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Growing green: *Venture capital support for clean technology*

By Jennifer Hayden and Yanuar Nugroho, University of Manchester

Global venture capital has been hit hard by the recession, dampening the prospects for many would-be start-ups at just the time when job creation and innovation are badly needed. Venture capital plays a critical role in funding the risky, early stages that other forms of finance often shy away from. Fund managers bring a mix of expertise and capital to guide a good idea to fruition with the goal of reaping large pay-offs at the IPO, but more often than not the venture fails — a risk that traditional funding bodies will not take on board. The success of the venture capital industry is important because it acts as a catalyst for innovation in the economy and can be critical in bringing course-altering technologies to the fore[1]. It is promising then that global venture capital is addressing itself to the grand challenge of climate change through its support of green technologies.

Green technology, or Cleantech, is a cross-sector business category that has emerged in response to the great threats and opportunities presented by climate change and the depletion of fossil fuel reserves. Cleantech is broadly understood as that which enables more efficient use of materials thereby improving the environmental footprint of a product, process, or organization. The industries that fall under this designation are involved in clean energy, energy efficiency, environmentally-friendly production, conservation, pollution mitigation and related training and support.

The UK's Carbon Trust estimates that the global opportunities in green technology could be up to £600bn. The firms highlighted by the recent Guardian/Library House CleanTech 100 listing provide a snapshot of the fastest growing European companies working to secure a piece of that pie; they encompass wind and solar power, biofuels, batteries and better energy distribution. For instance, the Edinburgh-based Pelamis Wave Power runs a commercial-scale wave-energy harvesting system. The French firm Watteco builds technology that enables communication between electrical devices and the grid in order to reduce energy consumption. And in Finland, Enfucell manufactures cheap, paper-thin batteries that are easy to recycle. The list is replete with examples of European ingenuity, underlining the potential for a new, highly competitive sector if given the best conditions to grow.

With global awareness of environmental problems approaching critical mass, cleantech, as a category, is rapidly growing along with the venture capital allocated to it. Before the recession began, venture

GRIPS' news

- **Labs for a more innovative Europe:** GRIPS' fourth Innovation Policy Workshop gathered European innovation labs' representatives in Copenhagen on October 12th and 13th. More information on this workshop will soon be available online: *http://grips.proinno-europe.eu/*

- **Public sector innovation to address societal challenges** - *Enhancing innovation in public services through transnational cooperation*: GRIPS' fifth IPW was held on October 28th & 29th in Brussels. The workshop's report, as well as a ministudy on "**Innovation in the public sector**" will be made available on the GRIPS website.
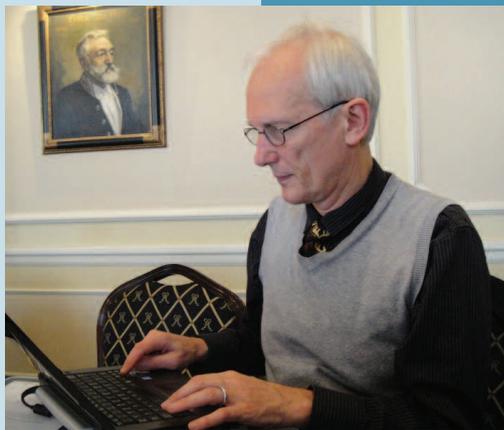
Editorial

by Ian Miles, Manchester Institute of Innovation Research.

This editorial draws on a few of the ideas developed at the recent INNO-GRIPS policy workshop on Public Sector Innovation.

Discussion at the workshop reflected a consensus on at least three points. First, public services are often highly innovative- competitive pressures and social concern drive innovation here. But, second, there are strong barriers to innovation and its diffusion in many public service organisations. Third, social, political and economic arguments underline the importance of stimulating more innovation in public services. Public service innovation should support the objectives of these services and not just reinforce the agenda of specific professions or organisations. Social and technological changes mean, too, that we may need to reconsider the objectives of public services. The Grand Challenges that Europe confronts can be translated into Grand Ambitions for our public services, in a world where citizens are increasingly demanding and informed users of services and agents of change in their own right.

Many public service innovations remain localised when they could be adopted more broadly to great effect. Knowledge about such innovations is lacking and those confronting problems need ways of finding out what public service innovations have been successfully brought to bear on similar problems elsewhere and tools to help them assess the requirements for adaptation of these innovations in new contexts. Such relevant experience may come from private or third sector providers of public services, as well as national and local government bodies.

There is also the issue of service objectives and outcomes. While there are many incremental innovations to diffuse that can improve service quality, we also need to consider more transformative innovations that can ensure the achievement of social goals. This may mean borrowing models from private sector organisation and management – an example is the way in which NHS Direct in the UK, inspired by telephone banking services, provides a first port of call for people facing health problems to get advice on which public services to turn to. While there are issues of access to consider, newer technologies, such as the Web and mobile phones, and emerging devices like health monitoring systems, could be used to restructure relations between citizen/consumers and care providers in dramatic ways. Public services should learn from external experiences but they can also be sources of innovation in their own right, and influence innovation elsewhere through demonstration effects and procurement.

Public service innovation is important for addressing societal challenges, maintaining economic dynamism and improving quality of life. But fostering such innovation is more than just a matter of better dissemination of information and sharing of experiences. It will involve the development of tools for service design and engineering, the creation of spaces for creativity and testing of ideas and learning methods of innovation management. It will require leadership that can promote innovation, pay attention to ideas emerging from all stakeholders, and challenge the risk-averse culture of many public organisations.

We cannot hope to achieve all of these conditions overnight, but progress on even a few of them could help unleash innovation, and good examples in one dimension or at one location may inspire change elsewhere. Then we can look forward to public services being seen, not as laggards, but as exemplary innovators. ■

capital investments in European green technologies increased from £407m in 2006 to £805m in 2007 and to £1.15bn in 2008. Globally, the figures rose from around $850m in 2004 to $6bn in 2007 and continued to rise to $8.4bn in 2008[2]. Impressively, clean energy accounted for 15% of global venture capital investments in the last year[3].

Green promises post-recession
Nascent green technology firms were not shielded from this recession's finance constraints, but they seem to have faired better overall than other sectors and recent signals suggest that they may pull out of the slump faster. Venture capital is just beginning to flow again and is searching out technologies that will create wealth *and* an environmentally sustainable economy. The clean technologies attracting the most venture capital and the amounts funded in the second quarter of 2009 were: vehicles at $236m, biofuels at $206m, advanced batteries at $165m and solar, which has been hit very hard, at $114m. Geographically, of the total investment, 66% was in North America, 21% in Europe and Israel, 11% in India and 1% in China[4]. Of course, it is not just a question of finance- there are significant technological challenges in commercializing what, in many cases, are still nascent and cost prohibitive technologies. But a breakthrough could be huge, perhaps paving the road for the next global energy giant- which explains why the likes of Chevron and BP, are also investing in these risky start-ups. Venture capitalists are excited about the prospects of turning the 'mother of all markets' – the $6 trillion global energy trade – green.

Clean technology is seen as one of the key growth areas for the EU post-recession. This year's European Business Summit and European Tech Tour Cleantech Summit were confident that Europe can lead the world in developing green technologies. But this will require the attraction of more venture capital and the creation of demand for eco-innovation, no easy task across the diversity of Member States. Boosting demand for cleantech is largely a matter of regulation and standardisation: policy instruments should set the market on a solidly 'green' track – making financial incentives greener, adopting rigorous feed-in tariff policies and facilitating cross border green venture capital to increase the

Experimental tidal power generating turbine from Openhydro - Orkney - the European Marine Energy Centre's © Mark Annand

market size are just a few routes. There may also be a role for EU venture capital to target cleantech portfolios with increased funding. Policies that embrace the opportunity inherent in creating a low carbon economy must be robust – feeble attempts garner lacklustre results.

It is not surprising then that venture capitalists involved in green technology find themselves more interested in what is going on in policy circles than ever before because the initial success of cleantech firms relies heavily on regulations, standards and government incentives[5].

However, the long-term role of the government here should not be overemphasized. Vinod Khosla of Khosla Ventures, who recently raised $1.1 billion for green tech investments, rejects this emphasis on government partnership. He suggests that any truly successful green technology will have to pass the "Chindia" test, whereby the technology could conceivably be adopted in China or India without being subsidized[4].

Competition from across the Atlantic
Many European governments have been actively supporting the move to a low-carbon economy for some time now. But it is only more recently that the federal government in the United States has begun to take de-carbonisation seriously by beginning to create the policy conditions to bolster demand for alternatives. The US now seems to be determined to lead the world in the technological solutions to the mammoth problem of fossil fuel dependency; and they will surely exert some positive competitive pressures on Europe in the process. Venture capital investments in US green technology grew from about $1 billion in 2005 to a total of about $12.6 billion over the past three years. However, the recession hit venture capital hard; over the first quarter of 2009, all venture capital investing in the US was down 61% from the previous year. But investments in clean technology fared better, down only 48% from the previous year[2].

Although US venture capital investment in cleantech is down at the moment, the EU still lags behind in this financing category; the size of an average US deal is twice the amount invested in Europe where the number of deals is also fewer. This may in part stem from EU fund managers being less inclined to take risks compared to those in the US. As we know, the US market is larger and more global than the EU and this may make ventures in cleantech more risky in the EU. It has also been suggested that venture capital in the EU has moved too far away from the innovation driving early stage deals to a focus on later stage buy-outs[6]. We need to encourage the growth of the EU venture capital industry by attracting risk taking fund managers with expertise that spans management know-how and the science and technology that is critical to the success of green ventures. Now is the time to form the policies that will support the venture capital industry in its quest to fund cleantech, and in turn, give Europe the best chances for leading the greening. ■
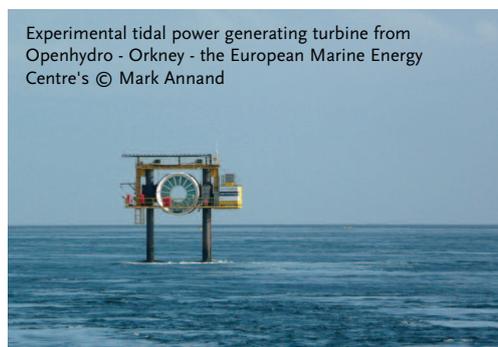
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6 Personal communication with European Venture Capital Association

La 27è Région: *Public Innovation Lab*

An interview with... Stéphane Vincent

By Julie Basset, LL&A

Stéphane Vincent is Director of "La 27è Région". He joined the FING (New Generation Internet Foundation) in March 2008, after having spent 6 years in charge of digital policies in the Limousin region and seven years as an Associate Director of the "Proposition" company. Stéphane Vincent has also been a consultant for administrations, state secretaries and local authorities.

Origins of the project

France is composed of 26 regions. The 27th is not an administrative entity, but rather an innovation lab designed to support public actors at the regional level and help them face technological as well as societal challenges.

The idea of the 27è Région was born on the last page of a collective book published in 2007: « Territories' digital challenge – reinventing public policies »[1]. The ten authors share the conviction that the public sector still underestimates the opportunities and societal challenges raised by the digital revolution. The last page of the document sketches a « scenario for the 27è Région », planning for the creation of an independent entity that would serve as an innovation lab for public actors at the regional level, modeled on private innovation labs. This entity would be free to think out of the box, be creative, call upon diversified expertise profiles – in short, go beyond traditional prospective activities.

The project, as a research-action programme, is supported by the French Regions Association (ARF), the Caisse des Dépôts (French public investment bank), as well as by the European Commission.

The 27è Région draws inspiration from several existing initiatives in Europe, such as the MindLab in Denmark and the Social Innovation Laboratory for Kent (SILK)[2]. It has also adopted and adapted other successful methods– for example, in the framework of 'Parks in residence'[3], artists were sent to various zones of the French Massif Central, in order to experience the conditions in which new inhabitants were welcomed (or not). These artists placed themselves in real-life situations, expressing their experience through various artistic means. The 27è Région adapted this principle of immersion to its own solution-finding objectives.

Basic principles: immersion and co-conception

The 27è Région currently manages a programme called "Territories in residence", an umbrella for 15 actions conducted in 15 places. Although addressing various challenges, the actions are based on common methods: a multi-faceted team is brought together and placed in a situation of immersion in order to experience the place and its users' daily experiences (during a three-month mission, the team spends three weeks in total immersion); this team is expected to transform the users' inputs and their own experience into co-produced solutions and prospective scenarios. The "Territories in residence" teams are usually composed of designers (especially service designers), architects open to user-driven conception methods, anthropologists and sociologists, as well as researchers specialized in the field of concern.

One of these 15 actions was recently devoted to the renovation of a Champagne-Ardennes high school, located in an economically depressed area and isolated from the city centre. The 27è Région team chose to focus on the following question « how to open the campus? » Together with the students, their parents and teachers, the team produced two types of solutions: immediately enforceable actions (an internal communication system was built in half a day), as well as longer term prospective scenarios, setting the way for the coming years. The Region Champagne-Ardennes is now willing to renew the operation.

The ideas, methodology and results were presented to the ARF members, as elements to be considered in order to solve similar or related issues.

Prospective design

The 27ᵉ Région also leads prospective design activities, in order to reinvent tomorrow's regional action and propose paths for the next few decades. Monthly one-day workshops called « Ateliers 27 » gather experts in public affairs, urban planners, designers, etc. to address varied issues and challenges such as: How could we plan for the coordination of energy production at the local level? What would a public policy simulator look like?

Encouraging new types of dialogue among public actors

The 27ᵉ Région also plays a diffusion role. It is an observer of innovative initiatives conducted throughout Europe – once identified, these initiatives are presented on the project's blog. In addition, public actors and elected representatives are invited to take part in a yearly study trip and to meet social innovators abroad. The last trip to London introduced the travelers to UK think-tanks and service design agencies and was an opportunity to discover operations like the Designs of the Time (Dott) initiative.

Each year, on the eve of the ARF congress, a BarCamp meeting is organized, in order to prepare discussions on the congress topic. In accordance with the BarCamp concept, all participants are invited to co-elaborate the event's programme at the beginning of the meeting. At the most recent BarCamp, policy makers, employment counselors, job seekers as well as active citizens elaborated a joint agenda on the topic of employment, so that all viewpoints were taken into account.

Feedbacks and expectations

The 27ᵉ Région does not rely on a specific administrative procedure to initiate its actions, but rather makes informal contacts before any initiative is launched – thereby ensuring that the places and regions concerned are willing to engage in the proposed innovative process. A convention is then signed, in order to ensure a proper legal framework. Whereas the action's outputs are never defined in advance, involved

partners agree on the methods to be used: interdisciplinary expertise, user implication, process transparency (action progress is presented through blogs, exhibitions, publications), and variety of the formats used (reports, photos, videos, etc.).

These elements of methods are indeed central, as a recent experience in Nord Pas de Calais (Northern French region) illustrates. Nord Pas de Calais supports a large R&D department, which has been working on issues such as public data re-use, attitude towards ICT, "safe-city" policy orientations, etc. While these studies, presented in a traditional report format, have drawn little interest from the citizenry, short videos produced by the 27è Région to embody the scenarios in a half-caricatured half-serious way have gained immediate interest from the public and the press.

The 27ᵉ Région values its lab status, as this allows the structure to act outside of administrative constraints and enables a variety of freedoms: freedom to take full advantage of a wide breadth of expertise and to call upon atypical profiles; to reinvent conception processes in order to involve all stakeholders and to produce adapted solutions for the public sector. The objective, however, is that regions develop their own innovation labs that can harness these methods, so that in the end regions develop the capacity to create their own particularly suited high schools, energy distribution networks of the future and so forth. In order to meet this objective, a balance still needs to be found between the freedom enjoyed by a non-administrative, independent structure and the substantial benefits garnered by integration with formal public institutions.

A possible topic for a next Atelier 27? ■

"Territories in Residence" cards: "what if I could... spend 500€ on a high school project?"

 "Le défi numérique des territoires - réinventer l'action publique". Coordination : Stéphane Vincent (Editions Autrement, mars 2007)
2 MindLab : www.mind-lab.dk / SILK : http://socialinnovation.typepad.com/silk/
3 http://www.letroisiemepole.com/interparc/blog/v2/

GRIPS' digest

By Pierre Bitard, ANRT

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PhDs and the knowledge and innovation economy

GRIPS' digest

The community of doctoral students worldwide keeps growing. Social sciences and humanities tends to grow quicker than sciences and engineering, and within each of these broad categories there are large variations. In sciences and engineering, which still represents the major part of the doctoral cohort, PhDs in the sciences are slowing down, while engineering is gaining momentum. Changes differ according to country, hence the key role played by 'brain migration' on a global scale.

National innovation systems produce more PhDs than ever: could this be an indicator of (increased) innovation performance? Not quite. New graduates cry out *"we want a job that matches our qualification"*, while policymakers who support PhD studies have a sense of dissatisfaction about the quality of the (peer-to-peer) evaluation system, and, last but not least, industries absorb only a modest share of the cohort, especially in Europe. So, where does this collective intelligence go if not to employments that would make the best use of it? How are PhDs supposed to participate in a country's innovativeness and competitiveness

if they do not advance knowledge frontiers and help transform these knowledge inputs into commercial fruits? An on-going passionate debate over these issues is taking place in France, the UK and Ireland over the past few months.

Where do PhDs go?
Detailed and consistent statistics covering long time scales[1] are available for the US. There, the situation is clear: about 45% of PhDs end up in academic institutions ('4-year educational type'), slightly less than a third go to private companies (and 6% into private not-for-profit), 10% work for government, while the remaining are self-employed. It should be noted that 45% of recent PhD graduates are "participating in post-doctoral appointments" (three-quarters of them in academic institutions), which, on average, last two years. Over a thirty-year period, the academic job uptake has tended to decrease to the benefit of the private sector's increases.

In Europe, such statistics are difficult to find. Ireland has been very active in recent years in terms of ambitions assigned to the higher-education

sector, and many studies were carried out on PhDs. In effect, a current key component of Ireland's innovation policy is to double the number of PhDs produced by fourth-level universities[2]. Innovation research has long been cautious on the risks of an over-emphasis on input indicators. However, as most innovation output indicators are out of (policymaker's) reach, this input indicator can be considered as one of the acceptable proxies of a country's potential for learning and research.

In Ireland, according to a census of post-doctoral researchers that left Science Foundation Ireland funded projects in 2007, around 20 per cent went to work in industry (9 per cent went to work in 'science and engineering businesses' and 10 per cent in other sectors), while the most common destination was another post-doctoral position on a different research project (38 per cent). In addition, 20 per cent of PhD graduates find employment overseas, which is quite a concern. This distribution is hardly satisfactory and calls for an examination of the value of the qualification itself.

What's the value of the PhD degree?

This issue is being considered in many countries. From a graduate's viewpoint, the value of a qualification is gauged against a set of criteria, including 'rapidness to find a job after graduation', 'starting salary and evolution', 'working conditions', 'personal accomplishment', etc. But, considering the highest educational qualification and given the individual and societal investments necessary to produce such a degree, expectations are great...and largely unfulfilled. The timelag between graduating and finding employment is not shorter than for master's degree graduates (quite the opposite), starting salaries are not higher either. As for working conditions, in academia, sustainable career paths are rare, and getting rarer. As more PhD holders are hired as post-doctoral researchers, the bottleneck is even more stringent. In industry, while it is sometimes a prerequisite in R&D jobs (especially in the US and in multinationals), it can turn into a handicap elsewhere since employers hire individuals on the basis of their aptitude to work and not on the basis of the degree. So, the recognition – not to mention respect – expected from the qualification is often not forthcoming. With more people who have PhDs, the perceived value tends to shrink, and this despite efforts in line with the Bologna process to ameliorate the image of the degree such as standardised and shorter durations, formal courses which make up the first year and 'professionalisation' (i.e. professional PhDs are developing so that people can continue to work while preparing a PhD).

At a national system level, this abundance of PhDs is valuable. Since uncertainty characterises research processes, a few 'large successes' may require numerous 'mild failures'. Those countries who have, often heavily, invested in developing PhDs acknowledge a resultant improvement in their research systems. But since resources are to be carefully monitored, the key question is then about the setting of a target share of the doctoral and post-doctoral cohorts that pursue research in areas of basic sciences. So, how to make careers in research both more attractive and more oriented towards the identification, evaluation and exploitation of knowledge for commercial application? How to do all this and avoid the research community getting the impression that funding is too skewed towards research that promises economic benefits?

PhDs, active players of the knowledge and innovation economy

The literature consulted for this digest points to a number of suggestions and good practices that would enable the improved impact of PhDs on our innovation systems:

- Continue to draw talent into research, organise career stability: do short-term contracts build up an efficient knowledge-based economy?
- Favour more predictable calls for commercialisation funding and longer term grants that better account for the timescales involved in bringing ideas to market;
- Secure funding for university spin-outs on a longer term since experience shows that it takes a lot longer to get a high-tech company off-the-ground: 8 to 10 years from basic research to proof-of-concept to production of market prototypes, and to do the market research all along;
- Shift the focus of PhD and post-doc evaluation metrics to take into account real-world contributions;
- Standardise the marking of PhDs with more transparent methods of assessment;
- Develop public-private funding and making of PhDs (after the French Cifre[3]);
- Encourage young PhD graduates to develop high-level quality teaching. ■

1 http://www.nsf.gov
2 There are about 1,300 PhDs graduating per year- two times as many as 10 years ago.
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Smart grids: *from an emerging set of technologies to a social (responsible) practice?*

By Pierre Bitard, ANRT

EU and US policy initiatives are supporting the advent of 'smart (power) grids" most notably through the earmarking of parts of their stimulus packages (see Grips' Newsletter 7). Following a few emblematic start-ups (e. g. Silver Spring Networks), the concept has recently been taken up by major, established players. Electrical-engineering firms (such as Siemens) as well as ICT companies have made smart grids the cornerstone of their development strategies. In the latter category, not only do we find long-time incumbents with hardware networks (such as IBM and Cisco) but also software companies such as Google and Microsoft. Are these buzz-driven strategies or signs of a real disruption? Drawing on recent press coverage, this article identifies the main business 'hot spots' and bottlenecks in the emergence of smart grids.

From a technological point of view, there are three layers where firms can compete in this emerging market. Reason and experience teach us that turbulences in the phase of emergence of a new technological system are common place.

First, the advanced metering infrastructure must be considered, this is a combination of chip and display coupled with telecommunication networks. This layer allows the transmission of reliable and timely information on power use (i.e. quantity, time and price). Whereas in Europe, data communication can be performed through power lines, in the US it cannot due to the existing grid's architecture- thus requiring that the US invest in wireless mesh technology. Companies on this segment can be either of the GE kind or of the Trilliant Networks type.

Second, utilities need to monitor and manage usage data gathered by the advanced metering infrastructure. Companies on this segment provide devices to keep records on billing, customer changes, meter failures and work orders for replacements. In this dynamic market we find both IBM and eMeter types of companies.

The third layer is the end-point, labelled 'home area network'. This 'home smart grid' would at least be made of two components- power consumption displays and thermostat devices. Both would be connected through wifi to optimise energy consumption via remote control. This segment with direct access to the end-consumer is the most competitive of the three layers and includes newcomers like Google with PowerMeter (web-based of course) and Microsoft's Hohm.

From a societal viewpoint, one may wonder whether consumers and policy makers are ready for and supportive of the change to smart grids. With the crisis, reducing resource consumption is becoming more acceptable to some and desirable or even compulsory to others. Improving 'demand response' involves consumer learning on a large scale so that with real-time energy usage information consumers could balance their energy use with evolving prices (and prices could be adjusted to the energy production). Savings could amount to 15% of a typical energy bill. But it takes some individual effort to switch from a passive bill payer to an 'energy stalwart'. Switching costs can be overcome if- and only if- operators and policies are reliable and trustworthy. ■

References: See websites of: IBM, Google, Microsoft, Cisco, Siemens, eMeter, GE, Trilliant Networks or Silver Spring Network.

1 "Smart grids entail two-way communication technologies that provide customers with real time information and tools that allow them to be responsive to system conditions, help ensure efficient use of the electric grid, and enhance system reliability", cf. 'Smart Grid: Modernizing Electric Power Transmission and Distribution; Energy Independence, Storage and Security; Energy Independence and Security Act of 2007 (EISA); Improving Electrical Grid Efficiency, Communication, Reliability, and Resiliency'. By Kaplan and colleagues (2008) p.272