ROADMAPS FOR FUTURE NAVIGATION

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Title
"Science Park operations on the verge between renewal and stagnation. Is there a green way out?"

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Executive Summary

This paper first discusses the current economic and operations context for science parks in Greece with its associated shortcomings, and financial restraints. In view of global and local level economic and policy shifts as well as recent conceptual developments within the third generation of science parks agenda (3GSP), the paper examines the opportunity of 'opening up' and expanding the reach and development potential of the science park through the example of a participatory process of Regional Technology Foresight in sustainable environmental technologies.

The tool is discussed from its inception, to its materialization, and special emphasis is given to the implications for visioning and strategy making processes. The rationale behind the Technology Foresight was to muster the competences necessary to address the regional needs in environmental technologies. It is suggested that advancing participatory planning tools such as the regional foresight on the environment can offer a good bridge for adapting the role of science parks into the nature-society interface.

Introduction

Truth exists; only lies are invented.
Georges Braque

Following the economic crisis the context for science park operations has become more challenging in the current period. Meanwhile science parks that do survive have changed their qualitative characteristics. It is important to recognize that they are in a process of transformation that is not clearly reflected in their assets and company statutes. Three tentative examples of those shifts are the following:

1. From locally based to de-facto spatially diffuse entities?

Fundamental in any analysis is to recognize that science park and their communities transcend the boundaries of their local environment. Science parks, their tenant firms and research communities are embedded in global webs of innovation and R&D. While science parks actors are locally-based organizations they also have an important transnational or global dimension both in the area of their direct operations, and increasingly indirectly through their participation in networks.

2. From real-estate to multifunctional organizations?

Whether acknowledged or not science parks comprise a variety of functions beyond a mere real-estate or business location. Frequently science parks are a supporting organization for regional innovation which integrates various managerial and organizational functions of some complexity as well as a web of relations and services to (non) tenant, local firms. Their effects cannot be measured in purely quantitative terms alone but require a more holistic and relational perspective. These are becoming structural characteristics of science parks organizations, which first have to be recognized, and then developed and utilized in any exercise of visioning and strategy over the future of its operations.

3. From multi-level engagement to complex (social) spaces of innovation?

There are conceptual issues in tackling the question of the role of science parks after the crisis. First here is the usual way of seeing the role of science parks and incubators as well as by extension regional economies. This includes at least three levels of analysis: a global/international view, a national, and a regional level of analysis. Of course actual innovation and innovating actors, either individuals, firms or communities of researchers and entrepreneurs are not 'resident' to any of these conceptual levels but are rather embedded in networks of actors operating simultaneously in the other analytical levels. Second there is increasing evidence that important shifts which affect the processes of innovation, the behavior and location of innovating actors are taking place across those levels. Thus rather than treating different analytical levels as convenient bubbles it is useful to thing of them as different aspects of a complex reality. Science parks are spaces of and for innovation. As social and organizational spaces they are confronted with pressures for adaptation to different requirements, needs and priorities by the collectivities of business and social actors who constitute them as such. Ultimately the science parks are judged by their contribution to the success of those connected collectivities. In today's environment this often means that 'reading', 'reacting' and 'anticipating' change is crucial to ensure that science parks contribute to delivering value and competitive advantage to their core collectivities.

Thus this paper attempts to look at the conventional levels, from the angle of the science park, but in a way that allows illustrating some of the dynamic, and open features they involve.

Global level: competition, interdependency and ecological crisis

At the **global** level economies and societies are witnessing the end of the financial crisis albeit in a highly unequal way. At the same time it is now evident that a deepening and widening ecological crisis lies ahead. Catastrophic natural hazards and energy (in)security are now established trends. Other inherent elements of the global environment are the heightened inequalities between countries, and especially between social strata and sub-national regions. It seems that the opening of international borders is also being coupled by the variable re-imposition of seamless internal borders. This is leading to a situation where it is necessary to rethink the traditional view on the context for science park operations; what constitutes 'foreign' and 'external' as opposed to domestic and internal. Some practical examples of these occurrences come from volatile foreign investments to science parks, as well as the highly cyclical and uneven pattern of research production and localization[i] (Antonopoulos 2008).

Local level: recession and stagnation in innovative performance

At the **local** level, communities are witnessing a macro-economically challenging environment which contributes to uncertainty over development prospects. Certainly in the Greek case this is very pronounced because of the highly pro-cyclical impacts of austerity policies and since the counterweight of anti-cyclical support to new business formation, especially in research-driven business, has been so far ineffective. The incubation process has become affected, where dwindling funding for research and innovation is contributing to gross fluctuations in the number of start-ups as well as in the tenancy periods, time to maturity and spin-off creation. Particularly in peripheral science parks there are examples of loss of activity, decline and closures or cessation of operations[ii] (Groumpos 2010). Furthermore there is a decline in innovation output already since 2007. Indicators of research output such as patent applications are also a cause for concern since they are showing stagnation in recent years. In the region of Western Greece the number of registered high-tech patents to the European Patent Office per million inhabitants was reduced from the high of 2.7 in 2003 to 0.4 in 2007. This is similar to the levels of the late 1990s. Decline in high-tech patents was also evident in the country's leading region Attica, where the number of high-tech patents fell from 3.8 in 2003 to 0.8 in 2007. (Table 1; Figure 1)

Table 1. Patent applications and European high-tech patents, regional breakdown for Greece. Source: EUROSTAT

	1999	2000	2001	2002	2003	2004	2005	2006	2007
				European high-technology patents per million inhabitants					
European Union (27 countries)	22,125	24,033	24,313	22,623	19,835	21,618	20,423	20,054	11,476
Greece	0,923	1,125	1,246	1,649	1,982	1,395	1,461	1,255	0,559
				Patent applications to the EPO by priority year, by NUTS 2 region					
Central Macedonia	4,268	6,135	6,186	6,608	8,502	3,755	8,805	12,098	5,836
Thessaly	1,347	:	2,026	4,966	1,016	6,035	7,958	2,984	6,106
Western Greece	3,645	5,651	3,214	5,285	6,661	2,054	5,462	6,072	5,428
Peloponnese	1,673	2,005	3,479	:	4,989	:	3,344	3,771	1,68
Attica	9,441	8,437	10,731	10,468	13,514	11,155	16,44	13,671	6,84
Crete	3,409	7,481	11,078	14,25	8,9	6,384	13,189	14,27	3,309
	High technology applications to the European Patent Office per million of inhabitants								
Central Macedonia	:	0,536	:	1,763	0,878	1,048	0,978	:	0,908
Western Greece	0,457	1,385	1,081	1,035	2,774	0,685	:	0,626	0,448
Attica	2,133	1,908	2,441	3,161	3,874	3,096	3,003	3,124	0,811
Crete	1,704	2,827	2,525	1,961	2,221	:	3,044	1,659	:

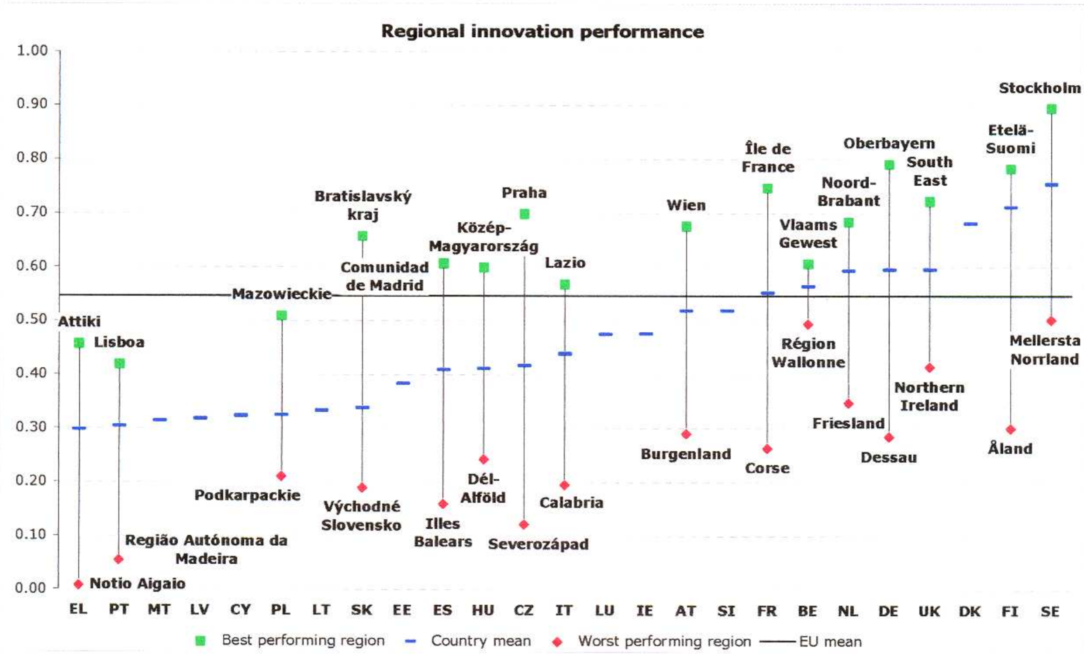

Figure 1. Innovation performance across the regions; Source: 2006 Regional Innovation Scoreboard

The challenge of new forms of living, production and innovation

Parallel and related to the above there are some ongoing shifts, increasingly becoming evident at the level of the **individuals**, which constitute the local firms and communities of practice. These shifts require the attention if not adaptation by science parks. Thus in place of only witnessing the out-migration of talent, which still remains a significant issue; there is also a trend towards reconsideration of 'conventional' life choices even among the high-skilled people. In other words there are multiplying examples of behavioral shift in the urban class. People are prioritizing some (re)emerging forms of autarky and local sourcing in their consumer behavior, and are undertaking to a lesser or greater extent changes of lifestyle (work, living), which often involve a reconsideration of their relation to nature, beyond the dominant/conventional urban and suburban/rural lifestyles. While it is not totally clear whether this trend will continue strongly in the post-crisis period, it already has some economic significance particularly for the food and agriculture sectors, and contains opportunities for a different sort of organization of provision of services for innovation. This is because both supply and demand in the niche markets, for instance, of urban small-scale agriculture and local food production are in need of new forms of infrastructure or inventive ways of re-using the existing infrastructure, as well as more flexible and efficient ways of organization. Science parks in proximity to rural areas should be no stranger to this.

Meanwhile science parks are facing the 'competition' of what seems to be an alternative to the traditional model of incubation and innovation (support) which is affecting their core business. This is another example of an emerging social phenomenon. Especially among young graduates in ICTs and the creative disciplines their workspace, entrepreneurial behavior and production processes have become hybridized. With the increasing availability of cloud computing tools and capabilities startups—not merely for cost reasons—prefer informal work environments (e.g. start a company with a shared desk or inbox) to the organized incubators, which among others have capacity problems. This process of 'open' incubation is revealing the existence of an untapped potential. But rather than hailing this development as positive growth it might be worth ensuring that there are good levels of access to business counseling and support to prevent a less than optimal use of local skills and resources. In particular there are concerns whether this informal type of entrepreneurship leads to a sufficient level of protection and valorization of assets such as IP rights. This is another possible field of expansion for science park activity.

At the same time new emerging forms of manufacturing techniques are questioning the traditional separation of R&D from manufacturing[iii]. With the advance of 3D printing it might be that small independent innovators and R&D firms will have there own capability of creating experimental product runs without having to rely to outside fabrication. This is likely to have implications for cities, regions as well as the spaces of research and innovation including science parks.

Science parks: a missing link in the webs of policy?

Another challenging influence seems to originate from the sphere of innovation and entrepreneurial **policy** itself. This requires de-centering the view from the science park to include referring to the distinct and often overlapping sets of actors which form the networks of policy making in innovation and business support. The reason is that there seems to be both a negative atmosphere as well as harsh critiques of science parks and their respective model of operation. The policy attitude towards science parks is at best highly variable. At the same time science parks are not playing a sufficiently central role in the shaping of innovation and business development policy.

The attitudes towards science parks are split. Usually a local 'coalition' consisting of policy, academic and private actors are generally supportive of the science park initiatives but the interest of national government and the EU institutions has waned in recent years. It is now increasingly rare for governments to take up the risk of funding a science park type of development. Financial constraints on government budgets have played their role on this but there is also a proliferation of worrisome analysis regarding science parks at certain policy institutions. For instance recent analysis by the OECD has questioned the effectiveness of science parks in the current economic environment[iv]. At the same time EU policy with the exception of the generic-level actions of CIP and the DG Enterprise & Industry actions, has demonstrated little real activities to include science parks as the leading 'pole' in regional and community innovation policy. While certain actions are open to science parks, there still much room for the EU to come up with a systematic agenda on how the existing technology infrastructures (including science parks) will be best integrated and exploited in the post-Lisbon and post-crisis period. The recent opinion of the European Economic and Social Committee (EESC 2010) is very informative on this.

On a different and more positive note the contradictory EU's 5th cohesion (2010: p.210) report[v] makes reference to science parks and incubators under the classification of 'indirect measures'. The report explicitly recognizes that 'indirect support—advice, networking, clustering and incubation—can be as effective as direct financial aid' (p.213). These are viewed as part of four innovative measures to support RTD and innovation, which are often combined: grants for research, collaboration and capacity building, both to the private sector and research institutions; investment in formal education and vocational training; indirect measures, such as support for business services, technology transfer, networking and research infrastructure; venture capital and loan funds, sometimes to a particular sector such as biotechnology. Indirect support measures, it is noted, 'by their very nature tend to have effects only over the long-term, but the (limited) evidence available suggests that they are no less effective per Euro than direct financial assistance' (EU 2010 p. 213). At the generic level of promoting competitiveness and convergence the report recognizes that 'technological readiness', 'business sophistication' and 'innovation' are drivers of advanced regional economies. (EU 2010: p 68).

At the same time that science parks seem to lose importance for policy there is another cause for alarm. This has to do with the quality and content of much of the public discourse on the management of the crisis. The management of the Eurozone crisis has been debated and performed at an intergovernmental level, where the privileged stakeholders are by definition the finance departments of national governments and international financial institutions. In that juncture the policy debate has very much become one focusing on conformity to national level macro-economic statistical indicators. EU policy making rather than equally focusing on the diverse capabilities and challenges of transnational and sub-national European regions has been effectively 'financialized' and 're-nationalized'. Especially for the Greek NSRF and economic policy, science parks as facilitators of localized systems of innovation do not figure in the picture which reads economies mainly in tax and monetary terms.

As a side effect the practically applied notions of competitiveness have departed from what used to be the norm in the pre-crisis period. It seems the working dimensions of competiveness have been reduced to those based on price and wage levels rather than on innovation, economic conversion and research and technology capabilities, which so far have received marginal attention. There is a risk here namely that binary conceptions of open deregulated markets are contrasted to the 'antiquated' incubation infrastructure offered by science parks and planned knowledge locations. The essence of this critique lies in the phrase 'science parks are not good enough at incubating' which could summarize much of the recent critical views. Nevertheless while stressing the shortcomings of current incubation models these critiques are often flawed since they are neither sufficiently addressing dynamic knowledge relations as the core capability of science parks, nor exploring or suggesting viable alternative paths to the prevailing models in planned knowledge locations rather than a vaguely stated 'market will provide' principle.

The 3GSP agenda

The recent shifts briefly outlined above have profound implications for science park operations. Out of the responses and adaptation strategies available or applicable the paper briefly discusses the contribution of an expanding agenda of debate within the science park community, the so-called '3rd generation of science parks'[vi] (3GSP.fi) paradigm or what elsewhere has been referred as 'Science Parks 3.0'[vii] model (IFTF 2009). This paper argues that the 3GSP agenda should be expanded to include also a hybrid mechanism for diagnosis of regional capabilities and futures at the disposal of the regional science park community. In this context the paper discusses the potential of foresight tools and techniques in the area of Environment and Renewable Energy.

Perhaps the biggest aim as well as success of the 3GSP agenda has been to raise awareness that science parks in order to be sustainable should be interconnected to society—urban and regional—and the increasingly informal and networked business communities rather than being 'enclaves' of innovation[viii]. This is collectively referred as a 'knowledge ecosystems' view. A tentative summary of the 3GSP agenda for success approach could include:

- *Visioning, strategizing, and community engagement*. This goes beyond the social capital strategies of 2nd generation science parks[ix] (Hansson et al 2005). In that respect the planning of activities and science park operations should not be limited to tenant firms and communities but rather cater for the needs of a much larger urban startup and young researcher-entrepreneur population. Examples have included management of office spaces outside the premises (Manchester Science Park), joint activities with informal entrepreneurial communities (open coffee events and communities), investment in hybrid workspaces (e.g. Oasis network)[x] and virtual co-work platforms, location of one-stop-shop for businesses at the premises, and advanced services for support and protection.
- *Triple helix involvement or available pool of resources*. Science parks and regional communities should ensure the strong involvement of triple-helix institutions which continue to be both pre-requisites and necessary resources for entrepreneurial research and innovation. Closer engagement with universities, university based research and alumni networks are important contact points for an agenda favoring regional resource pooling. Similarly large corporations and industries are important partners and nodes of the regional knowledge networks.
- *Development consensus among supportive stakeholders*. This is an essential dimension of the new agenda but often difficult to achieve. The exploitation of sources of financial capital, as well as state funding and community support for development of either physical or 'soft' entrepreneurial activities is important in that respect.
- *Proactiveness and strategic behavior*. It is perhaps useful to visualize the engagement of science park with economy and society along two axes:
    - responsive-reflexive. This means that science parks need to develop and include into their strategic and business plans the lessons from recent event paths and episodes of development. For instance science parks should recognize the regional and overall fluctuation and volatility in business formation, as well as develop an in depth understanding of causes and implications of (sectoral) rounds of investment, and disinvestment, closures or rounds of 'creative destruction'.
    - inclusive-equitable. Science parks have a vested interest in searching for, releasing and developing dormant potential for innovation and knowledge creation. This would practically mean reaching out to the informal but increasingly prevalent urban co-work spaces. At the same time it should be recognized that discouraged potential remains unexploited due to exclusionary practices of the past as well as due to the barriers of social class, gender, disciplinary origin, and place biases.

Admittedly the 3GSP agenda has expanded more on the entrepreneurial and 'work' and social related aspects of science park operations. This has been a justified choice for maturing science parks since this can be considered as an obvious area of operations beyond the basics of physical infrastructure and real estate provision. But there remain some missing steps to the effort of networking or 'regionalizing' the science park. Such a promising step and area of operations is the broadly defined sphere of the Environment. Lots of the current research effort and innovative activity is being re-centered or re-cast under the conceptual triangle of Environment-Economy-Society relations. Notwithstanding the differences in regional specialization, in the Greek science parks the broadly defined environment focused research and innovation, is by far the largest group of activity together with ICT technologies. This includes such areas as energy, agriculture and food production, resources, ecosystem and natural resource management, waste treatment, and natural hazard control.

It is thus essential for the science park to:

- effectively liaise with the relevant research and business communities, which often experience difficulties in access to markets, or access to innovation
- integrate in its programming of activities and planning development an holistic environmental outlook (Figure 3).

Foresight tools

The use of foresight tools is widespread in sectoral, technological, and regional development and planning approaches today. It is a recognized method useful for both planning purposes as well as for the construction of future visions. The purported origins are in the UK. The approach has been adopted by national level authorities and following also the support and pilot exhibition by the EU research framework program it has been rapidly undertaken by regional authorities[xi]. (For a recent review of the origins of foresight in science and technology see Martin 2010; for foresighting for development read Wehrmeyer et al 2002).

Advantages of the approach

The technology foresight is an excellent tool for application at the regional level. There are some particular advantages. Fist it can be done 'in house' that is with existing capabilities and staff commitments. The only major requirement is the preparation of the format and drafting of guiding documents and the relevant data selection and analysis procedures. Second the approach is practical and consensual in the sense that it allows focusing the debate from management of current affairs (and conflicts) to future needs/opportunities. Third the approach especially of scenario methods enables bold visions and inspiring future states which cannot be achieved by mere statistical forecasts or extrapolations. Fourth the application can be managed through recruitment techniques to a satisfactory response rate. Fifth it reads local conditions better than other techniques since it requires the collaboration of local elite groups in technology, business and knowledge production. These 'local experts' are much more likely to understand the local conditions and contribute to envisioning future prospects.

Critique of the approach

At the same time there are limits to the reach of a foresight application. It is referred as foresight and not forecasting. The essence is to offer possible alternative images of future states rather than an accurate prediction of future trends or outcomes. While it has the potential to generate valuable input to stimulate thought and debate it also has some major weaknesses. There are four such points worth discussing here:

- 1) Effectiveness, susceptibility to simplification and lock-ins

Often the regional foresight approach leaves little room to account for unexpected events and trends. Business and technology managers are prone to following established modes of thought and frequently (over) simplifying in areas lying outside their current areas of expertise[xii] (Weick and Sutcliffe 2001). There is a tendency in research and business communities to follow visible, established and measurable concepts and indicators. More importantly there is a critical element of serendipity in technology development that a foresight application might have to try hard to apprehend and include in a meaningful way[xiii] (Taleb 2007). Frequently the future alternatives are 'broad brush' variations of a similar reality base rather than radical visions of the future. Another issue is that the process remains sensitive to political time as to its applicability. While the tool is stimulating it is not an alternative for lack of debate culture or talk and search capacities at the regional/local level. Such inertias require a coordinated attack rather than individual approaches.

- 2) Foresight applications can suffer from the neglect of the (social and) territorial underpinnings of innovation.

While certain techniques are more participatory or democratic others are purposefully selective or elitist (e.g. Delphi group discussions). Thus the application runs the risk of a selection bias in its sources and the discourse developed within it is not representative or inclusive of developments across the region. This is a critical point because the focus on local and regional geography requires a very accurate depiction of macro realities and their particular regional representations.

- 3) Neglect of micro-sociological foundations of innovation

Another risk is to reproduce a hierarchy bias. Innovation is far from resident to management level, lower management and often individual 'street level' innovators and their networks of practice have important (non-conventional) things to say about regional technology futures.

The achievement of rich and inclusive accounts of future states is complicated by the occurrence of 'group think' and 'sectoral level' views. Innovations and Technological development rarely follow established paths of development and are rather the result of mix-and-match as well as novel combinations of existing knowledge (Yul 2007). Moreover sector-wide views are often too generic to come to grips with the inter-linking and overlapping ecologies of corporate entities. Increasingly production and innovation are hypermobile intangible assets based processes, where small informal networks and individuals play a key role.

- 4) Mis-match to sectoral realities

In addition to overplaying sector wide commonalities the application is possibly problematic to use in rapidly mutating research and industrial sectors. That is because both the geographical pattern of industries and the mode of organization and production can be seen to be rapidly mutating and thus not easily foreseen.

The example of regional technology foresight for environmental technologies in the region of Western Greece

The regional foresight exercise for Environmental technologies is an example of re-marketing the science park at the regional level as a space for environmental innovation. This was done as an integral part of the cluster initiative 'Regional Innovation Pole' which was implemented between 2006-2009. The regional technology foresight tool was developed as part of the ongoing effort to develop the science park's role within the regional innovation pole of Western Greece. It functioned as its diagnostic device. The regional innovation pole was a union of local and regional research, knowledge and innovation (triple helix) organizations seeking to promote the innovative potential of the region[xiv] (see www.innopolewest.gr).

The origin of the initiative lies in the initiative of the General Secretariat for Research and Technology (GSRT) of the national Ministry of Development which implemented actions that aimed to aid of technological dexterity and distinction in important Regional technological nodes. The creation and growth of 5 Regional Innovation Poles in Greece constituted an embryonic axis of technological policy with the aim to reduce the difference of innovative record in Regions of the country from the Community mean. The action was included in the Operational Program "Competitiveness" of the Third Community Support Frame (CSF) of the of Ministry of Development, with a total budget of 20.2 million Euro for the period 2005-2008. The specific thematic areas of the project were the following:

- Axis I. Information and Communication Technologies
- Axis II. Safety and Technologies of Foods
- Axis III. Environmental Management and Protection

According to the guide of practice for regional technology foresight in Greece by the Directorate General for Research, of the EU Commission: 'the technological foresight is a systematic participatory process which includes the collection of information and the building of visions for the medium- and long-term future with the aim to guide decisions that are taken today and stimulate joint actions'.

Materialization of the tool (how it came to being)

This was actually the **first** Technology Foresight which was carried out in the region of West Greece. The main aim of the exercise was to develop a common strategic platform and jointly address common conditions, options and challenges. Another aim was to bring together specialists, planners and decision-makers. Representatives from the regional and local authorities, the enterprising sector, universities, research institutions and others of the Region of Western Greece (RWG) had the opportunity to realise constructive discussions aiming at the essential comprehension of the current state of the region and the creation of a common vision for the future.

The project had a duration of 24 months (1/11/2006 - 15/12/2008), which at the beginning seemed a long time. However, in the process it was proven that it takes time to develop a common language for the present state of the region and construct a common vision. The time horizon for the exercise was set to 2021. Three separate exercises were carried out at the same time, each focusing at specified thematic areas of the regional innovation pole. This paper describes the Technology Foresight which focused on the third axis: Environmental Management and Protection. Benchmarking of international approaches (e.g. Finland) of the national foresight and a regional (Western Macedonia).

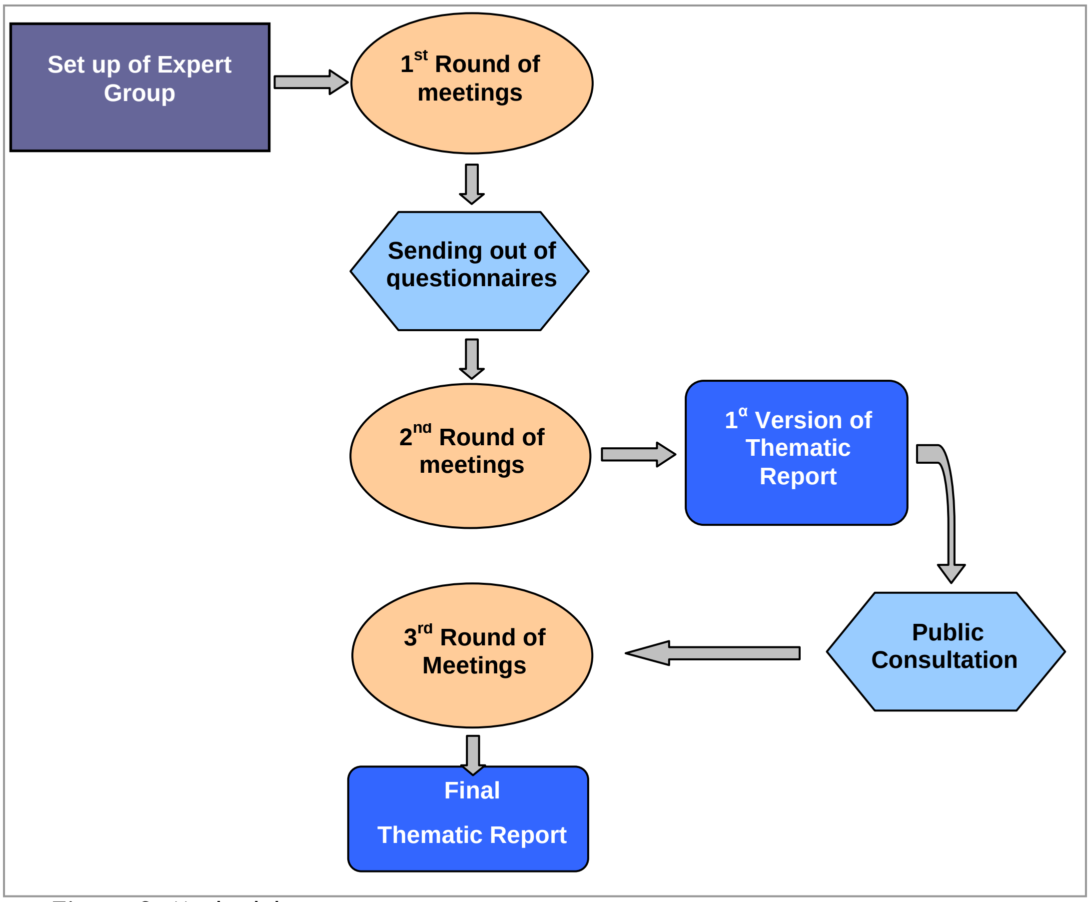

Figure 2. Methodology

Results

The RTF proceeded to examine three diagnostic areas overall:

1) mapping out challenges:

This unit had a three –level emphasis on global, international, and regional level and made explicit reference to the pressing issues of climate change, demography, urbanization (suburbanization, urban problems) and the energy crisis.

2) mapping out existing resources:

This unit included mapping all existing hard or physical infrastructures for environmental development (environmental interest plants and production facilities), mapping of institutional capacity (including relevant development agencies), local network linkages between research and industry, and place-specific resources such as hydro-power, wind-power and solar power. All this data were later fed back to the group of experts undertaking the SWOT analysis. The assessment took into consideration the forecasted prospects of existing resources, such as materials (e.g. rock gravel, marble etc).

3) mapping out existing capabilities:

This unit involved mapping the skills level in relevant environmental specializations, developing a qualitative estimation of gross value added by the environmental sector and assessing the innovation potential of firms and possible startups.

The project had five thematic areas of application. These were discussed in the consultation rounds and also through the questionnaires to local expert participants. (See Figure 2)

0. An overall (generic) environment level where aggregate developments were discussed
1. The thematic developments related to land. This included assessments and of urban development, urban waste, recycling, agriculture and wildfire hazard. Rather than only commenting on the current situation participants were asked to rate possible alternative future progress on those issues
2. Developments related to the water and sea resource included assessments of water quality, pollution of internal waters and seawater, fishing resources, and blue flags
3. Developments related to air included measures of air quality, greenhouse gas emissions, effects of climate change
4. A specific thematic focus on vulnerable ecosystems and safeguarding biodiversity. This was a part of the consultation and questionnaires where participants were asked to the possible future situation e.g. in protected areas and sensitive regional ecosystems.
5. A focus on renewables and the energy sector considered the existing prospects of power generation, and the potential especially from gas, hydro, photovoltaic and wind capacity.

In areas 1 and 4 there were local participant businesses.

The project contributed three scenarios, which upon agreement of the consultation groups were submitted for evaluation in the final questionnaires. The first scenario was entitled Sustainable Development. It was foreseeing a future were environmental problems were on a track of being tackled, and resource and ecosystem management were improving in efficiency; citizens, companies and civil society actors changed their behavior for the better. This scenario however, received 0% probability of materializing.

The second scenario was entitled Quality Variance. Under this scenario the region would have mixed results. There would be improvements in planning of environmental oversight but there would be setbacks in the implementation of interventions. This scenario received 82% probability of materializing.

The third scenario was entitled Dramatic Degradation. Under this scenario the region would be unable to exploit its potential or address environmental problems in a systematic way. Developments in urban centers and in the business world and civil society would not have moved in a way that respects the regional environment. Local companies practically externalize much of their environmental costs. This scenario received 18% probability of materializing.

Pathways

This unit asked participants to rate the various points raised in the SWOT analysis. Among the weaknesses institutional capacity received the majority of the votes and among the strengths the existence of ‘hard’ infrastructure in universities and environmental research was rated highly

Technologies

This unit asked participants to indentify the technologies and the conditions that need to be met for the region to achieve a desired level of environmental development by the end of the foresight horizon. This included focusing on 12 environment related economic sectors from photovoltaic power generation to tourism. Particular emphasis was given on the sectors were the region is lagging behind and the sectors that have good potential for development. The evaluation addressed both research and development gaps, as well as strictly speaking technologies with potential.

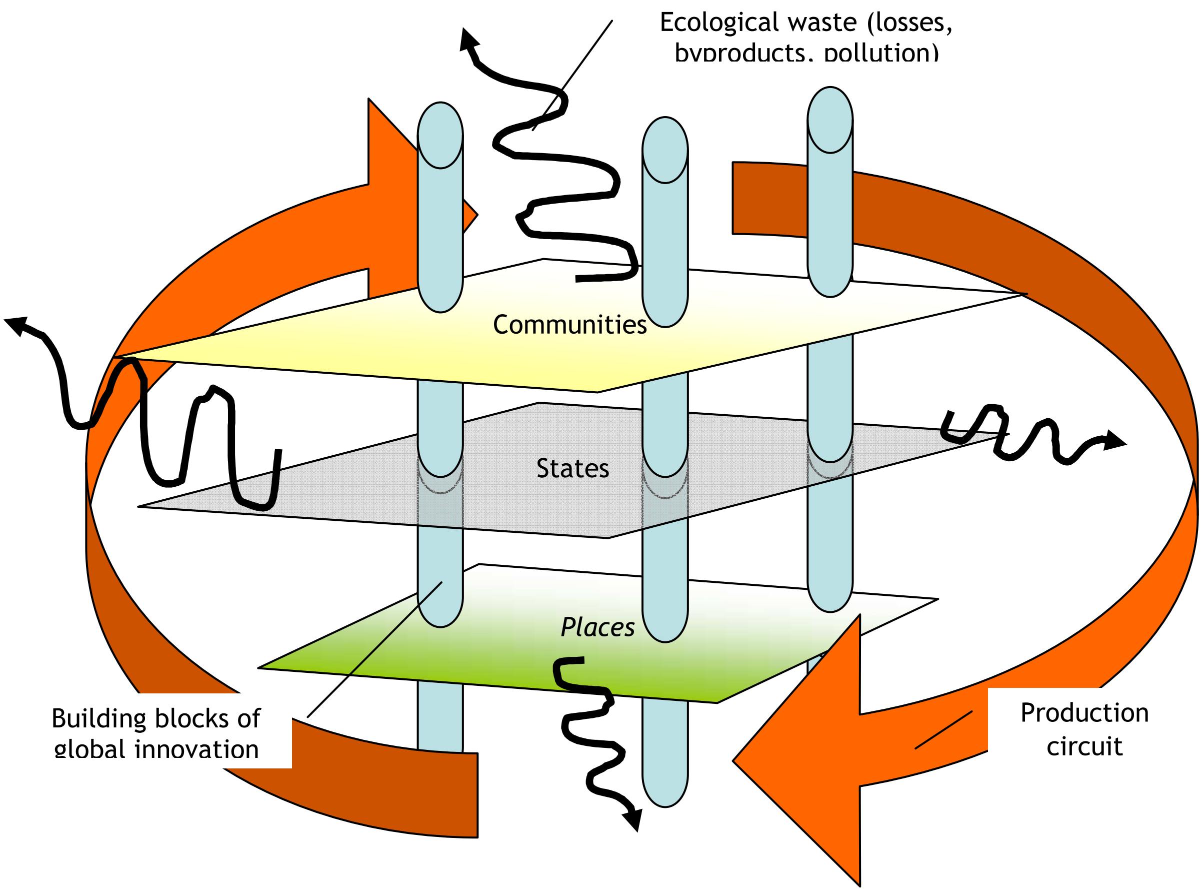

Figure 3 A diagram of the losses and waste in the representations of growth and innovation. Losses and waste of resources are rarely accounted for.

Conclusions

Science park operations are confronted with the option of stagnation or a bold shift toward different forms of organization and services that include more explicitly the interface between nature and society. Societal changes, as well as behavioral shifts at the individual level are suggesting that at least in some niche areas there exist opportunities for expansion and integration. Science parks should be able to mobilize existing resources in those areas as well. One such attempt has been the regional technology foresight in western Greece.

In brief the Environmental Technology Foresight mapped out a series of challenges to the region's sustainability at the urban, trans-urban and regional scales. These varied from institutional capacity deficits in environmental policy regulation and oversight, to highly focused technology gaps for instance in waste management and fire risk prevention. An effort was made to invite experts in environmental sustainability from as wide a background as possible, in order to be able to come up with an inclusive picture and avoid disproportionately favoring specific high-profile 'green industries' such as renewable energy. While it’s a large debate which environment technology sector offers the best potential and less costs given existing levels of investment at the regional level, it became evident with the foresight process that regarding environmental technologies: a) the region possesses a variegated portfolio of competences, b) that attitudes to certain technologies and 'technology gaps' tend to differ with some of the ongoing developments, though deemed successful from an ecological viewpoint—also seen as bypassing the region and much of their value added accruing to extra-regional private interests.

The overall conclusion is that by capturing and matching the necessary knowledge stream between technology needs and technology supply, the science park can ensure the emergence of new growth spaces and opportunities for development that will bring added value at the societal/regional level. To fulfill this mission, it is our view that science parks need to be more reflexive to global developments in technology, environmental trends, and strategies but also highly responsive to the strategic, organizational and human development needs of their home city-region.

End notes

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[i] Antonopoulos, C.N (2008) "STPs as location for FDI; learning from past investment incidents: semiconductors in Western Greece", E-article available online at IASP Bookstore at http://www.iasp.ws/publico/jsp/herramientas/lstLibrary.jsp?cd=11715&ca=650 last access 14/02/2011

[ii] Groumpos P.P. (2010) Speech at FP7 SWAM technological cooperation initiative. Patras 7-9 July 2010.

[iii] The Economist, February 12th 2011,"Print me a Stradivarius: the manufacturing technology that will change the world" pp.69-71.

[iv] OECD (2009) Territorial Review Copenhagen. March 2009

[v] EU (2010). *Investing in Europe's Future*. Fifth report on economic, social and territorial cohesion, November 2010.

[vi] Machester Science Park (2007) "Third Generation Science Parks: a report by Professor John Allen" pp. 1-22.
Karostech, 3rd Generation of Science Parks - Network Incubation and Serendipity Management www.3gsp.fi

[vii] IFTF Report (2008) "Future Knowledge Ecosystems: the next twenty years of technology-led economic development" Report Number SR-1236.

[viii] Felsenstein D. (1994) University-related science parks – 'seedbeds' or 'enclaves' of innovation?, *Technovation* **14**, 93-110.

[ix] Hansson, F., Husted, K., & Vestergaard, J. (2005). Second generation science parks: from structural holes jockeys to social capital catalysts of the knowledge society. *Technovation*, *25*(9), 1039-1049.

[x] Network Oasis http://en.wikipedia.org/wiki/NetWork_Oasis

[xi] Martin, B.R. (2010) "The origins of the concept of 'foresight' in science and technology: An insider's perspective". *Technological Forecasting and Social Change*. 77 pp.1438-1447.
Wehrmeyer, W, Clayton A. and K. Lum (2002) *GMI* Theme Issue 37 pp. 24-36.

[xii] Weick, K and Sutcliffe K (2001) *Managing the unexpected: Assuring High Performance in an Age of Complexity*. University of Michigan Business School Series.

[xiii] Taleb NN (2007) *The black swan: The Impact of the Highly Improbable*:2007, 2nd Ed. 2010

[xiv] Antonopoulos CN, Papadakis VG, Stylios ChD, et al (2009) "Mainstreaming innovation policy in less favoured regions: the case of Patras Science Park", Greece*Science and Public Policy*, 36(7), August 2009, pages 511–521. Available online at http://www.ingentaconnect.com/content/beech/spp