalization creates a lot of opportunities,” says Pinho, who has a particular interest in wind energy and biodiesel plants.

In an October 2006 IMF report, Portugal was shown to have a 10-20% competitiveness gap vis-à-vis its trade partners in the EU. One of the conclusions was that export growth had deteriorated in the 1990s because of low corporate investment in technology. Entry into the EU meant a fall in the country’s risk premium, which triggered a consumption boom that lasted until 2000. The sharp appreciation of the euro since 2002 has contributed to a widening of the current account deficit. The most distorting element, however, has been the jump in relative labor costs: it is the ultimate culprit in the loss of market share. Traditionally a producer of low-to-medium tech goods, Portugal has lost its competitive ground to regions with undervalued currencies, like China or some countries in Eastern and Central Europe. In a 2006 compet-

“Our challenge is to make room for this new generation of entrepreneurs flaunting a different mentality, a generation that is innovating in all areas and investing in the education of its workers.”

Artur Santos Silva, President of COTEC

the boardroom is a matter of common sense. “Our challenge is to make room for this new generation of entrepreneurs flaunting a different mentality, a generation that is innovating in all areas and investing in the education of its workers,” he says. One of the ratings for innovation is based on the percentage of workers that have undergone training in a single year. The numbers for Portugal have not yet reached their optimal level.

“Without investment, there is no innovation. If you study our economy, you’ll notice the missing factor is the contribution of

investment to GNP," says Santos Silva. But the numbers for 2006 are already showing an improvement, with projections for investment revised upward to 10%, according to the Ministry of the Economy. This is an impact of the government-led Technology Plan (TP), an attempt to

"We're innovating in order to change our competitive model. It's not just a political agenda, but more of a directive for private enterprise and universities."

Carlos Zorrinho,  
National Coordinator of the  
Technology Plan.

change the ways Portuguese companies rationalize investment. Widely seen as a market enabler, the TP has drawn out 112 directives to spread the mantra of R&D. The goal of the TP is to bring investment in technology up to 1% of GDP by 2009. From electronic billing to paperless hospitals, it entails a thorough streamlining of the public administration. Officials warn it is not a bunch of hype, either; the TP includes measures to evaluate its own progress.

This, after all, is the can-do country of the 55-minute company. Portugal made headlines in Europe last year for its *Empresa na Hora* scheme, whereby companies could register in that period of time after bypassing the usual red tape. According to Minister of Finance Teixeira dos Santos, both the UN and the European Commission found it to be one of the most innovative business initiatives of the year. It was also a clear indicator that the Portuguese administration was betting on modernization. "There is an effort to modernize the administration and alleviate its burden of bureaucracy. This, together with the improvement in infrastructure and IT, is critical," says Teixeira dos Santos.

"First of all, we're innovating in order to change our competitive model. It's not just a political agenda, but more of a directive for private enterprise and universities," says Professor Carlos Zorrinho, the national coordinator of the TP. One of the how-to challenges consists of finding a strategic fit with foreign universities. These days, they not only sell knowledge: their role is also to help the community create wealth. Portugal already has cutting edge R&D at universities like the IST polytechnic in Oeiras,

## "A strategy is about winning." Excerpts from an interview with Prime Minister José Socrates

Photo: Ricardo Oliveira



Elected in 2005 after two economic recessions and when the government budget deficit was at 6.85% of GDP, José Socrates understands the need for change. For him, knowledge is the new priority.

### **Why should a US-based company consider investing in Portugal?**

Companies wishing to take part in the global economy will find very good conditions here. Hiring a research scientist costs less than in the US, Finland or Germany and our scientists and engineers are very well trained academically. Also, if you look at an atlas, you will see that Portugal is at a confluence of many markets. Most important, though, is the fact that we have a system in place that satisfies the needs of entrepreneurs.

### **What is Portugal's 'Technology Plan' and how does it work?**

The Technology Plan (TP) is a framework to create knowledge, technology and innovation. It was, and still is, Portugal's most modern and updated political strategy. We need to convince people that the priority for our country is knowledge. We need to learn and become more qualified.

### **What has the TP achieved in the last two years?**

Ten months ago, companies were forced to keep accountancy books that went back to the 19th century. Now, a company only needs to keep a single book. This is a simplification that leads to better regulation. The idea for *Empresa na Hora* (Company registration in less than 1 hour) has been one of the most innovative projects in Europe. Last year, 48% of all companies in Portugal were constituted in less than 55 minutes. Another principle of the TP is to create an environment that places a premium on risk-taking behavior. The TP has already instituted changes in our society creating a sense that we are moving ahead. According to the World Bank's competitiveness yearbook, Portugal has climbed one or two points in the index.

### **Public spending in R&D has increased by 64%. What is being done to boost corporate investment?**

The first step is for state funds to reinforce private spending on R&D. Secondly, we are working with companies to help them account for all of their R&D investments. In Portugal we have some of Europe's best companies in the car-making, petrochemicals and paper pulp industries. It's impossible for them to compete globally without an R&D policy. Of course, the results won't show up in one year alone. The most important thing is to follow a strategy and stick to the plan. A strategy is about winning. That's exactly what we're trying to do with our economy.

### **What lies ahead for Portugal?**

My duty in the last two years has been to put the house in order and pass structural reforms that can instill confidence. We have to get the economy going by investing in skills and qualification. It is difficult to do simultaneously, but we need to keep this strategy up over the next 10 to 15 years. About 37% of the 21.3 billion euros (approximately \$28 billion) in EU structural funds will be invested in education and training. In the previous period the figure was 25%. Of course the public works sector, such as roads and bridges, will suffer from the fund restraints. But that's politics: choosing where you put the money. My duty is to have a clear strategy.

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outside of Lisbon. “We have strong examples of excellence, but they are not really structural. We need to disseminate those examples through the educational system. The Portuguese are very creative, but they need to be more rigorous,” says Zorrinho.

In a twist, the state bureaucracy is beginning to set an example about ways to improve the business framework. The TP is an opportunity for Portugal’s administration to see itself as a competitive weapon, rather than a constraint. With new data architecture, it has



*Basilio Horta, President of AICEP; right, Artur Santos Silva, President of COTEC*

eliminated more than 300 procedures. Although there is a real consensus in Portugal, oddly enough it is in the private sector where divisions are still patent. Some SMEs are modern, vibrant and adaptable. They do not bat an eye when asked to work with university professors. The problem is the other kind of enterprise, the more stolidly traditional one based on a surviving monopoly. “We’re prepared to use the EU cohesion funds, which run from 2007 to 2013, to help them change. Public policy is designed to make them move, but they must have the will to do so,” says Zorrinho.

“I think the TP is very good. But the most important thing is people. It is all very well to follow the example of Finland, but let’s not forget that the Nordic countries invest a great deal in education,” says Mario Costa, the General Director of Select Vedior,

a multinational human resources group. Costa would like to see more concrete measures. If the ultimate goal is economic success, then the government should be prepared to train both the young and old in the new context that lies ahead. Costa is referring to a change in the operating system, the only lasting formula to do away with Portugal’s comfortable conservatism. “The younger Portuguese business people are going abroad, but when they return sometimes they stop thinking because the bureaucracy thinks small. If you want the TP to work, you need to change that,” says Costa.

The Portuguese thinking machine needs guidance. At Select Vedior, Costa works with 14 different divisions. One of them, New Boston Select, consists of 6-month internships for college students at IT projects. It works like a trainee program in which the government provides fellowship money and the individual companies



put their share. For Costa, it is important that young people understand that life is not a gravy train. It is about acquiring skills and being productive. Costa speaks of his 360 employees in Portugal as a learning franchise. “I provide a lot of training and never expect anything from the government. The incentives are always very clear,” he says.

As in any formula, an increase in TFP in Portugal will be a combination of factors. So far, the TP has mobilized energy. And for a knowledge-based economy, that kind of cohesion goes a long way.



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# Charting the knowledge economy

PORTUGAL HAS EMBARKED ON A NEW AGE OF DISCOVERIES. BUT THIS TIME IT INVOLVES PATENT FILINGS, SCIENCE INSTITUTES AND VALUE CREATION AT INDUSTRIAL PARKS.

Prince Henry the Navigator (1394-1460) was a farsighted patron. From his observatory in Sagres, he charted the waters for Portuguese ships sailing south to the Gulf of Guinea. With the skills of cartographers like Jehuda Cresques, he sponsored voyages into the unknown, furthering scientific methods along the way. Borrowing from the Arabs, Prince Henry's caravels adopted the maneuverable lateen sail which made inshore surveying possible. In the end, his expeditions also served to open new trade routes for Portugal's merchant marine.

Today, the astrolabe of late-medieval navigators is a museum piece. Mapping and surveying is done via GPS and it too has become a tool to enhance economic competitiveness. For Mariano Gago, Minister of Science, Technology and Higher Education, knowledge is an instrument that can help reposition Portugal in the world economy. Portugal's research labs are partnering with universities in the US to broaden their horizon. Gago thinks joint projects will encourage private companies to work proactively with academics. For 2007, the Ministry of Science has raised the budget for R&D at industrial parks, turning them into an affordable platform for SMEs.

"Research institutions are not only important for higher education. Part of their mission is to involve companies in industry and financial markets," says the Minister. So far, Portuguese centers of higher learning have signed agreements with MIT, Carnegie Mellon and the European Space Agency. The Instituto Tecnológico e Nuclear (ITN) shares professionals with the French-based Commissariat à l'Energie Atomique (CEA), while the Instituto Meteorológico (IM) is gaining an edge on climatology via the European Center for Media Weather Forecast (ECMWF). "What we want from institutions like MIT is their brains in conjunction with ours," says Gago. The number of young scientists with PhDs has increased by 10%, he says.

Policymakers are after risk-taking behavior and sophisticated investment. Portugal, at 39 N, 8 W, is ideally positioned to serve as a hub for the Americas, Europe and Africa. The government-sponsored Technology Plan (TP) is an effort to make the country and the economy permeable to knowledge. Formally presented in July 2006, it sets an agenda to mobilize society, make up for the ICT lag, qualify the workforce and upgrade equipment. There are 112 goals in the TP, 79% of which have already been attained, according to a 2006 paper by the consultative council on technology.

"Our aim is to bring investment into R&D to 1% of GDP by 2009. That is something the government can manage," says Gago. With the added resources, Portugal will get rid of red tape, improve education, implement ICT in the public administration, foster a domestic R&D network and create scientific nodes to reinforce the tandem between universities and the private sector. To date, examples of state-sponsored programs include e-commerce platforms for SMEs, incentives for electronic billing and the posting of industrial property online. The business framework will also be a key factor. When firms have full access to broadband from places like Sagres, it means Portugal will have come around 360°.

Ingenuity will be the fiercest ally for a resource-poor nation like Portugal. In the new era of R&D, protecting the country's intellectual property (IP) will be in the hands of people like Antonio Campinos. As President of the Instituto Nacional da Propriedade Industrial (INPI), Campinos tracks industrial applications for all sorts of inventions. INPI was set up by decree in 1998 to protect Portuguese patents, trademarks, names, company logos and certificates of origin, among others. Its mission is to reinforce competitiveness by securing an efficient IP framework. Through its directorate of international affairs, INPI also facilitates the flow of

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scientific ideas. The institute is fully certified by ISO:9001. For Campinos, who has given countless seminars from the European mainland to far-flung islands in the Azores, a patent is an asset.

“We need to increase the filing of IP rights and the number of European trademark filings. For the last 30 or 40 years, Portugal has had the same average number of patent filings. We need to transform these patents into assets because in a global economy, that is what they are,” says Campinos. INPI is facilitating the filing of patents to make up for the dearth of locally registered trademarks. Portugal has a mere 200 national patents each year, a low number in comparison to other Eurozone countries. However, since the TP objectives have become public, the number has grown by 20%. This is also the first time patents are being filed by university departments, as opposed to people working out of their garage. With an efficient system in place, he is convinced foreign investment will begin to pour in. But are the changes indicative of a mentality shift?

According to Campinos, sharp companies will always be the best actors in the IP scene. If they manage to turn profits by working in tandem with college research departments, the TP is on a roll. “Universities must spearhead the changes in patenting. They are the ones with the knowledge and the dimension that Por-



José Miranda, President of ISQ

tuguese firms simply don't have,” says Campinos. That said, much of the task is up to college deans who have to assume risk and invest in cutting edge technology. Engineering professors need to engrain the idea among their students that industrial solutions can easily be turned into business applications. INPI works the business angle by joining forces with the Instituto de Apoio às Pequenas e Médias Empresas (IAPMEI). One of their most successful ventures has been the GAPI (Gabinete de Apoio à Promoção da Propriedade Industrial), a scheme introducing innovative

ideas to the SME sector. The objective is to extend the patent system to Portugal's network of industrial parks.

“The idea of a network is essential for Portugal,” says Campinos. INPI preaches what it says. Fully wired, it won national prizes in 2004 for implementing an IT system that provides features like advanced phonetic searches for trademarks, a world premiere. Designed by Portugal's publicly listed Novabase, the INPI web site ([www.inpi.pt](http://www.inpi.pt)) provides free public access to its database. According to Campinos, the portal gets an average of 3,000 hits per day. All patent files are digitized, as well as trademarks and design copyrights. By June 2007, the head office in Lisbon will be fully paperless. And by the end of the year, INPI clients will be able to file for patents electronically. Campinos expects 70% of patent filings to

**Cutting to the core**

The **Technological and Nuclear Institute (ITN)** is a state laboratory under the Ministry of Science, Technology and Higher Education endowed with scientific, administrative and financial autonomy.

The primary driving force of the ITN is to play a strategic role in the areas of protection and safety, technical training and human resources, research, cooperation and services to the community in the sphere of nuclear sciences and technology, increasing its role as a national and international reference laboratory.

The ITN can establish partnerships with companies and entrepreneur associations, to strengthen innovation and creativity in the private and public sectors, or to promote the application of technology.



[www.itn.pt](http://www.itn.pt)

X-Ray of detail of 17th century ceiling painting in São Roque Church, Lisbon

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take less than four months by next January.

TP or not, Portugal can no longer afford a technology gap. After entering the European Union in 1986, much of the investment that should have gone to bridge that gap was redirected to Eastern Europe. New drivers are needed to make up for the lost opportunities. José Miranda, President of the privately run Instituto de Soldadura e Qualidade (ISQ), thinks it all boils down to political will—and transfer of knowledge.

ISQ pitches itself as a technology network. Its staff of 800 engineers helps link up Portuguese entities with outside markets in construction methods, workplace safety, environment, metrology and electricity. It all began in 1965 as a humble welding institute. Today, ISQ offers testing and calibration services, helping clients meet quality audits. In 2006, it calibrated 48,000 mechanical units in Portugal alone. ISQ also runs a fully independent R&D program with more than 50 projects. The Institute's operations abroad have given it credibility: about 30% of turnover is generated in international markets. Portugal is not often perceived in terms of supervision of technical structures abroad, and yet ISQ is overseeing the construction of a new particles accelerator at the European Organization for Nuclear Research (CERN), based in Geneva. Miranda has staff deployed at the International Thermonuclear Experimental Reactor (ITER), north of Marseille. And engineers from ISQ are on the advisory board of a new Euro-American astronomical observatory in Chile.

"Innovation is essential. Our idea is to create new units that adapt to market trends. This is at the root of any services firm. For example, we started the first lab of electrical low voltage in 1981 and we created a safety & environment unit in 1986, when it was just a budding field in Portugal," says Miranda. The idea is to feel the industry pulse and pass it on to ISQ's customer base. Of course, that is easier said than done. Miranda cites the necessity of highly trained workforce, labs that allow for non-destructive testing and specialists in metallurgical calculus. "Developing these areas ourselves is important, but we need the support of others in the field. Right now we have a joint project with Lockheed Martin which is sponsored by the Welding Institute of America," says Miranda.

In March 2007, ISQ opened what it dubs its first business incubation center where SMEs can test-drive their ideas. Miranda is also venturing into social engineering by getting immigrants enrolled in technical training programs.

The R&D into niche markets is the buzz at Taguspark, a high-tech site about 20km west of Lisbon. It is home not only to ISQ but also to Portugal's Instituto Superior Técnico (IST), an elite polytechnic. About 50% of people working here are under 30 years of age. Its dispersed owners, 35% of which are private banks, make it the ideal venue for independent R&D projects. Taguspark is where

companies like Microsoft, Imogen, Sun Microsystems or Ericsson rub shoulder-to-shoulder with Portuguese students. Nuno Vasconcelos, the president of the executive commission, is every bit as optimistic as Miranda.

"The outlook is upbeat. Just in terms of the IST, we expect to have 3,500 graduate and post-grad students. We're also looking forward to the arrival of the Business and Economics School (ISEG) to our campus. That will create new critical mass," says Vasconcelos. About 80% of companies are in the IT and electronics sector because of the bias of IST. The goal, eventually, is to steer Taguspark toward scientific R&D.

Taguspark fulfills the need of private companies to prioritize economy, agility and speed. This is a campus where private initiative is not only behind R&D projects, but also behind sales. Vasconcelos thinks the TP is indispensable to unlock Portugal's

creative potential, but that input from entities like IAP-MEI is key. "The problem in Portugal is that R&D has been carried out with public funds and it is private companies that need to invest in innovation," Vasconcelos explains.

Startups at Taguspark now share office space with university staff and large multinationals. In turn, firms like Siemens outsource their projects to local SMEs. All companies that want to settle here need the approval of a 9-person science and technology board. That was originally the case with Chipidea, which was born in Taguspark as part of the work between a single professor and his PhD students. After a seven-year run, the software start-up backed by local venture capitalists became the leading provider of the broadest, state-of-the-art analog and mixed-signal technology portfolio in the world. It now occupies 3,500 square meters of office space and has branched out to 8 countries, including Macau and mainland China.

"I usually say that this is a business with a mission," says

Professor José Epifânio da Franca, the company's CEO and a former State Secretary for Education. "We felt the commitment to create a professional environment in Portugal that could take students out of the university and offer them good prospects for a successful career development." Franca points out there was no real product idea at the foundation of the company, not even a technological idea. He and his partners simply believed that if they were able to put together a team of engineers in a very specific area of semi-conductors technology and gain credibility in the world, then a high-tech venue would have been created in Portugal out of the talent of a handful of people. "Nowadays we work with twelve out of the top twenty semi-conductors companies in the world," he says with satisfaction. "And five out of the top five are Chipidea customers." Chipidea's story could make Franca the poster-Professor for Portugal's successful mix of scientific knowledge and business savvy.

At the INPI (Instituto Nacional da Propriedade Industrial) we safeguard ideas and the individual rights of industrial property. As economies advance more and more through innovation and the creation of technology, we protect and manage the use of national laws, as well as laws from conventions, treaties and international agreements which were ratified by Portugal.



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## Highly conductive science

Portugal's state laboratories are coming out of the cold.

By regrouping into science consortiums, there is a new conductivity of ideas.

In a magnetism laboratory, cold is sometimes your best ally. Increasing the heat can lead to losses in field strength. As the temperature rises, the slope curves upward until magnetism drives to zero. Modulating ambient temperature is therefore critical. This is precisely what Portuguese policymakers have attempted to do with the network of state research labs—identify the ideal conditions for ground-breaking research.

To generate synergies with institutions like the French-based Commissariat à l'Énergie Atomique (CEA), the radiation labs in Portugal are being placed under a consortium known as Physic-N, where management will no longer be subject to public administration laws. The added flexibility will make state labs more competitive and let them work like de facto private entities.

Julio Montalvão e Silva knows the ins and outs of low temperature and high magnetic fields. As president of the Instituto Tecnológico e Nuclear (ITN), he has found new ways to sponsor research into nuclear fuel cycles and the safe handling of radioisotopes. ITN boasts Portugal's best facilities for radiation science. The campus, outside of Lisbon, is the only domestic institution with a Helium liquefier able to reduce temperatures from 0.3 to 400 Kelvin, creating intense magnetic fields. There are 100 undergradu-

ate students currently training at ITN, as well as a host of PhD students. ITN also leases out equipment to smaller research groups.

"We're the only Portuguese institute with both theoretical and practical knowledge in all areas of radiation," says Montalvão e Silva. "We have a lot to give, but also a lot to learn. This should be a



*Julio Montalvão e Silva, President of ITN*

strategic objective for all research institutions." Money is short, but ITN allocates it all to research projects, facilities and equipment. That is the case with the newly acquired Squid magnetometer, which was expensive and is used 24/7. Scientists have also come up with practical applications. Medical instruments can be sterilized with gamma rays at ITN. "Radiation can even be used on cork to bottle wine. By radiating the cork, you kill the fungus that some-



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Synergies with other institutions will make state labs more competitive and let them work like de facto private entities.

times leaves an aftertaste," says Montalvão e Silva.

The medium-term goal at ITN is to get more trainees involved in research projects. Labs in Portugal have traditionally hired scientists on short-term contracts. It was the only way to stay in business. Montalvão e Silva, however, is now concerned with critical mass. ITN has developed its own spatial defractometer, known as a 'hotbird', for example. But the young researcher who designed it was killed in a tragic accident. Now, only a few post-doctoral students are able to work with the machine. "I'm worried about losing staff to other countries, where wages and working conditions are better," he says. That could change with the increase in this year's budget for the Ministry of Science. It is a perfect time window to reverse trends and recruit new staff, especially a younger generation with new ideas.

For Adérito Serrão, President of the Instituto de Meteorologia (IM), the preferred formula is to change research institutions from the inside out. Absorbing a different mindset can be just as important as acquiring new machines. At the IM, Serrão is following up a partnership with the Massachusetts Institute of Technology (MIT) with a series of tangible projects. "One thing is to absorb technology that can be transferred from MIT and the other is to place people there who can absorb the mentality. It's very important because the MIT, together with the US government, chose Portugal. I think



all our staff sees the new consortiums in a very positive light," says Serrão.

The IM, now part of the Risco Consortium, is a leader in meteorology, with 162 weather stations and 3 observation centers. It receives images from a g-stationary satellite, as well as from EPS and MetOp. Serrão's institution has joined all the different research centers that have arisen in Europe, such as EUMETNET and EUMETSAT. Meanwhile, IM has invested in a new computer platform to process forecast models more efficiently. With the spike in natural disasters related to global warming, the workload at the IM has a direct impact on people's lives.

Serrão is hoping to push policymakers in emerging markets like China, as well as in industrialized nations like the US, to do more to control gas emissions.

The rise in global temperatures is going to hit Portugal especially hard. In the meantime, the IM has become part of an early warning system for heat waves and acid rain. "Recently, we issued a yellow warning and then an orange one. We're in a position to issue this type of warning for the population and to give advice to disaster prevention organizations. We have video conferences with them providing that week's forecast so that resources are mobilized before a disaster occurs," says Serrão.

It will take time—and perhaps a lower temperature—but thanks to the TP, Portuguese research institutions are more globally competitive than they have ever been. "Portugal is no longer the country associated with an old man on a donkey. It is becoming a country of high technology. I think we can put meteorology at the center of research and as a science that serves as a gateway to improve other fields," says Serrão.

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MINISTRY OF SCIENCE, TECHNOLOGY AND HIGHER EDUCATION

## Wiring the paradigm shift

ICT penetration is behind many of the changes in Portuguese society. But how deeply wired is the country's educational system?

Portugal has undergone its own paradigm shift in values and beliefs. "The transformation of this country runs deep. You will find people who are ready for new initia-



Pedro Veiga,  
Chairman of the Board of FCCN

tives and open to scientific partnerships," says Professor Luis Magalhães, the President of the Agência para a Sociedade do Conhecimento (UMIC). Institutions like the UMIC and the Fundação para a Computação Científica Nacional (FCCN) are providing much of the wiring for Portugal's technological revolution. "ICT is more than an instrument for economic development. It actually changes the way society operates on many different levels. We look at our role as being the social absorption of high tech in all sectors of life," says Magalhães. The UMIC engages stakeholders in society to further the cause of ICT. "In 2005, we achieved full broadband connection for the educational system from grades 1 through 12," says Magalhães. At 95% of universities and polytechnics, UMIC and the FCCN installed wireless access, thus creating a nationwide Virtual Campus. It is one of the highest rates of connectivity in the world. A backbone of fiber optic wire now also links all research departments at Portuguese universities. "We received a lot of attention from companies like Cisco Systems and Microsoft in the US," says Magalhães. The .pt domain name spread quickly in the 1990s thanks in part to the efforts of the FCCN. Originally founded to promote high performance computing, it was enlisted by the Ministry of Science, Technology and Higher Education in 1997 to ease the shift into an information society. Its mandate was to improve access to the Internet

in the educational system. "The Internet in those days was not as advanced as it is today and the telecommunications market was not liberalized. Now we have an extremely advanced network," says Professor Pedro Veiga, the Chairman of the Board at FCCN.

Networking is the main activity of the FCCN. As you read, it operates a fiber optic network humming at a rate of 10 gigabytes per second. Veiga also refers to B-ON, a scientific digital library implemented jointly by the FCCN and UMIC. After signing subscription contracts with the publishers of scientific journals, university students will have access to 16,500 publications. The database is accessible through an Internet portal and offers an advanced platform for Portuguese scientists. "It represents a big step forward in the quality of scientific work carried out at research institutions," says Veiga. From behind his desk, Veiga points to a double-screened video conferencing unit. The FCCN has installed larger versions at several Portuguese universities to improve results at academic meetings. "Video conferencing is very important in higher education. You can broadcast a seminar, have meetings—which I do often from my office—and network with colleagues in different countries," says Veiga, who will be rolling out a voice-operated Internet Protocol for universities in 2007. "We have an additional advantage, which is that there is a lot of content in Portuguese coming mainly from Brazil. We're trying to create a momentum here and I think we will surpass German and French content by 2008," adds Veiga.



- FCCN operates an advanced world class research and education network – RCTS:
  - Backbone operating at 10 Gbps with FCCN owned optical cable;
  - All public Universities connected and R&D institutions to the network;
  - All portuguese public schools connected to the Internet since 1997.
- FCCN operates the main Portuguese Internet eXchange (GigaPIX)
- FCCN is the Registry for .PT – [www.dns.pt](http://www.dns.pt)



# Making waves in the private sector



IN THE EARLY 1990s, THEY WERE THOUGHT TO WORK WITH A TECHNOLOGICAL GAP. TODAY, PORTUGAL'S PRIVATE SECTOR HAS CREATED LINKAGES FROM TIDAL POWER ALL THE WAY TO MATERIALS SCIENCE, SOFTWARE AND DESIGN.

Renewable energy and electrical equipment were not big business when Carlos Martins got his start in 1990, at the age of 26. So he and his brother Jorge put their talent to work at a steel construction company, Martifer Construções. The firm has since developed more than 2 million square meters of commercial real estate in Portugal and Spain. Today, it is involved in stadium roofs, bridges and skyscrapers. Placed at the high end of engineering, its flagship projects include the Vasco da Gama tower at Lisbon's Expo 98 fairgrounds and Porto's new Francisco Sá Carneiro Airport.

The transition into energy infrastructure became natural. Constructing wind power generators was a result of the experience with steel alloys. In between, the group earned a reputation for cutting edge R&D in green energy. It has a research team and a subsidiary dedicated solely to windmill technology. To make headway into these new business lines, Martifer became a group with synergies across sectors like construction, warehousing, electricity, energy equipment and bio-fuels. Within its five core business units there is a portfolio of 40 companies.

Offshore testing of a new prototype for tidal power will begin this year. Martins wants to put together a complete hydraulics structure based on articulated floats. Known generically as 'Waves', the research project has been undertaken together with the Instituto Superior Técnico (IST) and engineering firms like Siemens.

"We're the fourth-largest steel construction firm in Europe," says Martins. "Until now we've been a very discrete company. But



Jaime Andrez, President and Chairman of IAPMEI  
Above, choosing colors at CITEVE, the research and technology center for the textile industry

The venture capitalist needs to fall in love with a project. Is it a winner? If the answer is yes, then the objective is to turn it into an economic success story.

we realize that it's important for Portuguese entrepreneurs to know there are success stories here." Thanks to its diversification into technology-heavy fields, Martifer has been growing 30% per year. The Group, half owned by leading Portuguese conglomerate Mota Engil, operates 3 logistical centers in Portugal, but it wants to export know-how to compete in new markets. In Romania, it has snapped up cheap land to produce raw materials for a third generation of bio-fuels. Its Chinese operation is in charge of assembling photovoltaic panels (PVs). Meanwhile, in the US, Martins speaks of harvesting 2,000MW of wind energy by 2011.

With group assets currently in excess of 300 million euros (\$402.9 million), Martifer has acquired stakes in Germany's REpower. By 2010, its financial officers expect to reach 1.5 billion euros (\$2.01 billion) in turnover, representing 45% growth. "We're listing at the Lisbon Stock Exchange by end-2007, or early next year," says Martins.

Innovation allowed Martifer to grow from an SME into a diversified group. With an adequate business framework and enough venture capital many SMEs could soon be doing much of the same. After all, it is normal for companies to aspire to new heights in a country where the perceived technological gap has capped potential for decades. The government-led Technology Plan (TP) represents the context that everyone has been hoping for. A catalyst of business ideas, the TP forces firms to think outside the box and carve new market niches for their products.

"The Technology Plan is a way to mobilize everybody in the same game, concentrating public and private investments in skills, technology and innovation," says Jaime Andrez, President and Chairman of IAPMEI (Instituto de Apoio às Pequenas e Médias Empresas e ao Investimento). With promising work in fields like biomedical research, materials science and renewable energy, Andrez is keen to reorient Portuguese industry. It will require new linkages between entrepreneurs and venture capitalists. But it is a targeted program that focuses on companies with true R&D potential. "For several years during my career, I witnessed a waste of ideas, money and entrepreneurs. At IAPMEI, we want to end that waste," he says.

"Portugal has all the components for an innovative system. We have good universities, solid companies and talented entrepreneurs. We also have a lot of players. But I think we need more of a competitive system that not only takes into account the components, but also their inter-relationships," says Andrez. He points to Alfama as an example of a wave-making SME. One of Europe's top performers, the young pharmaceutical group is developing small-molecule drugs to fight inflammatory diseases like rheumatoid arthritis. From its Drug Discovery Unit at Lisbon's Institute for Molecular Medicine (IMM), Alfama has signed partnership agreements with research centers like the Institute for Chemical and Biological Technology (ITQB) and the Institute for Experimental and Technological Biology (IBET). It leases lab space and sponsors scientific panels. Its Chief Financial Officer, Maurice Matteodo, has worked out investment plans with a group of venture capitalists.

The problem underlying the Portuguese economy has never been a scarcity of ideas, but risk-happy investors. "Venture capital in Portugal was the missing instrument in the support structure of new companies," says Andrez. For SMEs, the early stages in the life cycle of a project were especially tough. Andrez first identified a pattern in the way universities came up with business ideas. They gave up from the outset, lacking capital to think strategically. Negotiations with the European Investment Bank (EIB) have reinforced the TP's role as an enabler for companies like Alfama. Andrez thinks IAPMEI programs such as 'Finiçia', a seed money scheme, will create platforms that foster new relationships in the private sector. He is not overly concerned with market size, another problem that has long dogged Portuguese SMEs. "The competitive size of a company is not physical. I think there is a virtual size that can account for competitiveness. It has to do with the balance between quality

labs, linkages to technology centers and financial backing. That is the real size of a company," says Andrez.

The venture capitalist also needs to fall in love with a project, according to João Vicente Ribeiro, former President of PME Investimentos. Is it a winner? If the answer is yes, then the objective is to turn it into an economic success story. "We aren't here to help out a company. We're here to create champions," said Ribeiro. There is a greater awareness these days of where venture capital is moving, as well as the mechanisms it needs to flourish. "In Portugal, venture capital had been forgotten. Now you can see from economic indicators that the level of investment in industry has spiked," said Ribeiro. "We should all be pushing in that direction."

Another roadblock for SME's has been critical mass at R&D departments. For too long, firms relied on the innovations of others.

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But the synergies created by necessity over the years have had a positive overall effect. “Our conclusion has been that they need to cooperate much more by networking in clusters,” says Artur Santos Silva, the President of COTEC. With outstanding universities in Porto, Aveiro, Coimbra and Lisbon, the supply and demand of knowledge should be at an equilibrium point. Silva cites examples from France, where the *pôles de compétitivité* of the 1990s turned cities like Grenoble into leaders in ICT and biomedical engineering. “At COTEC, we ensure that the knowledge generated at universities can be used by entrepreneurs. In this way, the links and bridges between demand and supply of knowledge are more successful,” says Silva.

“The competitive size of a company is not physical. There is a virtual size that can account for competitiveness. It has to do with the balance between quality labs, linkages to technology centers and financial backing.”

Jaime Andrez,  
President and Chairman of IAPMEI



Porto's Francisco Sá Carneiro Airport showcases steel structures by Martifer

“We had a measure of success with our own competitiveness network in the Minho region,” adds Silva. “It has turned into a software hub employing academics from the local university.” Focusing on technology alone is not going to be enough, though. Whether it is through quality or brand recognition, new paths to success need to be discovered. More independent thinking is needed. For Silva, an entrepreneurial mind is a treasure trove, but only if it is educated not to indulge in groupthink. An open, receptive society that adopts new products is emerging in Portugal. That in itself will constitute a global competitive advantage. Silva cites the Scandinavian countries as a model: the economies there are market-oriented and flexible, but they have also proven compatible with social safety nets. A risk-taking attitude would complete the turnaround formula and help do away with structural deficits.

The trend in Portugal is toward product differentiation. Locked in the Euro-zone, Portuguese policymakers can no longer resort to tinkering with the currency to bolster competitiveness. The strength of the euro since 2002 also means that Portugal's

SMEs cannot bank on low-cost labor to sell in the global market. Until 1990, almost one-third of the country's exports came from the agricultural sector: cork, wine, paper and pulp. “This sector has now dropped from 14% to 12% of exports, while car production, electronics and machinery have made important gains,” says Silva. Textiles and apparel have migrated toward lower-cost operations in places like China's Pearl River Delta. Focusing on added value will save some traditional industries, such as wine. But without clever marketing and logistics, even those products could lose their appeal.

“The solution is to fully espouse globalization,” says Artur Duarte, president of Aerosoles. “What is really driving the changes

in Portugal is the need to face the economy in new ways.” A footwear manufacturer, Aerosoles has used R&D in materials science to create new products based on breathing textiles, water-proof dyes and hypoallergenic synthetics. Innovation in product lines is central to the firm, which currently exports 95% of its production. Duarte has opened 110 retail doors in places as diverse as Germany and Dubai. Aerosoles has 135 stores in North America; by 2010, it plans to double that number.

To keep up with its sophisticated consumers, Aerosoles needs to innovate non-stop. Here too Duarte has leveraged the company's international supply chain to keep prices down. The main design center for Aerosoles is in northern Italy. But the company outsources its projects to labs in different locations. Despite the physical distance, ICT makes it possible to get messages across teams of designers, engineers and salespeople. Synergies in the textile sector are also critical, so Duarte is constantly looking for partnerships in countries like India, China and Brazil. “The general manager of our retail chain is a Frenchman. Our main product

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"The solution is to fully espouse globalization. What is really driving the changes in Portugal is the need to face the economy in new ways."

Artur Duarte, President of Aerosoles.

manager is Italian. The secret here is to find the best person for the job in the global marketplace," says Duarte.

Still, market niches can be elusive. For Duarte's design team, keeping the pulse of consumer fashions is part of staying on the ball and ahead of the curve. The strategy at Aerosoles is to anchor the brand firmly in the market and anticipate the next season's collections as a rare preview. "One of our strengths is to keep our identity very clear and at the same time create new approaches to every season. Everybody is waiting to see what we've been up to—right now we are creating some imaginative offers for the spring-summer collection of 2008. This is one of the secrets to staying in the market for so long," says Duarte. As long as consumers are convinced they are getting something new, the strategy will work.

In Portugal innovation is starting to go beyond the obvious market niches. Because it works as a 'mentality changer', R&D can serve to unmask conceptual lagoons in the economy. Things get even more subtle in the domain of software programming. At Sociedade Interbancaria de Serviços (SIBS), one of the greatest success stories of local innovation came from the unification of bank transactions. SIBS is behind the success of the Multibanco, the inter-bank services network for routine transactions including ATM machines. "Sometimes, innovation is about how you do things, how you manage them. In our case, innovation was more based on a business model than on technology," says Vitor Bento, the president of SIBS.

The system developed by SIBS included automated clearing for checks, electronic transfers and commercial paper. "It was a brilliant idea for a competitive model in which banks cooperate at the level of infrastructure, but compete fiercely in terms of the relationship with their customers. Because they could cut costs by pooling their resources, they were also able to serve their clients better," says Bento.

A great success with users, Via Verde (Green Highway) also came from a rethink of payment systems. Motorists can pay their tolls or their parking spaces through the Multibanco automated network managed by SIBS. Now, Bento is keen on the Prodigy program that aims at reducing the use of checks by half and the

use of cash by 20% in two years. "Everybody is talking about mobile (cellular) payments and mobile banking. We have had mobile payments in Portugal for more than ten years. It is called Tele-Multibanco, where we can replicate most of the transactions that you perform in the ATM, including buying movie tickets. When it started, it was probably ahead of its time," says Bento. With one of the highest relative investment percentages on R&D in the country, SIBS promises more ways of making life easier for the Portuguese in the near future.

In the world of bricks and mortar, innovation has come with a steep learning curve. SMEs have had to learn coping mechanisms to deal with the inflows of EU funds for infrastructure. It was not software that plucked Portugal out of the 19th century—it was the bulldozer. "Today, Portugal is a completely different country from what it was 10 years ago. That's true even if we're just speaking about

highways and the connections to the interior," says Eduardo Capinha Lopes, a Lisbon architect and the founder of Capinha Lopes & Associates. The infrastructure upgrades have altered the landscape just like SIBS revolutionized payment systems in the financial system.

Capinha Lopes, among several other projects, is designing 20,000 housing units for retirees. The new niche of 'assisted living' condos is a growth sector in Portugal's property market, especially along the coastline of the Algarve. Poor urban planning in the 1970s meant that traditional architecture was rapidly displaced by large shopping centers, sometimes as large as 50,000 square meters. They landed like spaceships on Portugal's geology. "This is a very small country. You can have breakfast in Lisbon, lunch in Porto and dinner in Faro. But from our point of view, that's actually an advantage," says Capinha Lopes. His firm now generates up to 75% of its revenue from international investors, many in the retiree housing niche.

With a staff of 80 in downtown Lisbon, Capinha Lopes is currently working on projects ranging from 35 to 100 million euros (\$46 to \$133 million). It is a dangerous size for an SME in Portuguese terms, he admits. But the branch offices abroad serve as a security blanket. "Tourism has become a national priority, as you know. With revised urban development plans the process is now easier for investors. Licensing is faster and more precise," says Capinha Lopes. But coping with volume means his team of architects will have to acquire technical know-how fast. There is yet another learning curve ahead. The best solution for Capinha Lopes & Associates is to tie the knot with a Miami-based firm which has shown great interest in Portuguese real estate. "This partner had investments in Eastern Europe and they found Portugal to be a good gateway. So they contacted us and we started a dating process in order to make things happen," says Capinha Lopes. The marriage has yet to be announced.

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## The glamour of techno-fashion

'Jeans' and 'technology' are not usually found in the same sentence.  
But in Portugal, it makes 100% business sense.

Portugal's textile and apparel industry has realized it needs to switch business models. There are only two solutions: by creating brand differentiation, or via fashion and design. Technological advancement is the more obvious path, according to Helder Rosendo, the General Manager of CITEVE, a research center for the textile and clothing industry. "If you can have both an innovative company and special design, you have an instant winner—what I call 'techno-fashion'," says Rosendo. Little pieces of functionality go a long way in the rarefied world of fashion. In Portugal, the garment sector has proven an ideal platform to test drive technological inputs into traditional sectors. With bottom-of-the-shelf competition from the Chinese market, R&D in synthetics is the only way for local mills to stay open. As recently as 5 years ago, Rosendo describes speaking to a deaf wall when preaching R&D to garment entrepreneurs. No one paid attention because they were still thinking in terms of low-cost production. "Now the companies are coming to us and saying: 'We need to develop something new. Can you help us?'" he says.

Serving big brand names like Calvin Klein and Armani worked well for Filipe Vila Nova. That is how his firm, Irmãos Vila Nova, first got its start. Building brand specialization was a steep learning curve, especially in the global market for jeanswear. Located in Vilanova de Famalicao, halfway between Porto and Braga, SALSA Jeans was at the epicenter of Portugal's textile



Salsa Jeans' young workforce hunts for the newest trends.

industry, concentrating 67% of domestic mills. A lot has changed since 1994, when he first started taking orders from the big brands.

To penetrate large department stores, Vila Nova steered firmly toward quality and brand differentiation. SALSA eventually found the answer on the fitting side of the equation. "I think other brands did not value fitting as much, the fact that one needs to adapt to people's bodies like SALSA did. Few women in Portugal are lacking one of our jeans in their wardrobe," says Vila Nova. He hired a designer who went through up to 30 variations to find the ultimate jeans product. Now, the company is obsessive about its fitting controls and 100% attentive to customer satisfaction. After 10 years, the SALSA brand is firmly anchored through a network of exclusive stores. Following up on earlier promises, Vila Nova has also launched a punchy web site ([www.salsajeans.com](http://www.salsajeans.com)). At its online shop, customers can rate glamour pants, shirts and skirts—all of which rotate 360 degrees and can be virtually fitted. Vila Nova believes the changes in the industry have been fueled from the demand side. "Clients started to deal with the Internet and new technologies and so they too began to evolve. We needed to go online with the client to understand what we had to do next," says Vila Nova. Portuguese fashion still has a long road ahead. From building brands it has moved into quality niches. The future, at least for the moment, is catering to the fashion victim's every whim.



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## Spinning off Portuguese IT

Software is often the byproduct of knowledge networks scattered all over the world. Through IT, Portuguese developers are finding niches in economies of scale.

In the software industry many tools aspiring to become applications fall by the wayside if they lack a marketability plan. A process that integrates research with business is the most intelligent way for Portugal to implement the government's Technology Plan. "Then there is promotion and the qualification of entrepreneurs, as well as licensing and incorporation," says José Encarnação, a founding member of INI GraphicsNet.

The medieval town of Guimarães is often referred to as the cradle of Portugal. Today, the town's Computer Graphics Center (CCG), linked to Minho University, is busy developing applications for the footwear industry and mobile handsets. The joint venture with INI GraphicsNet, based in Darmstadt (Germany), means it is part of a global knowledge network with R&D labs in 15 countries. So far, INI GraphicsNet has spun off a number of digital media companies including CyberMD, of Providence, Rhode Island.

"Computer graphics is one of the key technologies in IT. It enables every aspect of data visualization," says Encarnação. Since 1999, the network of software developers and patent specialists links the R&D team in Guimarães with others in Barcelona and Singapore. Encarnação, who shuttles in from



Jorge Sá Couto, General Manager (left) and João Paulo Sá Couto, Managing Director (right) of JP Sá Couto

Germany, is proud that the CCG is exporting Portuguese know-how to the rest of the world.

As traditional industries slowly die out, Portugal's IT edge will need to sharpen. Critical Software began with just three people and \$2,000 in startup capital. Today, 70% of his business is outside Portugal and the company's culture is thoroughly international. The company worked with NASA to develop jet propulsion software. Part of its credibility stems from a stunning record in industry certification. "We always look to apply for the most difficult certification. By doing that, we overcome the negative perception about Portugal as a non-technological country," says the VP of Business Development, João Carreira.

"As far as private companies go, our perspective is that we are technologically prepared," says João Paulo Sá Couto, the Managing Director of JP Sá Couto, an electronics distributor with his own brand of 'Tsunami' computers. Sá Couto, who is also in the business of IT security, thinks plans like the TP can have a practical impact on the daily life of consumers. "There is a relative increase of broadband as well as the number of PCs per family and school. A more functional state and society are the goals, something which is hard to achieve but possible. For sure the private enterprise leads the way in this area and results are appearing," he says.

For a while, JP Sá Couto rode the wave of Internet penetration and cared little about research. "Five years ago we realized we had to be more proactive. So we set up Portugal's first systems' builder lab, which represented a large investment," says General Manager Jorge Sá Couto. Ever since, the lab has sent signals that spinoffs can take place across the board. The new business attitude has earned JP Sá Couto a cooperation agreement in forensic projects with the criminal police. JP Sá Couto has partnered with Microsoft to supply media centers. The vendor is currently supplying INES, an engineering think tank, with all its hardware solutions.

"We see IT in its wider perspective," says Jorge Sá Couto. Beyond economies of scale, though, Portugal's IT sector is still looking to level the field, which will make private firms like JP Sá Couto more competitive. As in the case of INI GraphicsNet, it is the synergies across countries and R&D teams that can turn Portugal into a factory of ideas. João Paulo Sá Couto mentions a TP provision that will immediately have an impact on his company, which sold 40,000 PCs and laptops in 2005. "The government is giving rebates of 250 euros to whoever buys a computer in Portugal right now," he says. Together with lower prices for broadband, such measures will facilitate the industry's takeoff.



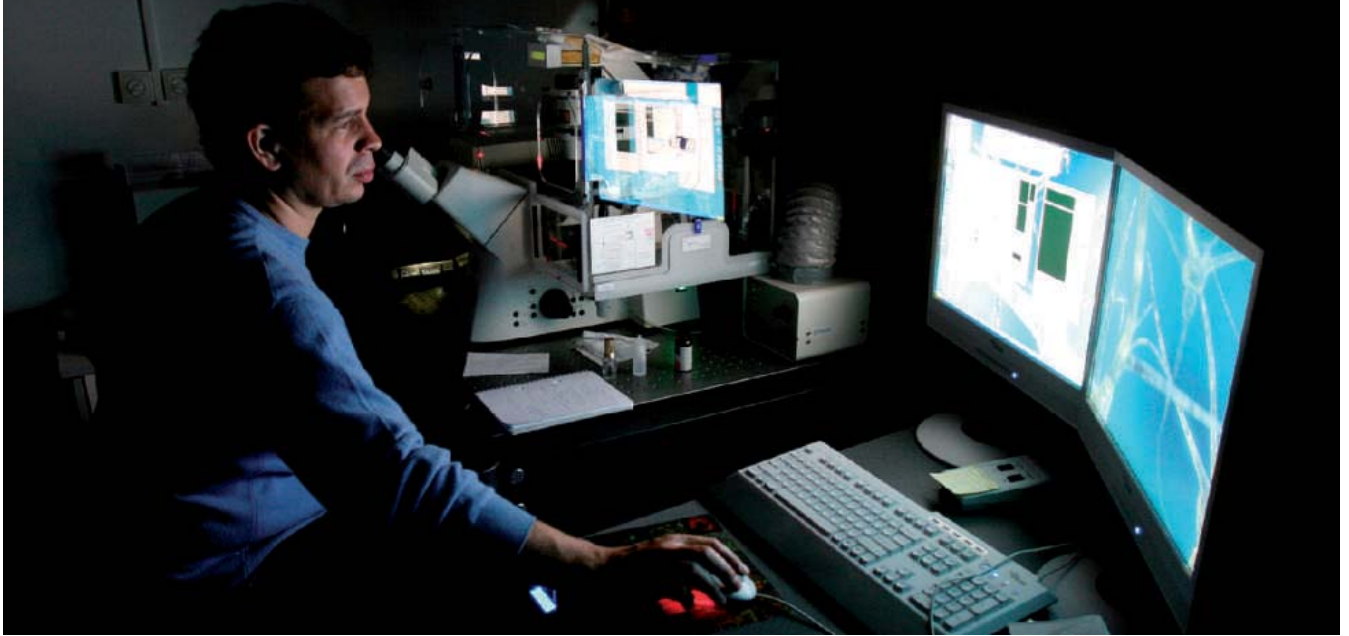
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**JP Sá Couto**



# Healthcare: touchscreen solutions

**NEUROSCIENCE, TELEMEDICINE AND PAPERLESS HOSPITALS ARE GIVING PORTUGAL'S HEALTHCARE NETWORK A NEW STATUS.**

Walk into the health center of Torre de Moncorvo and you will have to put your old-fashioned ideas about Portugal aside. The clinic is well-staffed and outfitted with its own dry chemicals lab. Patients from outlying villages come here for light surgery consultations via telemedicine terminals. No one is as surprised by the futuristic installations as Portugal's own Minister of Health. "We knew they already had the equipment, but it was still fascinating when I visited a month ago," says Antonio Correia de Campos.

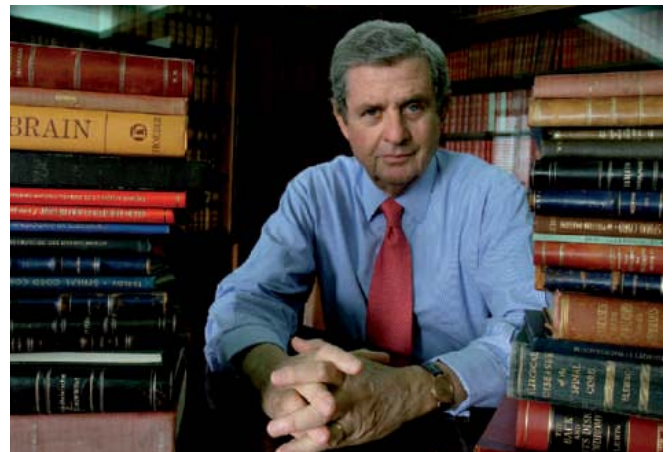
As anecdotal evidence, the Minister cites the case of his 96-year-old mother. On a Sunday night, she sustained an injury to her head after a domestic accident. She was quickly whisked away to a hospital in the city of Viseu, north of Lisbon. A cat scan was done that same night. The results were digitized and forwarded to a clinic in Porto. At 9 a.m. the next morning, the local neurologist in Viseu was reading the clinical report. According to studies by Lisbon's Universidade Nova, the Portuguese rate their healthcare system's quality above utility services and cell-phone operators.

"This is 21st century technology, but it's not a caviar thing—it's bread and butter," says Correia de Campos. An ageing population, professional mobility and globalization have revolutionized Portugal's healthcare. Within 10 years, all EU countries will be facing these issues head-on. The Health Ministry, despite a tight budget, is using technology to bring e-diagnosis to the smallest clinic in the Algarve. The Portuguese government has also opened channels with private pharmaceuticals and medical suppliers to outfit health facilities with domestic products. Hospitals where private management has been introduced, legally known as EPEs (Entidades Públicas Empresárias), are generally well rated by patients.

Portugal's healthcare system has gradually shifted to an electronic management system. Doctors and nurses have gotten used to working in a paperless environment that allows for easy tracking of

clinical histories. For the Ministry of Health, electronic formats are also a way to cut costs. Designed by Medicos Na Internet (MNI), the Alert® software package initially evolved out of the specific needs of emergency rooms: triage systems, case management and data warehousing. Soon, new integrated applications were developed based on the original Alert®ERT (Emergency Room Tracking). Products from this software suite have been implemented in over 25 hospitals in southern Europe and could soon be adopted by more countries.

The pioneering IT system by MNI has revolutionized Portugal's healthcare system by phasing out old inefficiencies. As of 2007, more than 45 hospitals and 105 polyclinics in Portugal have switched to Alert®PFH (Paper Free Hospital), which has made its appearance in the US as well. With the Alert® package, a patient's



*João Lobo Antunes, President of IMM; above, unravelling the secrets of the human body through technology at his institute.*

entire clinical history shows up on a touchscreen after scanning the bar code on a bracelet. As the patient is dispatched through different hospital departments, or workstations, the Alert®PFH system integrates clinical histories, diagnostics and medical prescriptions.

PORTUGAL **Brains at work**

Led by Dr. Jorge Guimarães, MNI was voted one of Portugal's top 24 firms for innovation in 2006.

The challenge is about efficiency gains, not making concessions on quality. The transfer from paper to electronic format is just one of the first steps toward optimization. Manuel Teixeira, President of Administração Central do Sistema de Saúde (ACSS), wants all hospitals to be paper-free in the future. "We define each year's goals and the investments programmed to fully implement an electronic platform. Technology will be essential," he says. He is also pushing to reduce the administrative load of hospital personnel by instituting touchscreen solutions through companies like Oracle and Fujitsu. Domestic firms are beginning to show interest too. Two years ago, there were 50 people working together with the ACSS on IT solutions. Now the number is close to 250. "It's not difficult at all. It's just a matter of investment capital and getting people used to it," says Teixeira.

Partnerships with the private sector will increasingly set the tone of Portugal's healthcare agenda. The Instituto de Medicina Molecular (IMM) is financing projects in molecular diagnosis through a leading financial institution, Banco Espírito Santo. The dividends of laboratory studies are then reinvested in other R&D projects. "We are particularly interested in neuroscience and cell biology," says Professor João Lobo Antunes, the IMM President.

The reform agenda is everywhere at the IMM, which carries out basic scientific research with clinical applications in mind. It is what Lobo Antunes refers to as 'translation research'. The IMM has a track record for generating industrial spinoffs that are successfully carrying out clinical tests in areas like rheumatic arthritis and joint-related disease, as well as in epidemiology. Scientists such as Maria Mota are considered top-notch in malaria research. The European Commission currently backs five IMM projects and a private pharmaceutical company is footing the bill for another study into the genetics of Alzheimer's. Finance for R&D also comes from the US: in the first half of 2006, IMM programs received about \$1.5 million from sources like the Luso-American Development Foundation, a private nonprofit, and Harvard University. "The US is actually our largest international source," says Lobo Antunes.

"Portugal cannot survive with a number of small and medium-sized research labs. We have to develop larger units to be competitive and get consortiums started with industrial firms," says Lobo Antunes. The IMM is aware that science can lose its independence by working too closely with industry. But so far, the partnership with

profit-maximizing pharmaceuticals is more about pooling resources than about following an industry agenda. For Lobo Antunes, the ancillary mission of any university is to develop patents and spinoffs through entrepreneurial networks. "Biotech is a great opportunity for Portugal. It's not yet a big business, but it's getting very interesting. We are especially well prepared in life sciences because of the tremendous number of PhDs, many of whom are based in the US," says Lobo Antunes.

While the technological revolution unfolds, Portuguese scientists need to define their growth ambitions. Concentrating in areas with a strong local tradition will generate clusters of R&D. Neuroscience is one of them. The field has a long history in Portugal going back to the days of Antonio Egas Moniz, who was awarded the Nobel Prize for Physiology in 1949 for his research into cerebral angiography and prefrontal leucotomy. There are 40 Portuguese candidates standing for international prizes in molecular biology, according to the Health Minister. For biotech, the task is to reach critical mass and reap the dividends as soon as possible. "We started late. But society and politicians need to understand that this is a real investment," says Lobo Antunes.

Legislation is another area that needs disambiguating. Pharmaceutical companies often walk a tightrope of strict government guidelines. Portugal's council of ministers approved the EU's new Drug Action Plan in 2006, which will serve as a roadmap for domestic pharmaceuticals. According to João Esteves, Chairman of Apifarma (Associação Portuguesa da Indústria Farmacêutica), the total market value of the sector is 2.33 billion euros (\$3.12 billion), not counting hospitals. "It's a small market compared with other European countries. But for Portugal it represents a workforce of about 12,000 people, 50% of whom have advanced degrees," says Esteves.

The idea is to retain this talent pool by creating a simulating R&D framework. Apifarma represents more than 130 companies working in proprietary medical products. Together with public institutions and private foundations like the Gulbenkian, Esteves is helping to attract young PhDs to research programs. "In terms of life sciences, we participate in 46 big European projects," says Health Minister Correia de Campos. His Ministry has signed an agreement with Apifarma recently to promote Portuguese pharmaceutical exports. Currently, the country sells more than 300 million euros (\$401 million) worth of pharmaceuticals, according to Esteves, which far surpasses sales of Port wine. In a country rarely cited for TFP, the pharmaceutical industry is on the frontline.



## New Vision

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## The Mysteries of the Mind: an interview with Antonio Damasio

Born in Portugal and with medical and doctoral degrees from the University of Lisbon, Antonio Damasio began his distinguished research career with the late Norman Geschwind at Harvard. He has helped to elucidate the neural basis for the emotions and has shown that they play a central role in social cognition and decision-making. Three of his books, "Descartes' Error", "The Feeling of What Happens", and "Looking for Spinoza", are translated in over 30 languages and taught worldwide.



Photo: Christian Steiner

social conflict). It is up to enlightened citizens to debate and regulate the possible uses of neuroscience.

**You left Portugal to live and teach in the United States: what advantages have your life and education in Portugal brought you?**

Growing up in Portugal provided me with a rich human foundation, in terms of values and relationships, and I have nothing but praise for the intellect and dedication of my teachers. But to develop scientific and technical careers it is also necessary to have at one's disposal the sort of complex infrastructure which younger Portuguese generations now have available, along with a sense that they belong to a larger community, in Europe and in the world.

**As someone who has heavily contributed to the study of consciousness, do you believe we are any nearer finding out how it originated?**

Modern neurobiology is on the brink of explaining how we have minds and how we are conscious of having them. It will also make clear that conscious minds offer a distinctive advantage in coping with the management of life. By the end of the decade few mysteries will remain on this score. And the more we know, the more the admiration we have for the human mind will increase.

**Do you believe there is a neural basis for human ethics?**

Moral behavior, ethical rules, and systems of justice are cultural extensions of the homeostatic mechanisms which regulate life in our bodies. They have a biological basis but they require the sort of "tuning and polishing" that can only come from individual education and social interactions. It is not a matter of nature versus nurture. It is about both.

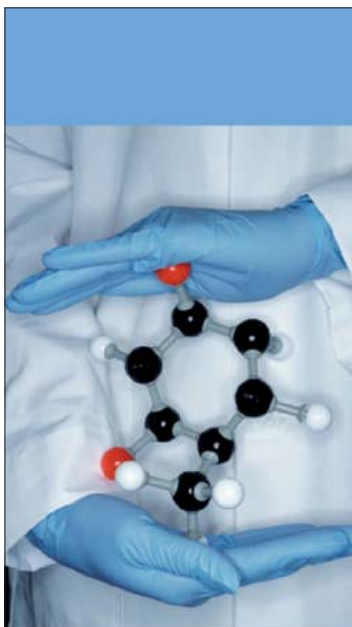
**Pathologies (congenital or acquired) can damage decision making. Would it be fair to say then that free will is a tenuous concept?**

Free will is a scarce commodity. We are reasonably free to decide not to kill our enemy, but far less free to prevent ourselves from making an enemy. We are free to decline dinner with an impertinent social climber but far less free to decline a high-caloric, artery-busting steak offered in a menu. And of course we have little will regarding how our genes decide to visit cancer or other forms of misfortune on our existence. When we vote freely for a political candidate we do so under the heavy influence of tenuous knowledge conveyed by publicity. The same when we decide on a car. Do we have free will then? Some, especially where it counts the most, which is when we abide by the laws that protect the integrity of others.

**Are you sometimes terrified by your own findings in neuroscience?**

There is nothing terrifying about the results of neuroscience: they simply reveal nature as it is, unchecked by culture. But neuroscience results can be used for bad purposes (e.g. the manipulation of others), or good purposes (e.g. the alleviation of suffering caused by brain disease or the elucidation of the reasons behind

Antonio Damasio is a David Dornsife Professor of Neuroscience and Director of the Brain and Creativity Institute at the University of Southern California in Los Angeles. The Institute of Scientific Information has named him one of the most cited neuroscientists of our time and he has received numerous scientific prizes, most recently The Prince of Asturias Prize in Science and Technology, and the Signoret Prize which he shared with his wife, Hanna Damasio, an equally recognized brain researcher (they also shared the Pessoa Prize).



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Funded by the government of Portugal and the European Union, the Institute of Molecular Medicine (IMM) fosters basic, clinical and translational biomedical research with the aim of contributing to a better understanding of disease mechanisms, developing novel predictive tests, improving diagnostics tools and creating new therapeutic approaches. Nowadays the IMM covers four great areas of investigation: cellular biology, immunology and infectious diseases, neuroscience and oncology.



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*The Port of Lisbon merges perfectly with the city around it.*

# Logistics in the open air

IN PORTUGAL, THE TRANSPORTATION SECTOR IS OPENING NEW TRADE CORRIDORS BY MERGING COMMERCIAL TRAFFIC AT SEAPORTS, AIRPORTS AND RAILROADS—ALL OF IT WHILE REDUCING CO<sub>2</sub> EMISSIONS.

Seen from Google Earth, the 30 km-long Tagus Estuary has the shape of an inverted pear. If you zoom in, the serene city of Lisbon appears on the tapered part of the pear's neck, where the channel width is less than 2 km. Traffic across the Tagus creates a constant buzz of activity in the metropolitan area. Along the Lisbon waterfront, dry bulk carriers load 11 million tons of solids per year, as container ships pass by imperceptibly en route to Hamburg. Fruit, paper and aluminum are loaded at the northern terminals. Sailing in from the Atlantic, the seaport seems anything but congested. It is so well-integrated into the cityscape that it might be confused with a decorative prop. Welcome to the world of multimodal logistics.

Despite its unobtrusive layout, the Port of Lisbon is a strategic platform handling 30% of domestic foreign trade. In the first half of 2006, container traffic alone grew 1.5% to more than 1 million tons. The breakdown of goods includes bulk liquids, chemicals, iron ores and cereal grains. But Lisbon is also increasingly popular as a stopover for cruise lines on the way to the Mediterranean. According to the Port Authority, more than 250,000 visitors came down the gangways at the main passenger terminal in 2006. Manuel Frاسquilho, President and CEO of the Port of Lisbon, recently announced a 20-year plan to deal with traffic growth. It involves negotiations with 11 different municipalities along the Tagus Estuary. The objective is to merge seaport logistics seamlessly into the railroad network, as well as to streamline city transportation.

"What I'm trying to do is come up with a plan for the next 20 years. The business is already there," says Frاسquilho. The seaport, one of Europe's main commercial hubs in the 17th and 18th centuries, is working out the details with logistical engineers in Amsterdam. The Port of Lisbon already serves as nexus to oil terminals in Luanda (Angola) and Santos (Brazil). To win market share in cities of the hinterland, such as Madrid or Seville, more dry docking ter-

minals will come online. Commercial traffic can be uploaded to a transshipment point near Guarda, according to Frاسquilho, until consumer demand makes it profitable to move the goods. A high-speed rail link to Spain would improve competitiveness. "Essentially, we're replacing the old industrial backbone and developing a multimodal import-export system," says Frاسquilho.

When Portugal became a member of the European Union in 1986, risk premiums fell and created a wealth effect. The consumer suddenly found that given the low interest rates on loans, it was cheap to buy a car. And so, the city of Lisbon had to find ways to relieve the new phenomenon of congestion. The fact that it was the western border of the European Union did not help, since intermodal traffic simply increased with the economic boom. But since the discussions about how to clean up public transportation were drawn out, companies like Carris broke ground on their own. A public transportation firm running the iconic yellow trams of Lisbon, Carris sank money into a new fleet of trains, buses and trams. By offering quality standards, it seduced the city's ridership. "That's why we opted for ISO:14000 certification for our environmental track record, which we hope to have obtained by next year," says J. Manuel Silva Rodrigues, the CEO of Carris.

No one is more exposed to the streets of Lisbon than Carris. The transportation specialist was founded in 1872 and reached a turnover of 74 million euros (\$98.8 million) in 2005. A dapper centenarian, the company has been quick to adapt to change. Out of 750 buses, 40 run on natural gas and the rest on blends of biodiesel. By offering joint ticketing with other urban providers, Carris is also addressing quality of life issues. While more people flock to the suburbs to avoid pollution, it has expanded its fleet to outlying districts. Carris is able to track each individual vehicle after implementing a new IT system. As for safety measures, video

surveillance has extended to bus stops. The massive modernization drive carries a price tag of 59 million euros (\$78.8 million). “We don’t even need to be creative, but simply look at the measures that other cities have taken in which the stakeholders in public transportation have gotten together,” says Silva Rodrigues.

Beauty and efficiency can go hand in hand, according to Portuguese urban designers. A new cruise ship terminal going up in the Tobacco Garden at the Cais do Sodré is part of Frásquilho’s strategic plan. Further west, the Port of Lisbon is making space for a placid marina in the Pedrouços dockyards. With 130% growth in passenger traffic, Frásquilho will begin working with other actors in the city’s transportation network, including railroad operator Comboios de Portugal (CP), Carris and Fertagus. New bridges will span the Tagus River to relieve the waterways. According to a CP spokesperson, the railroad system could absorb more traffic if facilities in Alcantara were expanded. After all, each train segment has the capacity to transport 24 truckloads of goods. All of this can be done while reducing CO<sub>2</sub> emissions.

“In terms of environmental impact, I think our most important contribution is to question the use of the private car,” says Ana Cristina Dourado, Manager of Fertagus, the private operator that services 14 suburban train stations. Scarcely 10 years ago, there was no grand design to fight air pollution. If one lived in dormitory towns like Barreiro, across the Tagus River, there were very few realistic options to the private car. “Now, it’s not only Fertagus. CP has good services, as does the Lisbon subway system and the bus fleet operated by Carris,” says Dourado. But in a country where much of the logistical grid is state-controlled, efficiency is not always prioritized. The private sector does a better job of managing costs, Dourado thinks. Fertagus is on track to becoming fully independent of city subsidies by 2010. Over the years, its reliability has earned them customer loyalty. “It’s up to the people to choose their form of public transportation. As a consequence, everything will run more smoothly,” says Dourado.



In terms of high-speed rail links the priority will be a Lisbon-to-Madrid route and a Lisbon-to-Porto connection.

*A view of Porto*

terms of high-speed rail links, after much deliberation the priority will be a Lisbon-to-Madrid route and a Lisbon-to-Porto connection. Investment in new infrastructure is also focused on the planned airport of Ota, 50km north of Lisbon. Its task is to replace Portela airport in downtown Lisbon. Mario Lino, the Minister of Public Works, Transport and Communications, wants innovation to permeate the project, with an eye on US-based firms that can provide engineering know-how. “We have some projects that are being built with just that in mind, such as the new airport. It should appeal to good aviation companies like the US-based Parsons Corporation,” says Lino.

The quantum leap in passenger capacity at the new airport terminal will usher in a new age for Portugal. The fact that it will be privately built and operated is a novelty. But the Minister is thinking ahead and sees part of the country’s future as a logistics specialist for Europe. It is the country geographically closest to South America, with which it also shares historic ties. Even for American companies, Portugal has competitive advantages that no longer exist in Great Britain or Ireland. If Lino’s inter-modal ways get traction, it will also be the first time environmental safety and quality of life issues are fully integrated into a major transportation scheme.

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## Naval industries: a niche affair

Oil rig and ship conversions are an emerging niche for Portuguese companies, together with environmentally-friendly paint.

The sea is one of the keys to Portugal's soul. Lisbon's Praça do Comércio, on the banks of the Tagus estuary, has mirrored that love affair for centuries. The marble steps emerging out of the water on the embankment have served as a landing point for armies of royal emissaries. Only the earthquake of 1755, and the tsunami in its wake, managed to displace the center of power to the safety of St George's Castle. Today, the nation's seafaring ethos is still alive. But to compete in Asian markets, naval outfitters and domestic shipyards have had to steer clear of mainstream markets. Theirs is a niche affair.

Technology has given South Korea an edge in container ships and ocean-going vessels. Ukrainian navy yards have specialized in steel hulls, which are then finished off in Poland or northern Spain. In the globalized world of shipping, arbitrage is instantaneous. Tell that to Mário de Paxiuta de Paiva, the President of Euronavy, who decided to promote his company among the big players in marine logistics in Singapore.

"It's very tough to come into a market where there are big established players. Those five years in Singapore were just for credibility," says Paxiuta de Paiva. Euronavy, is valued at 40



Mário de Paxiuta de Paiva, Chairman and CEO of Euronavy

million euros (\$53.7 million), a relatively small size in global terms. But with innovative environmental coatings for marine infrastructure, Euronavy has grown 300% in the last five years. Its customers include the US Navy, Petrobras and BP. The focus for Paxiuta de Paiva, an engineer by training, is on high-tech paints and water-based technology. "Ten years ago, the coatings

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applied to ships, marinas and oil rigs were not environmentally safe. They contained lots of heavy metals, including lead, which can be carcinogenic. We use technology to bypass the health hazards," he says.

Everyone thought it was impossible to get rid of the sulfurous content in old coatings. To remove one square meter of old paint, industry operators like Euronavy used to apply 70 kilos of clean material. It has taken a great deal of laboratory testing to perfect the methods by implementing green technology. "The solution was to avoid the problem altogether. How? You can collect the contaminated water, filter it, treat it and re-use it in the process. That's how you produce 1.5 kilos of contaminated water instead of 70 kilos. That's the big change," says Paxiuta de Paiva.

Labor costs, and the strength of the euro mean that Portuguese naval outfitters will continue to specialize in high-end services. In Setubal, south of Lisbon, Lisnave turned facilities like the Mitrena docks entirely to ship refurbishing after the company was restructured in 1997. Lisnave has since built 3 additional Panamax-sized dry docks on 1.5 million square meters of land. This is where major steel renewals take place and where piping is retrofitted into tankers and chemical ships. Repairs of ballast, hydraulic systems and tail shafts—all of it is done in the navy yards of Setubal. As electricity plants switch from coal to the cleaner-burning natural gas, demand for low-temperature piping on boats has soared.

"With the twist of our economy, and namely during the late 20th century, Portugal began to extend its transportation and commercial network to all economies," says Frederico Spranger, the CEO of Lisnave. In the 1960s, at the height of the shipping boom, Lisnave furnished global markets with oil-loading tankers. It also built ships for the merchant marine. Today, after repairing more than 10,000 vessels, the business context has morphed yet again. Spranger is investing 6 million euros (\$8.06 million) in training 250 workers to carry out different tasks in the shipyard. "We need to have flexible workers who can cope with the variation of ships coming in. Sometimes it's a structural thing, at others it's about piping, engines or generators. A lot of work can be performed by this type of flexible dock worker," adds Spranger.

Work on oil tankers currently represents about 50% of Lisnave's market. Because of its prime location on the Atlantic seaboard, the company has a competitive edge on oil routes from the North Sea, West Africa and even the Gulf of Mexico. Investment in platforms for the oil industry could also become a core business. The platforms can be exported cheaply as floating structures to countries like Brazil and Venezuela. Another growth segment for Lisnave, and for Portuguese wharves in general, is the outfitting of boats for LNG (Liquefied Natural Gas). Lisnave has invested in specialized equipment that works at very low temperatures. "Certain equipment needs to be installed in air-conditioned shops," says Spranger.

But the shipping firm in Setubal is also turning to cruise ships, a business constantly on the lookout for cosmetic upgrades. Spranger thinks there are 5 million potential clients for Lisnave in the mid-range cruise market, especially if the Port of Lisbon manages to win market share from powerful players like Barcelona. "It's a niche market to which we'd like to offer services when it takes off," concludes Spranger.

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