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Cleantech Incubation Policy and Practice

Recipes for creating cleantech incubator hotspots in Europe

JUNE 2014

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CIE Cleantech Incubation Europe

Content

Preface

This Cleantech Incubation Policy and Practice handbook is one of the main deliverables of the Cleantech Incubation Europe (CIE) INTERREG IVC project. The project aims to collect and share best practice from the incubation of cleantech start-ups across Europe to foster entrepreneurship, grow the economy, and green our society. While writing the handbook with authors from more than five different European countries, we discovered that this experience of "collective writing" was becoming more than just a formal deliverable of the INTERREG funded project. The experience itself was exciting, and has allowed us to discover the challenges but also the benefits and synergies of pan-European collaboration to integrate knowledge and experience from so many backgrounds, disciplines and cultures. In addition, we believe this handbook has been produced at the right time for all European countries for two main reasons:

The first is that climate change and a reliable and sustainable energy supply require with increasing urgency a clear strategy at a national level but also at a European level. Now is the time to define a strategy that enables Europe to leave fossil fuels as a matter of the past, by minimising their contribution in order to decrease greenhouse gas (GHG) emissions, and to maximise the contribution of our own renewable energy sources.

The second reason is that the current economic crisis is urging all public authorities in Europe to define clear stimuli to push our economy in a direction where new start-ups and jobs can be created in order to provide social and economic benefits to society. Market forces alone are not enough and efficient public-private partnerships emerge as an important strategy to stimulate innovations and facilitate entrepreneurship and job creation, in particular in the cleantech market. Cleantech start-ups promise to be the win-win opportunity in this direction, with direct environmental, economic and social benefits.

We hope that this handbook, based on best practice and real-life cases from all across Europe, will provide wise advice, best practice (and next-practice) to policy makers and practitioners in cleantech incubation in order to foster a more sustainable society that is taking into account the rights of future generations.

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Executive summary

This handbook showcases the main results of the INTERREG IVC funded project, Cleantech Incubation Europe (CIE), that was delivered by a consortium of partners from six European countries (Finland, France, United Kingdom, Italy, Hungary and the Netherlands) between 2011 and 2014. The goal of the project was to identify and share best practice in policy, strategy and operations from the incubation process of cleantech start-up companies across Europe and highlight the specific challenges cleantech start-ups face in successfully growing their company.

This handbook will help practitioners and policy makers to identify effective tools, practices and policies that aid them in establishing fertile grounds for cleantech start-ups and sustainable business creation, to foster a more sustainable society and regional economic growth.

Primary best practice examples have been identified in more than thirteen European cases of leading cleantech incubators and cleantech innovation clusters. Best practice was collected from cases in Austria, Denmark, Finland, France, Hungary, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom. Aside from a more general description of best practice and useful tools in cleantech incubation, this handbook provides concrete examples for each best practice and links to organisations and institutions that have implemented them.

In order to describe the best practice, the authors have defined a cleantech incubation process model that consists of four critical phases in the incubation value chain to stimulate and facilitate start-up companies; from the business idea and technology or knowledge transfer, to selection, incubation and exit. For each phase, best practice examples are defined with respect to the involved stakeholder network, education and training, business services, funding, infrastructure, organisation, and strategy and policy. The key recommendations and conclusions with respect to the identified best practice are summarised below.

The context of the incubation process, the **cleantech incubation ecosystem**, is strongly influenced by policies at a European, national and regional level. At these levels, best practice to stimulate business creation in cleantech, are:

- National and regional policies on sustainable innovation and economic growth (linked to the 20/20/20 targets of the EU) to increase investments in research and development in cleantech, to create national and regional market demand, to support internationalisation, and to provide tax incentives for investors and companies that support cleantech;
- Public procurement strategies that support cleantech innovations and enable start-ups to find launching customers at governmental organisations;
- National and regional policies to strengthen cluster development and cluster specialisation (in order to build critical mass) in cleantech areas at a regional level, and to facilitate triple-helix cooperation and promotion.

The first stage of the cleantech incubation process is **idea generation**. This stage involves the creation of new inventions and knowledge, and business ideas to turn these into commercially viable products and services, emerging from the innovation community. Best practice to strengthen idea generation is to:

- Provide sufficient basic funding for researching cleantech solutions and sustainable innovations. This creates the opportunities for novel inventions and innovative technologies that can be turned into commercial products and services.
- Train and educate researchers and students at universities in entrepreneurship and business thinking and create awareness for entrepreneurship by organising business challenges, competitions and communication about entrepreneurial role models.
- Establish technology transfer offices and officers at universities and/or research institutes that are responsible for extensive scouting of the scientific and innovation community to identify commercially interesting inventions, technologies and cleantech solutions.

During the **selection** stage, cleantech start-up teams with promising business ideas are evaluated and selected to participate in formal business incubation support programmes or incubators. To enhance the selection stage, the following best practice can help to select the most promising start-ups and create a strong pipeline:

- Organise competitions to encourage entrepreneurs to develop viable business ideas and spur competition to get the best ideas into the incubation pipeline and aid in the evaluation and selection of promising ideas.
- Provide pre-incubation support to entrepreneurs to help them with strengthening their business plan, business model, and team, before they are allowed into the incubation programme. Pre-incubation programme also acts as a filter in the selection process, and helps entrepreneurs to reduce risks and make a well-informed decision to start a new company and prevent later disappointment.
- Provide support in Intellectual Property Rights (IPR) to new entrepreneurs to secure rights and competitive advantage, and enable successful commercialisation of products and services.
- Install experienced selection committees linked to the incubator or incubation programmes that assess the start-up business plans, capabilities, skills, and team commitment. Include members with different profiles and capabilities, such as private investors, bankers, (serial) entrepreneurs, incubator managers, scientists and/or technology transfer officers.

In the third stage, **incubation**, start-ups participate in the actual incubation programme. During incubation, cleantech start-ups are supported with dedicated incubation infrastructures (offices, R&D labs, test and demonstration facilities, amongst others), and with incubation services like training and coaching, business support and mediation. The following best practice in cleantech incubation infrastructure and services has been identified:

- Develop incubator office space for start-up companies in very early and growth stages where there is ample room for meetings, networking and spontaneous combinations and collaborations.
- Establish shared prototyping, test and demonstration facilities for start-ups in cleantech (especially in capital-intensive R&D areas like renewable energy, energy storage, bio-based materials, or waste and water management) and enable easy access for start-ups to existing R&D facilities at research and university campuses or institutes.
- Create training and coaching programmes with specific attention to cleantech markets and business skills. Involve experienced cleantech and business professionals in coaching.
- Establish an industrial and professional network around the incubator to facilitate start-ups in making easy connections with partners, experts and potential customers and investors.
- Establish a dedicated cleantech cluster organisation to connect established start-ups to industrial partners and knowledge partners, and offer post-incubation services and foster the growth of SMEs. Regional cleantech clusters help to promote local innovation clusters at a national and international level.

During the fourth and final stage of the incubation process, start-ups **exit** the formal incubation programme or incubator, and have to stand on their own (on average after 2 to 4 years). Best practice to support the exit of the start-up company is to:

- Define explicit exit strategies within the incubator that are clear to all incubated start-up companies. An effective exit strategy starts during the incubation period, with systematic goals and milestones, and reviews about the start-up's performance during the incubation period.
- To ease the exit from the incubation programme, start-ups can negotiate longer-term access to special shared infrastructures (test and demonstration facilities, manufacturing facilities, etc.).

For each stage of the cleantech incubation process, different **start-up funding** sources are necessary. Attracting early-stage capital is one of the main challenges for a cleantech start-up, especially if scaling-up investments are high and industry infrastructures are capital intensive. To enable cleantech start-ups to cross the 'valley of death' successfully the following best practice is relevant:

- Facilitate start-ups to easily access public R&D and Proof-of-Concept funding. This usually requires close collaboration between universities, the incubator, and national R&D funding agencies.
- Establish (small) low-interest pre-seed loan arrangements for individual entrepreneurs to support themselves during the first year(s) of the start-up. Organise this at the incubator in collaboration with banks, government and/or universities.
- Establish a close relationship between business angel networks, the incubator and the start-up community. Involve business angels as coaches, mentors or 'entrepreneurs in residence' to support the start-ups.
- Establish dedicated cleantech seed investment funds that better match the risk-profile of cleantech start-ups (longer investment periods, scaling challenges). Seed funds can be based on combined public-private funding.
- Build a well-informed network of venture capital funds and corporate venture capital funds around the incubator. It is important for cleantech start-ups to connect to corporate venture funds of established companies in the start-ups' industry (e.g. energy, water, utilities, automotive) that can become the start-ups' main customers or acquisition partner.

This best practice in cleantech incubation policy, strategy and operations is the key ingredient of successful cleantech incubation and will help practitioners and policy makers to develop energetic and creative incubation ecosystems.

In addition to this best practice, recommendations for developing a proper **business model** based on four ideal-type business models for cleantech incubation are outlined. The models are based upon various degrees of stakeholders' involvement, and of public or private funding: scientific valorisation, local development, private investment, or sponsorship business models. The handbook also defines principles for **performance measurement** systems of cleantech incubation processes that accommodate for the specific interest of the different stakeholders involved in the incubation process, which helps policy makers and practitioners justify their investments in cleantech incubation.

The handbook closes with **future challenges** for cleantech incubation in Europe for policy makers. One of the most critical future challenges is to ensure sufficient funding of cleantech incubation processes and of (investment) funds for cleantech start-ups (especially in the case of capital-intensive infrastructures or production facilities). Successful business creation in cleantech requires **long-term economic development agendas of regions and nations** in order to build critical mass and realise competitive advantage, both at a regional, national and European level.

This handbook has provided an extensive overview of best practice in cleantech incubation across Europe. It helps policy makers and practitioners to quickly identify effective tools and policies which have been tested across Europe. Of course, the list of identified best practice is not exhaustive and policy makers and practitioners are discovering and developing new components of cleantech incubation programmes and processes continuously. In order to keep learning and sharing experiences and best practice in cleantech incubation to boost Europe's economy in cleantech and green growth, it is necessary to foster European collaboration in this field and consolidate the best practice exchange networks in incubation that have been developed during this INTERREG IVC project.

Introduction

This handbook has been published to act as a guide to the best policies and practice in Europe that encourage cleantech incubation at a regional level. We want to provide all European regions with good examples to establish a positive business climate that will also green their economy. In this handbook we set out what policy makers could do to create lasting economic growth by supporting cleantech incubation processes.

Why did we write this handbook?

Europe's economy is currently in crisis and will stay that way as long as it is based on the paradigm that we can make endless use of natural resources. Years ago, the scientific report 'The Limits to Growth', commissioned by the Club of Rome and conducted by MIT in 1972[1], pointed out how exponential growth is not possible when the finite resources of our planet are being consumed. Economic growth will bring our society and environment to the point of collapse as long as it is based on wasting the resources available to our planet. The same clear argument and strong sense of urgency is also demonstrated in the more recent book and video 'The Story of Stuff'[2] that has received critical acclaim.

Nowadays it is universally acknowledged that strong economic performance requires 'integration and a balanced consideration of social, economic and environmental goals', as stated at the 3rd UN Conference on Sustainable Development, in Rio de Janeiro in 2012. The good news is that many authorities have already changed their paradigms and strive to make their economies green and more sustainable. The European Commission aims to realise a circular economy in its borders, in which resources are re-used, and wants the EU to become a smart, sustainable and inclusive economy by 2020.

[1] *Donella Meadows, Jorgen Randers & Dennis Meadows, 2004, Limits to growth: The 30-year update, Chelsea Green Publishing Company.*

[2] *Annie Leonard, 2010, The Story of Stuff: how our obsession with stuff is trashing the planet, our communities and our health – and a vision for change, Free Press.*

Cleantech products and services are essential for a green economy. With cleantech, technological knowledge is being used to reduce the environmental impact and ecological footprint of current generations in order to improve our quality of life and preserve the planet for future generations. Companies and knowledge institutes find their role in society to support the supply of technological solutions that take us significantly further along the road towards a flourishing, sustainable economy. In this handbook, the definition of cleantech as stated by Copenhagen Cleantech Cluster is used: cleantech is 'any activity that produces or implements processes or products, that contribute to produce renewable energy or sustainable materials, reduce the use of natural resources by exploiting the resources or energy more efficiently, reduce the harm caused by fossil fuels, or reduce pollution problems through products, processes and consultation'.

At the core of an innovative economy, start-ups can be found, that is: legal entities younger than five years and smaller than 250 employees that operate a business or prepare its launch, according to a new invention or a new application of an existing technology. Starting from a creative idea, they sell or deliver a product, process or service; they have a risk-taking attitude and a willingness to innovate. In such a technologically complex sector as cleantech, business incubators can play a key role in helping start-up companies to grow, become successful and get products to market. A business incubator is an organisation that supports the growth of start-ups to successful enterprises by offering an integrated package of possible services such as workspace, coaching, complementing the team with the right people, providing channels to investors, helping them to enter domestic and international markets, and finally to suggest suitable exit strategies how to leave the incubator as a full grown company. A business incubator is therefore much more than a multi-tenant building.

Who wrote this handbook?

This handbook has been produced by the INTERREG IVC project "Cleantech Incubation Europe (CIE)" (2011-2014). Both public and non-public partners from each compass point in Europe have contributed to the project, from Helsinki, Finland; Essonne, France; Peterborough, UK; Turin, Italy; Gödöllő, Hungary and Delft, the Netherlands. We have concentrated our focus on the "who, what, when and how" about cleantech incubation, showing the results and best practice of the thirteen European cleantech clusters that have been analysed during this project.

Best practice is a tool or service (set of activities and resources) that has proven to be successful in helping to establish a good business climate for cleantech entrepreneurs. The best practice described in this handbook mention the service or tool in such detail that it can be transferred to other incubators or incubation programmes. Tools like a pre-incubation programme, pre-seed funding, coaching, selection mechanisms and business development support can be provided to a start-up in order to increase the growth-rate and success of a start-up.

List of thirteen analysed clusters:

Barcelona, Spain
Cambridge/Peterborough, UK
Copenhagen, Denmark
Delft/Rotterdam, Netherlands
Essonne, France
Gödöllő, Hungary
Graz, Austria
Helsinki, Finland
Malmo/Lund, Sweden
Munich, Germany
Oslo, Norway
Turin, Italy
Zurich, Switzerland

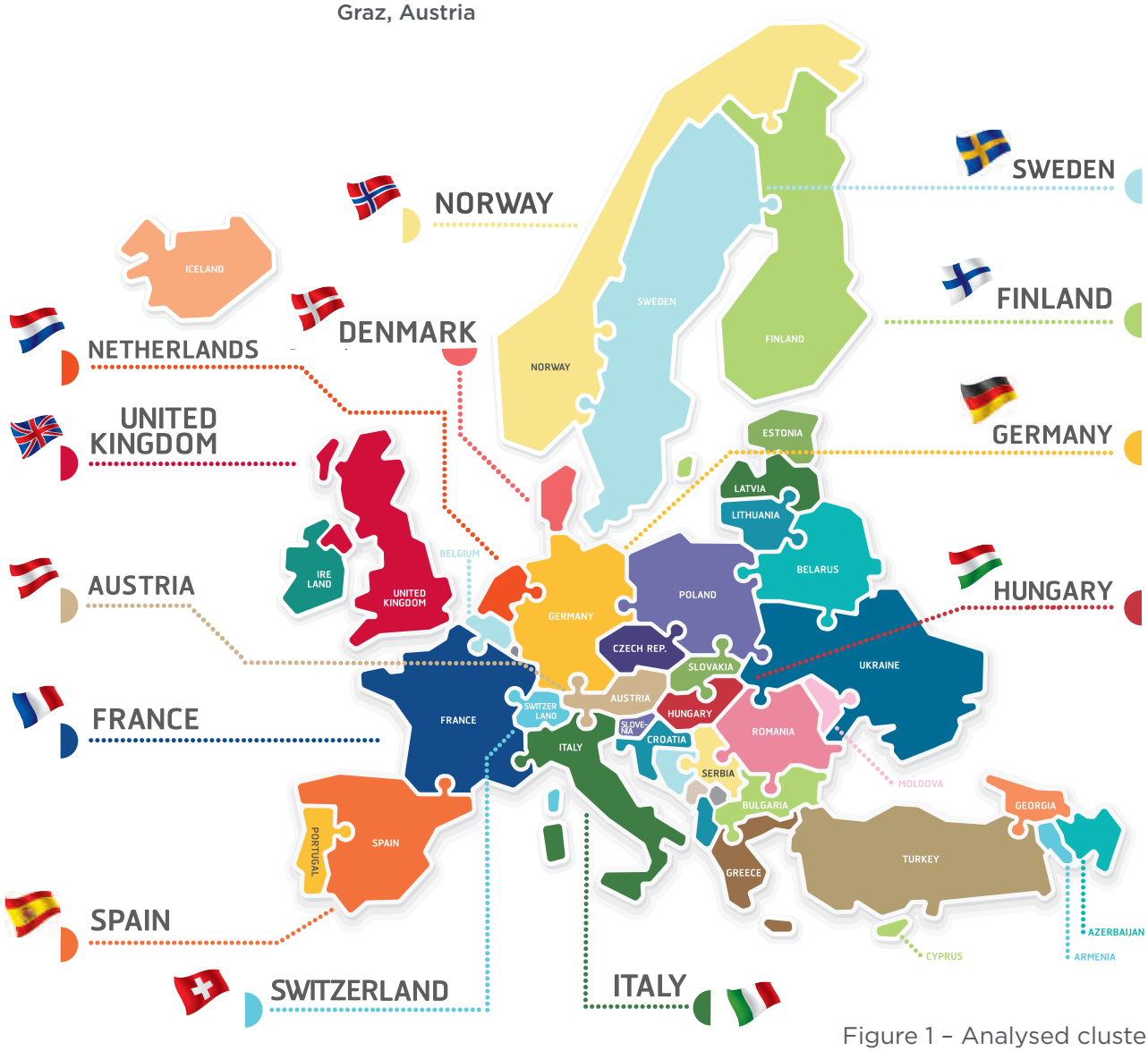

Figure 1 – Analysed clusters

The cleantech ecosystem

The cleantech ecosystem is the network of relevant influencers that impact on the incubator organisations and its start-up businesses. This stakeholder network includes investors, knowledge institutes, authorities and other companies.

The foundation of a regional cleantech innovation ecosystem is a cleantech incubation programme. This handbook shares the best policies that could support and encourage such a programme. We chose to extract the best practice for cleantech incubation from the thirteen clusters mentioned above and translate those to the four different phases of the cleantech incubation process. The first phase is for preparation, namely the idea generation by the entrepreneur. The second phase is the selection of potential start-ups by the incubation programme, then the third phase is the actual incubation process that leads ultimately to the fourth phase which should be a, preferably profitable, exit. The whole process starts with someone with a bright idea that needs to be pitched in order to be selected to get access to the programme and to exit a few years later as an established and successful company. In all these four phases we see the following tools are essential: education, network, business services, funding, infrastructure, organisation and strategy. In the stakeholder network around an incubation programme, we see an essential role, apart from national and local governments, for universities and other knowledge institutes, private and public investors, industry and business service providers. Every incubation programme, whatever its size or maturity, is strongly influenced by and part of this ecosystem around it. This context is one of the key factors which influences its structure, local potential, resources and of course its success.

The actors and tools that are part of the recipes for successful incubation, as described in this handbook, are summarised in Figure 2 opposite. This model will be a connecting thread in the following chapters.

Figure 2 – The cleantech ecosystem

Relevant actors		Universities Research institutes National government Local government	Universities Research institutes Private investors Industry Business service providers	Universities Research institutes Public investors Private investors Industry Business service providers Regional government Local government	Private investors Business service providers Regional and local government
	Cleantech Incubation Process	IDEA GENERATION	SELECTION	INCUBATION	EXIT
Best Practice	**Education**	Technology and knowledge transfer **(2.3)**	Pre-incubation **(3.3)**	Training and coaching **(4.5)**	-
	Network	Innovative environment **(2.2)**	-	Mediation and network **(4.6)**	Mediation **(5.4)**
	Business services	-	Intellectual Property Rights (IPR) support **(3.5)**	Business support **(4.4)**	Growth infrastructure and support **(5.3)**
	Funding	Funding of basic research **(2.2)** Funding of technology creation **(6.2)**	Idea and business plan competition **(3.2)**	Funding during idea and technology creation **(6.3)** Funding during market-focused business and product development **(6.4)**	Funding during commercialisation and growth **(6.5)**
	Infrastructure	-	-	Office space **(4.2)** Test and demonstration facilities **(4.3)**	Growth infrastructure and support **(5.3)**
	Organisation	Technology Transfer Offices (TTO) **(2.4)**	Idea and business plan competition **(3.2)** Formal selection process **(3.4)**	Incubator and cluster management team **(4.7)**	-
	Strategy	Innovative environment **(2.2)**	Selection of winners strategy **(3)**	Business model of incubation **(7)**	Exit process steps **(5.2)** Incubation performance **(8)**

Structure of this handbook

The following pages in this handbook have been designed to guide policy makers through the good practice for creating a positive business climate for cleantech start-ups in their region. The writers of this handbook have studied best available practice of cleantech incubation in Europe and this handbook is based on their findings. Case studies have been thematically structured in order to present 'recipes for success' at every stage of the incubation process and for setting up a supportive stakeholder network around the incubation programme. We expect that every policy maker dealing with this matter also has to deal with the themes selected as they form the steps necessary to create a lasting cleantech incubation programme.

In the first chapter, the role of national and regional policies will be described. Policy makers are made aware that, in order to establish a good cleantech Incubator, they have to prepare the ground for it by defining the innovation context at national and regional level.

Chapter 2 focuses on actions that are stimulating the phase of idea generation. Generation of ideas is not a deterministic process, an environment is needed where knowledge is freely exchanged. More specific actions can be identified like: basic research funding in cleantech, creativity education courses, scouting and interviews with cleantech researchers, setting up specific cleantech knowledge transfer offices in universities, establishing good links between universities and cleantech incubators, raising entrepreneurship awareness.

Chapter 3 goes further into tools for the selection process. In this delicate phase where the start-ups are still in an embryonic stage, it is important to provide them specialized support in the area of intellectual property management. Many cleantech ideas are suitable for legal protection that can give to start-ups a competitive advantage.

Chapter 4 highlights key incubation services and infrastructures that support cleantech start-ups.

Chapter 5 is about one of the most critical phases, namely when it is time to leave the incubator.

In chapter 6 the focus is on actions needed for the most life-critical aspect of cleantech incubation: how to financially support start-ups. As cleantech start-ups have specific characteristics like their scale, large capital costs, long lifecycles, and regulation, policy makers have to be aware of the difficulties for these start-ups to attract capital due to higher risks and much longer return-on-investment periods.

Chapter 7 presents four ideal-type business models for cleantech incubation. They are based upon various degrees of stakeholders' involvement, and of public or private funding: scientific valorisation, local development, private investment, sponsorships.

Chapter 8 learns about key performance indicators for cleantech incubation processes like: average private funding attracted by each start-up per year, new start-ups per year, start-ups surviving after incubation, average cost per job created, average revenue generated by each cleantech start-up during the incubation.

The handbook closes with future challenges for cleantech incubation in Europe for policy makers, our insights into the short and long-term future for cleantech incubation in Europe.

In the appendices we have included the methodology and questionnaire that we used for collecting data from clusters; a detailed description for each investigated cluster, and the general project description.

1 Cleantech incubation ecosystem

In order to secure Europe's position in innovation, a fertile ground to start developing incubation activities is needed. In the cleantech sector effective policies are required from public authorities in order to stimulate innovation in this direction, as cleantech flows from an alternative economic model in which resources will be recycled instead of downgraded. Governmental policies are extremely important drivers for the creation of start-ups, given that the European attitude towards investments in innovation is usually driven more by government than private investors. As most business incubators do not have a specific industry or sector focus, the incubation support programme is offered to all types of start-ups that emerge. Only a number of those are in the cleantech sector. Specific government policies could increase the share of cleantech start-ups. In this chapter, long-term EU and national policies are discussed, as well as regional and local policies.

1.1 European and national policies

Cleantech incubation in Europe is strongly based on stimuli and commitment of public bodies, which means that the initial trigger that starts the cleantech incubation process is in the hands of public authorities. The European Union has set ambitious climate and energy targets for 2020. These targets, known as the "20-20-20" targets, set three key objectives for 2020, namely 20% reduction in EU greenhouse gas emissions from 1990 levels, raising the share of EU energy consumption produced from renewable resources to 20% and 20% improvement in the EU's energy efficiency. Although the 20-20-20 strategy is pursued by all member states, and clean technologies contribute to reach these goals, there are still quite large differences in national policies specifically addressed to the development of the cleantech sector. There are countries that have given political support to the cleantech sector for more than a decade, from the investments in R&D to the creation of a proper national and international market demand as well as a strong support for internationalisation. On the contrary in some other countries there are no specific policies supporting the cleantech sector. In those cases, both the start-ups and the individual incubator need to rely on their own initiative and on local investors or sporadic regional funding.

The European Institute of Innovation and Technology (EIT) was set up in March 2008 by the European Parliament and Council, to increase Europe's innovation capacity and impact and to be a driver of sustainable growth and competitiveness. The tools to reach these goals are the Knowledge Innovation Centres (KIC), identified as groups that bring together business, research and education in thematic areas (climate, ICT and energy) in order to accelerate sustainable innovation. Several of the interviewed clusters have a partner network in one of the KICs.

Cleantech incubation ecosystem *continued*




EIT's Climate-KIC and KIC InnoEnergy

Climate-KIC drives innovation in climate change through partnerships between large and small, local and global, between the private, public and academic sectors. All partners bring their industry experience to the community and are connected through a national or regional centre. Climate-KIC creates new partnerships to integrate research, business and technology to transform innovative ideas into new products, services and jobs. ETH Zurich and TU Delft are some of Climate-KIC's academic partner institutions.
Barcelona benefits from the participation in KIC InnoEnergy (Iberia), which allows them to focus on energy start-ups and build strong external investor networks, thanks to the good reputation of the incubator as a mentor. KIC InnoEnergy Iberia works on renewable energies (wind, CSP, PV, wave and tidal energy) since some demonstrative projects on Concentrated Solar Power are already present in Spain and Portugal.


Transnational policies – Norway and Sweden

There are several good governmental support schemes for cleantech in Norway. The green certificate market between Sweden and Norway is a good example of a transparent and predictable policy initiative that may help the cleantech sector. After years of negotiations, in 2012 Norway finally decided to enter the Swedish green certificate market. Following this, producers of electricity from renewable resources in Norway wouldl meet a whole new support-scheme, possibly motivating further investment and helping Norway to reach its goal of 30 TWh of increased production and energy efficiency by 2016 relative to 2001. With a sufficiently high quota and well-defined regulations, a green market, might be a cost-efficient way of subsidising the most competitive renewable technologies, otherwise not able to enter the market. Merging this market with Sweden might further increase the economic efficiency.

National governments tend to have separate economic and environmental policies. There are many examples where these two policies contradict each other, for example where economic growth comes before environmental concerns. Some countries succeed in combining them by creating a national policy on sustainable innovation and economic growth. Innovative companies can take advantage of the whole country's positive cleantech climate, the available funding and of a market ready to receive and ask for their products. Good examples of a national policy with clear goals and specific regulations in order to set a positive cleantech business climate can be found both in Finland, in the Helsinki Cluster, and Denmark, around the Copenhagen Cleantech Cluster.

Finland, Helsinki cluster

Cleantech has been a clear priority of the Finnish national government agenda for many years. The public investments in R&D account for 4% of its gross domestic product (GDP) each year, the third highest globally. Cleantech is considered a business opportunity and as a horizontal activity which should be applied to all business sectors. Specific regulations have been developed to put this in practice as per the recent Strategic Programme which was launched in 2012. The programmes aims are to double the present revenue of the cleantech sector in ten years (arriving at 40 billion euro in 2018), to create more than 40 new high-growth companies annually, generate 40,000 jobs by 2020, andto increase cleantech venture capital investments to 15% of total investments.

Denmark, Copenhagen cluster

In Denmark, a strong national agenda aiming at greening the economy and achieving energy self-sufficiency has been developed after the oil-crisis in 1975: it was 99% dependent on sources of foreign oil and now aims to become completely energy self-sufficient. Denmark has an ambitious goal of a 20% share of renewable in gross energy consumption by 2011, and at least 30% in final energy consumption by 2020 (10% more than the 20% EU-target). [Ministry of Foreign Affairs Denmark, 2010]
The Danish government is thus a strong industry supporter and is taking dedicated steps to reach the long-term goal for a green-growth economy independent of fossil fuels. They do this by long-term subsidies and market support for renewable energies and cleantech solutions.

1.2 Regional policies

In both Finland and Denmark the national agenda is the main driver whereas in Germany there is both a national and regional innovation policy in place, focused on driving cleantech growth.

Germany, Munich cluster

Germany has a strong national cleantech policy framework and a solid infrastructure for renewables. In 2012, the cleantech industry was set to more than double in volume, reaching 4.4 trillion Euros by 2025, creating jobs and maintaining its global market share. The volume of German companies in areas such as resource efficiency, sustainable transport and recycling is expected to rise 125% to 674 billion Euros. They will keep a market share of about 15% while creating an expected 1 million jobs. Germany plans to increase its reliance on renewable sources of power such as solar and wind as it phases out nuclear generation.

Cleantech incubation ecosystem *continued*

Germany, Munich cluster *continued*

Munich is one of Germany's strongest economic regions, and also one of the leading regions on an international level too. The state of Bavaria, of which Munich is the capital, creates about 18% of Germany's GDP. Its economic growth is slightly above the national average (2.9% 2012). Also the unemployment rate is lower than in rest of the country. It is the economical centre of southern Germany and home to many big international companies, such as BMW, that recently launched its first full electric car. In the Munich region, cleantech covers the spectrum of innovative products, services and processes that help assure a healthy environment, the efficient use and preservation of our natural resources, the reduction of pollution and other harmful climate risks, and provide a sound quality of life.

The Bavarian State Government has defined the cleantech field as one of the priorities for Bavaria over the long term. As they realise companies that are committed to research grow more quickly and are more stable in times of crisis and the Bavarian State Government wants to increase expenditure in research and development to 3.6% by the year 2020.

Spain, Barcelona cluster

The area is strong in public relations and outreach, hosting large tradeshows in cleantech related topics. The main actor is Fira Barcelona, one of the most important European trade fair organisations. Its international prestige is closely linked to the Barcelona brand, a city with over a century of trade fair tradition.
As an economic driver, it is one of the best platforms for business, international exposure of companies, product marketing, networking and knowledge exchange. Its economic contribution to the city of Barcelona and its surroundings is estimated at over 2,500 million Euros. One of its main features is its support of productive sectors, professionals and entrepreneurs. In order to face the challenges of globalisation and anticipate market demands, it combines organisational experience, innovation, technological development and competitiveness. Fira is a consortium comprised by the Barcelona City Council, the Catalan Generalitat and the Barcelona Chamber of Commerce, which combines public ownership with autonomous company management.

- Together with Kyoto Prefectural Government and Kyoto City Government, Fira organises the annual Smart City Expo World Congress.
- Barcelona was world capital of the electric vehicle in 2013 and hosted the Electric Vehicle Symposium (EVS), the benchmark world congress for this sector. The city has taken the relay from Los Angeles, United States, becoming the venue for the EVS27.

So far several examples of strong national or regional policies have been discussed. Another task that national and regional governments have is to coordinate the different cleantech clusters for complementing contributions and expertise. Cluster specialisation, for example in wind, solar, and hydrogen avoids duplicated financial support and maximises the potential results of public investments.

Finland, Helsinki cluster

From 2007-2013 Finland had a cluster-based Centre of Expertise Programme (OSKE) where expertise and research resources, that are spread out over the country were brought together in one centre of expertise to focus on the economy and innovation. There were 21 centres of expertise grouped in thirteen different clusters: the Finnish Cleantech Cluster is one of them and involves four regional centres of expertise specialising in cleantech. It provided appropriate stimuli to the cleantech market by reducing the public energy bill via a long term (ten-twenty years) strategy and public procurement support to cleantech start-ups and energy saving companies. In addition the government supported export activities by creating international value chains for Finnish companies, since the Finnish home market is relatively small.

The Netherlands, Delft/Rotterdam cluster

In Delft/Rotterdam the regional cleantech strategy is characterised by an alignment between the incubation value chain of the main stakeholders of the region with respect to the economic growth agenda of the region. Two important cleantech thematic areas have always been among Delft expertise: water/delta technology and industrial biotechnology. The primary objective is to create new jobs and economic growth particularly in the cleantech field. There are no quantified targets for the number of new start-ups/spinoffs in the area of cleantech, but there are targets for the number and growth of start-ups/spinoffs in general. The regional agenda includes high-tech start-ups and campus and science parks development.

1.3 Public procurement

Other tasks governments could take, concern innovative public procurement. A strong and clear green public procurement strategy and policy, and strong incentives are critical factors necessary to accelerate cleantech incubation. Governments could offer tax incentives to invest in cleantech products. Cities have an undeniable role in driving cleantech innovations by obtaining products from cleantech start-ups. The public procurement processes need to be redesigned to make them more available to cleantech start-ups. Usually start-ups are not able to win any public procurement tenders because they do not fit existing criteria as they are too young or too small. Moreover, a start-up does not have the time and capacity to enter these long processes. This should be improved or changed so that start-ups also have a chance. Established companies and governments should enable/allow start-ups to participate in tenders and procurement and at least reserve a dedicated budget for this. Furthermore, the procurements should be selected on how much the product contributes to the transition to a more sustainable economy.

Finland, Helsinki cluster

The City of Helsinki is already actively applying technologies of cleantech start-ups in several domains of “green city” related activities: energy efficiency in living environments, low emissions and new technologies in public transport, waste management, district heating, water and air quality. The city is aware of its role in creating possibilities for the private cleantech sector to emerge and grow. Also the Finnish cleantech cluster encourages building pilot and demonstration facilities.

1.4 Triple Helix cooperation

Governments can support the setting up of a dedicated cluster development organisation that has a collaboration programme between the different stakeholders, which can be NGOs, regional government, incubators, universities, science parks, banks, pension funds, companies, research institutes, consultancy companies, and venture capitalists. Such a stakeholder network is an advantage for start-ups since they will find both a facilitator for their needs as well as a possible buyer or market for their products. The incubation programme itself can actively work to build a stakeholder network from scratch or to nurture one if it exists already.

Collaboration between different stakeholders in a region is a way to boost economic growth in a region. When the following three stakeholders are involved: universities, industries and governments, this collaboration is a 'triple helix cooperation'. Triple helix cooperation has a special status as this forms a fertile basis for economic growth based on innovation. An innovation cluster implies a triple helix cooperation between its members: companies and investors, educational, scientific institutions and public authorities. The public authorities could play a role in enabling this kind of collaboration and facilitate it.

UK, Peterborough cluster

Peterborough is home to "EcoCluster", a growing interactive network of around 350 businesses, entrepreneurs, investors, academic partners and researchers (Cranfield University, Anglia Ruskin University, University Centre Peterborough, and Peterborough Regional College) working in the cleantech sector with the support of the public sector (Opportunity Peterborough and Peterborough City Council). EcoCluster has the key features of a typical successful business cluster. In fact, it facilitates collaboration, synergy and the transfer of knowledge in a triple helix structure between businesses, public sector and academic institutions within a defined geographical area (Peterborough and its surrounding area) in a specific industry (cleantech). Peterborough is also leading the European Strategic Cluster Partnership, a cluster network under the EC funded "Eco-Innovation Cluster Partnership (EcoCluP)" project. The network connects 2,500 eco-innovative and cleantech businesses across Europe and helps facilitate collaboration between the clusters themselves. It is the next generation of cluster initiative from the European Commission, which aims to create collaborative partnerships of clusters since the EC believe that global challenges cannot be solved by one cluster in isolation.

Cleantech incubation ecosystem *continued*

Italy, Torino cluster

Torino cleantech cluster is a network composed by a wide group of actors, with some **core nodes** which are already well connected for many years with trusted relationships. The cluster itself also has good connections with external stakeholders. It is a good example of a very complete stakeholder network mainly based on three components: the knowledge production (by the two universities of Turin, Politecnico di Torino and Università degli Studi di Torino), the start-ups creation and incubation (Turin has two business incubators, namely I3P, the Innovative Enterprises Incubator of Politecnico di Torino and 2I3T, the incubator of Università degli Studi di Torino), and the market acceleration supported by the science and business park called "Environment Park". These core actors share the most part of the stakeholders' network on the territory, creating a true regional cleantech ecosystem. On the contrary the two incubators I3P and 2I3T have not had frequent interactions due to the different academic institutions of origin and of reference.

1.5 Recommendations

In order to support a flourishing cleantech cluster within their borders, national public authorities should support the climate and energy targets set by the EU for 2020, by creating a national policy on sustainable innovation and economic growth in order to reach those targets. European cleantech clusters can take advantage of the KICs set up by EIT and start collaboration with these networks of leading academic institutions, innovative corporations and entrepreneurs in order to support and bring to market their own cleantech innovations. Regions should focus on specific cleantech themes that their entrepreneurs have been proven to be strong in order to maximise the potential results of public investments.

Furthermore, governments can boost cleantech companies by being their launching customer; by giving preference to obtaining cleantech products and services in their public procurement. Finally, governments can support the triple helix cooperation in a region by providing funding and facilities needed in order to create an innovative breeding ground.

2 Idea generation

This chapter describes best practice connected with the process of idea generation and valorisation including the generation of many innovative ideas, which could lead to the creation of successful and feasible products or services on the market. In order to build up a large portfolio of high tech innovations and start-ups in a cluster or region, an innovative environment is needed. The majority of ideas within the university context are generated and valorised by two groups: students and researchers. Below a visualisation of the process of creating an innovative environment and the process to valorise technologies and knowledge, can be found.

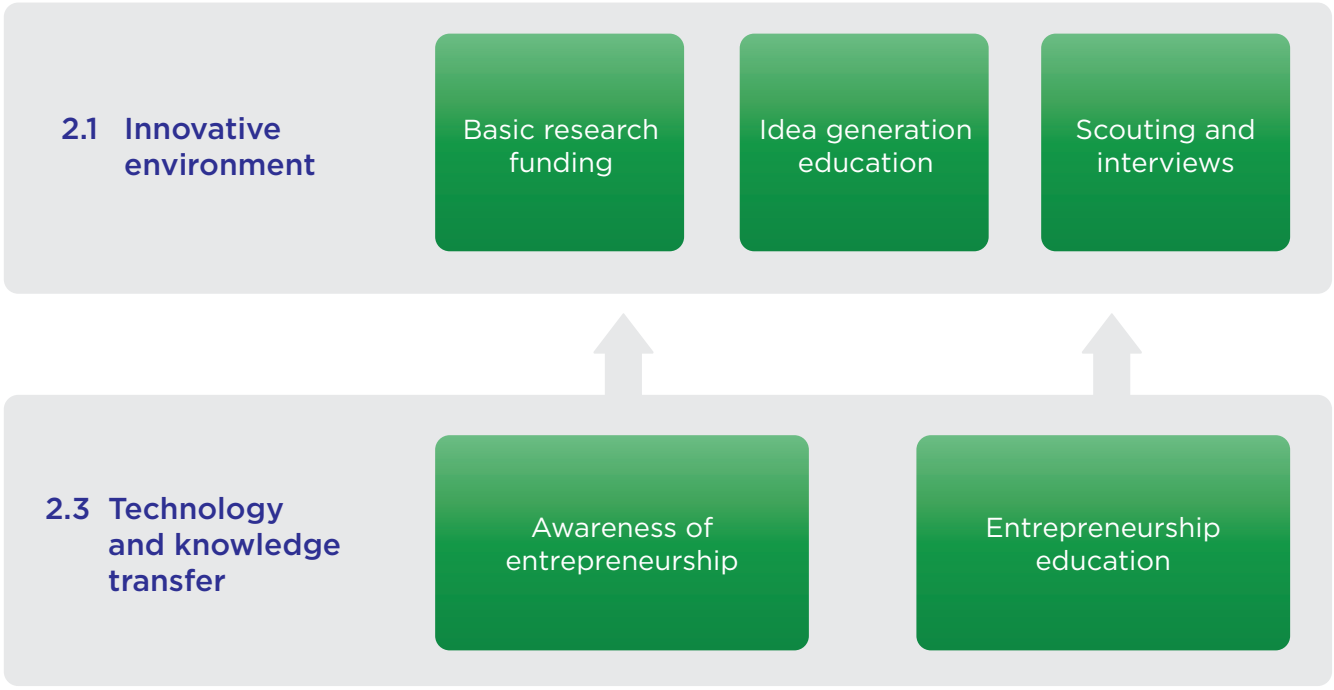

Figure 3 – idea generation

2.1 Innovative environment

Research has underlined the importance of the innovation environment for idea generation. A closely allied “community" of researchers is a good "hub" for creativity, for new idea generation and for innovation. Inside this community, knowledge is freely exchanged[3] or, even better, in this community "knowledge is a commons" as explained and recommended by the winner of the 2009 Nobel Prize in Economy, Professor Elinor Ostrom from Indiana University[4]. Almost all important breakthrough ideas happened at the conference table at the weekly lab meeting, when everybody got together and shared their latest data and findings. This is the typical university environment where researchers and students stimulate each other which means it is sometimes difficult, if not impossible, to point out a person as the single inventor. It is this collaborative environment with the cooperation from people with different backgrounds, ideas and fields of expertise that contribute to open science and continuously feed the public domain with new knowledge, technological solutions and new inventions.

The CIE consortium has identified several examples of best practice, **explained in more detail opposite**, that could positively influence the innovative environment within an innovation cluster or (scientific) community: (1) basic research funding, (2) generation of ideas education, and (3) scouting and interviews.

Usually these tools are used by high tech incubators or knowledge institutes, such as universities or research centres because these institutes are obligated to create an innovative environment and house high potential people who can bring the ideas a few steps further, for example by starting their own company. All tools could contribute to increase cleantech specific innovations, if dedicated cleantech education and research programmes are funded and designed.

[3] *Johnson, S., 2010, where good ideas come from. The Natural History of Innovation, Riverhead Books.*

[4] *Ostrom, E., 2006, Understanding Knowledge as a Commons, MIT Press.*

Finland, Helsinki cluster

The main success factors of the Finnish cleantech cluster are possible thanks to the country's positive approach and support towards innovation and the innovating companies that can take advantage of the whole country's positive business climate. Finland is a leading innovator across multiple sectors and has been developing certain cleantech industries (like waste to energy) since the 1930s, making it light-years ahead of many other nations. Nowadays also the old stronghold industries' such as pulp & paper, chemistry and telecommunications are transitioning to become greener and more sustainable. They are also including elements of cleantech innovation in their own production processes. SMEs play a crucial role in the creation of new jobs: 100% of new jobs created (net) in 2001- 2010 happened in SMEs, big companies lost 274 jobs.

8 research centres for renewable energies – Norway

In February 2009 the Norwegian government had established 8 world class research centres for offshore wind technology, solar cell technology, bioenergy innovation, environmental design of renewable energy, zero emission buildings, international offshore wind energy and subsurface CO^2 storage.

Basic research funding

In general, basic research is funded from three different sources of public/private funds:

1) Direct funding from the government, for example the ministry responsible for science and education. The annual funding depends on the amount of students graduated and articles published.
2) Funding from independent public organisations allocated for scientific research. The annual funding depends on winning bids of European or National research funds.
3) Contract-based funding from private companies or public bodies.

Investing in cleantech research at national level is fundamental for stimulating cleantech innovation, because history has shown that important inventions have been devised at research departments of universities. In addition, the EU Innovation scoreboard shows that the more a country invests in research, the more the country increases its innovation performance. The innovation leaders in the EU are Sweden, Germany, Denmark and Finland[5]. The top investors in R&D in the EU are Sweden (3.3% of GDP), Finland (3.1%), Austria (2.5%), Denmark (2.4%) and Germany (2.3%).

[5] *Innovation Union Scoreboard 2013, European Commission, 2013.*

Research-funding in Sweden, Lund/Malmo cluster

Government appropriations for research totalled SEK 30,33 billion in 2012. Central government is the largest financier of research at higher education institutions. The most important central government financiers outside the direct state contributions for research and postgraduate education to higher education institutions are the research councils, the Swedish Agency for Innovation Systems and other research-funding agencies. Funding for research also comes from research foundations, the EU, municipalities and county councils. Industry invests more than three times as much as central government in research and development. However, almost all of the R&D investment that comes from industry remains within the business sector.

EEA and Norway Grants 2009-2014 – Hungary

Norway, Iceland and Liechtenstein signed agreements allocating roughly 40 billion HUF to Hungary on Wednesday October 12, 2011 at the Royal Waiting Room at the train station in Gödöllő. The EEA and Norway Financial Mechanisms give priority to major Hungarian-Norwegian initiatives like environmental protection, a fund for Hungarian civil society and research cooperation. With its EUR 150 million, i.e. approx. HUF 40 billion quota, Hungary is the third biggest beneficiary of the 15 recipient EU countries of the EEA and Norway Grants. The Grants, running until 2016, are provided for Hungary by three donor countries, Norway, Iceland and Liechtenstein in the spirit of solidarity. Approximately 96% of the funds are provided by Norway.

The overall objective of the Grants is to reduce economic and social disparities and to strengthen bilateral relations between the donor states and beneficiary states. Of the 12 supported programmes, the largest amounts will be available for environmental protection, bilateral research cooperation and capacity development of NGOs.

Idea generation education

Idea generation, also known as ideation, is the creative process of generating, developing and communicating new ideas. This phase encourages thinkers to be divergent in their thinking and generate many possible solutions. Idea generation education could range from a single course, for example to learn brainstorming techniques, to entire faculties dedicated to creativity such as Industrial Design Engineering or Architecture. Idea generation could also be stimulated within an existing, established company or institute, seeking innovation. A positive affect is the strong link with the market.

Idea generation programme within an existing company – Sweden, Lund, Ideon Science Park

Ideon runs programmes for existing companies who wish to invest in new start-ups. An example of who Ideon has worked with is a company called Ideadle, a manufacturer of windows and doors. They have 3,500 employees, operate in 10 countries and have a turnover of 600 million Euros. They have been on the market for 50 years but lost their ability to innovate. Therefore, their CEO called and asked Ideon for help. Together the incubator and the company set up a programme. The programme resulted in 7 new innovations and a couple of those innovations are now start-up companies inside the incubator.

Scouting and interviews

Scouting activities are the mining tools of universities and research centres for extracting interesting knowledge with high innovation potential. The scouts, have the basic skills and competences for monitoring research activities and identifying the most promising innovative ideas. To do their work efficiently scouts establish and maintain good relationships with researchers. When it comes to intellectual property rights (IPR) issues, the scouts advise and execute a prior-art-search. Prior-art is any body of knowledge that relates to the invention and includes previous patents, trade journal articles, publications, public discussions, trade shows, or public use or sales anywhere in the world. The search for prior-art helps prove the novel and non-obvious legal conditions that are required for a patent to be granted. The scouts are also able to determine if there is a potential market for the invention, what the general market is, who (what companies) are players in the market, and how difficult market-entry will be.

Together with their colleagues and other experts, the scouts select the most appropriate way to valorise the knowledge and, when appropriate, to create a start-up. Scouts or scouting programmes should at least have knowledge of both science and markets, be ready to talk with scientists and researchers, be able to identify the core value proposition of an innovative idea, describe the innovative idea in simple words and be able to communicate the potential value of the innovation to the market. Scouts are usually experts coming from industry, for example former managers or professors already advanced in their career.

Scouting is an important step in the cleantech incubation process due to the ability of scouts to search for high potential, innovative ideas within specific areas and departments such as cleantech. Therefore it can significantly increase the amount of cleantech start-ups.

Valorisation Programme Delta Technology and Water (VPdelta) – the Netherlands, Delft, TU Delft

The valorisation programme Delta Technology and Water, abbreviated VPdelta, is a programme that takes the cluster of delta technology and water as starting point for promoting and advancing innovative initiatives. The programme aims to endorse collaboration between start-up companies, research and educational institutions and governmental organisations that are active in the field of delta technology and hydraulic engineering. It tries to fill in the gaps of the existing entrepreneurial eco-system, maintained by the Delft University of Technology (TU Delft) and the high tech incubator YES!Delft, by means of supporting over 20 start-ups, initiating and realising test facilities, such as Flood Proof Holland and Aquadock, accelerating over 70 innovative projects and making showcases visible. The VPdelta team consist of 8 people with different backgrounds and expertise, keeping their eyes open for innovative projects and start-ups.

Entrepreneurship education – Germany, Munich, UnternehmerTUM

UnternehmerTUM is a centre for innovation and business creation at the Technical University of Munich. It promotes entrepreneurship for students, academics and professionals, generates new start-ups and creates new business. For scientists and entrepreneurs UnternehmerTUM organises:

- Entrepreneurship qualification: Special qualification programmes for doctoral candidates, especially from TUM Graduate School.
- Start-up night: Events offering the participants an opportunity to hear experiences and tips from alumni from the Technical University of Munich (TUM) about their successful business launches. Also providing information about support opportunities as well as concrete offers of assistance.
- Technology Entrepreneurship Lab: Evaluation of research findings' or technologies' market opportunities.
- Workshop "Spot your Opportunity": Identifying possible applications for technology and developing an understanding of the market.
- Start-up Coaching: Advice and active implementation support to start-ups.
- Executive MBA in Innovation & Business Creation

Thanks to the high student population and the two important universities in the area, the generation of ideas is quite rich. The selection process is active and each year the incubator has a high number of proposals. Many yearly competitions and campaigns are organised in connection with the university as the Start-Cup Piemonte and the business plan competition.

2.2 Technology and knowledge transfer

Technology and knowledge transfer can be defined as tailoring academic knowledge and skills for use by society at large. It contains all values from utilisation, in economic terms, to the possibilities of creating social or cultural value. The channels for applying the academic knowledge are companies, government bodies, NGOs and individuals. As mentioned in paragraph 2.4 many universities have set up a Technology Transfer Offices (TTO) or Knowledge Transfer Offices (KTO) to interact with the external world for knowledge valorisation.

Technology transfer – Denmark, DTU University, Copenhagen

DTU Tech Transfer has a dedicated support programme for cleantech inventors as part of the Copenhagen Cleantech Cluster programme. They have a Proof-of-Concept fund for cleantech inventions and select cleantech projects/ideas/inventions to turn into business. Gap funding was available for around 30 projects in the period 2008-2013 (around 70,000-100,000 Euro of funding per project). The selection was done by an internal board consisting of scientists, business developers and an IPR specialist. For academic start-ups or spin-offs IPR is dealt with by the Tech Transfer Office of the university. Students retrieve full IP ownership and any revenues realised from the IP. The university will apply for the patent and becomes the patent owner when employees make an invention, but revenues on the patent are equally shared among three parties: the university, the department and the inventor (33% each).

Awareness of entrepreneurship

The goal of awareness activities is to encourage and support motivated students and researchers, who wish to expand their horizons in the dynamic field of entrepreneurship. Awareness of entrepreneurship can be accomplished by organising challenging events that highlight the opportunities and possibilities. The events vary from workshops and business tours, to let students experience life as an entrepreneur, to business plan competitions to help and advise students who want to start their own company.

Within the university context, the TTO office, faculties and high tech incubators are all partly responsible to create awareness of the possibility to start up their own company, among students and researchers.

YES!Delft students – the Netherlands, Delft, YES!Delft

In addition to the educational activities organised by the Technical University of Delft (TU Delft), YES!Delft has an active awareness programme. The YES!Delft student board, a full-time student committee with 4 members linked to YES!Delft, organises many promotional activities and events to promote entrepreneurship among students of the TU/Delft. This involves for example the Global Entrepreneurship week, inspirational lectures, a start-up career event, entrepreneurship trips to leading start-up hotspots around the world (Silicon Valley, Israel, Rio de Janeiro, Shanghai), and 1-2-Start-up (a three-day workshop for students and PhDs to develop a business plan). It is the objective of YES!Delft and YES!Delft students to reach at least all 17,000 students of the TU Delft once in their academic career to let them consider and think about entrepreneurship and starting up a company themselves.

Entrepreneurship education

In the last decennia, efforts have been made towards introducing entrepreneurship into the higher educational system as a way to develop entrepreneurial attitudes, skills, behaviours and mind-sets and improving young people's employability overall. Only in recent years in economy or management school and university curricula, the subject entrepreneurship has been included as a mandatory course. In all other science, technology and human science schools and universities it is very rare to find this kind of background knowledge for innovation.

In parallel, one of the issues at EU universities is the growing number of PhDs that cannot be adsorbed by the academic world itself. They must find other directions and one way to leverage PhD knowledge for the society is to support them in establishing new companies by means of special courses in graduate schools, specific seminars, internships at SMEs and start-ups.

Entrepreneurship education – Germany, Munich, UnternehmerTUM

For students UnternehmerTUM organises:

- Manage&More – the Entrepreneurial Qualification Programme: Through the Manage&More Programme, UnternehmerTUM qualifies entrepreneurial talents from all universities in Munich for their ongoing professional career. Each semester, 20 students are selected from all universities in Munich for this 18-month programme. Manage&More focuses in particular on the practical, entrepreneurial qualification in projects: Working in interdisciplinary teams, the participants develop and implement business concepts to create innovative, marketable products and services.
- Lecture "Innovative Entrepreneurs": Managers and executives from medium-sized and large companies providing insight into their strategies and share their experience with growth-orientated companies (winter lectures) and lectures about establishment of companies. Entrepreneurs and founders state how they have made their way in business and what experience they have gained in the process. Venture capitalists describe the various manifestations and risks when acquiring a share in business (summer lectures).
- Business Plan Basic seminar: participants develop their own business ideas, checking their marketability via interviews and presenting their results clearly structured in business plans. The objective is to recognise and actually implement business opportunities.
- Spring and summer school: Spring School is an intense seminar in which selected master students and participants taking their doctor's degree are trained in business matters. The International Summer School participants develop business ideas in interdisciplinary teams relevant to society and to present such ideas in a suitable manner.

Entrepreneurship education – Denmark, Copenhagen cluster

Next Generation is an educational programme in cooperation with the three largest universities in Denmark. Together they want to incorporate innovation and entrepreneurship in the university curriculum. Additionally the programme is working to find and support the many green and sprouting entrepreneurs, who already exist among students, and graduates. They offer the students courses in innovation and entrepreneurship via workshops and summer schools and guidance via a wide-ranging corps of ambassadors. Partners of Next Generation are: Copenhagen Business School, Copenhagen University, Technical University Denmark / DTU, The Foundation of Entrepreneurship Denmark, Copenhagen Business Services, Venture Cup Denmark, and Symbion.

2.3 Technology Transfer Offices (TTO)

Many Universities have set up Technology Transfer Offices (TTO) or Knowledge Transfer Offices (KTO) to interact with the external world concerning valorisation. The main goal of a valorisation department is to advise and to support the transfer processes, for example receiving finance from public and private sources, applying for patents or starting businesses. Some TTO employees are responsible for advising and supporting fundraising activities of scientific researchers and research groups. In parallel, the TTO employees are often obliged to attract funds and expand their network to continue their own valorisation work, research and events for the future such as incubation support for start-ups.

TTO – Austria, Graz, TU Graz

The Graz cluster is characterised by a clear and smart understanding of the dynamic work environment of scientists and researchers within universities. Therefore the TU Graz acts according to this principle and is able to make the best of researchers' potential. Their goal is not to change the mind-set of researchers that have a successful academic career. Good scientists should remain scientists in their view. However, postdoc students, PhDs and students not on a scientific career path should/could be able start a business and are supported and approached through specific campaigns and activities. The TTO does not have specific targets for increasing the number of inventions in cleantech or for increasing the number of cleantech start-ups that are based on their inventions.

Furthermore, the TTO at TU Graz has a comprehensive set of activities not only focused on technology transfer. Thanks to their experience in working with both academic and entrepreneurial environments, they understand the importance of increasing student awareness for entrepreneurship. Therefore some specific activities are organised

New Szechenyi Plan – Hungary, Gödöllő cluster

In 2013 Szent István University published the New Szechenyi Plan. The title is: Raising the quality of educational and research performance at Szent István University. Research activity at the Szent István University (SZIU) has long-term traditions. As recognition of its scientific activity SZIU received a qualification of "excellent university" in 2010. Scientific cooperation within the university and with other higher educational institutions, academic and research institutes is very important. It became more and more important to be in contact with the business sector as well.

As a first step, a small booklet had been prepared presenting the university research teams and all the research fields and developments as well as highlighting their innovative and advisory services. Within the framework of TÁMOP-4.2.1-08/1/KMR-2008-0003 grant programme the Technology Transfer Group had been established at the Grants Administration and Innovation Centre (PIK) of the university in the fall of 2010. Its mission is strengthening the relationship between the university and the business life through the following activities:

- organising courses in intellectual property protection and innovation management and awareness raising
- collecting new, innovative ideas from the research teams and evaluating them for potential utilisation. facilitating market access for the promising ideas (products, services) providing legal and economic advice
- novelty search, intellectual property protection (e.g. patenting) and maintenance of university patents involving external experts
- contribution in contracting and formulating the research contracts, their performance monitoring
- assistance in the formation of spin-off companies facilitating the business use of intellectual property
- internal and external consultations for the utilisation of the research results, covering the administrative issues, which allows the research teams to perfect operation.

2.4 Recommendations

For every European country it is important to keep investing in the innovative environment of their cleantech cluster by means of investing in basic research, idea generation education and scouting programmes dedicated to cleantech. A possible suggestion is to follow the EU Lisbon strategy: to invest at least 3% of GDP in research. This ambitious goal (defined in 2000) was concentrated in the sentence: "... make Europe, by 2010, the most competitive and the most dynamic knowledge-based economy in the world". As can be seen, this significant investment in research has not been achieved by all countries.

It is recommended to invest basic R&D funding, idea generation education and scouting and interview activities in order to create an innovative environment, in the near and long future, to secure Europe's position in innovation. A fertile ground to start developing incubation activities is a place where enough innovative ideas are generated continuously. The creation of such an innovative environment and the ability to transfer the technology and knowledge into commercial values, are typical processes and activities fitting the objectives of universities and research centres. A focus on a specific topic, such as cleantech within these processes can be seen as an opportunity.

In parallel, it is also important to keep investing in order to transfer the technology and knowledge of a cleantech cluster to commercial values by means of investing in entrepreneurship awareness and education programmes dedicated to cleantech. To increase the success rate of the investment, it is wise to focus the investment on specific cleantech areas, fitting the strength of the region/country.

3 Selection of start-ups

This section describes several examples of best practice of the selection mechanisms and processes present in the cleantech incubation process. Often the philosophy 'quality through quantity' can be applied on the inflow of ideas and start-ups. On the other hand, selection seems to be an important incubator management task since it is the basis for effective resource allocation with respect both to individual incubators and to the general economy. Firstly, the majority of incubators are financed by public funds and a clear selection procedure is one way to justify the money spent. Secondly, it is wise to avoid unfair competition in the local market, for instance by only supporting individual entrepreneurs commercialising a unique idea. Selection refers to the task of identifying those firms that are 'fragile-but-promising', whilst avoiding those that cannot be helped through business incubation as well as those that do not need incubation.

In chapter 2, 'Idea Generation' best practice for generating ideas is described. The inflow of a high-tech incubator exists of start-ups, who have been established recently, to commercialise a scientific-based idea or invention. The first step in the selection procedure is to screen the large amount of ideas to end up with the unique ideas suitable to investigate further on the business potential. Due to this combination of scientific knowledge and business impact, two important 'gates' supporting the selection process are described: idea and business plan competitions (3.1) and formal incubation selection process (3.4). All support offered to start-ups, who have not currently been admitted to enter the incubator, aimed to improve the initial idea or business plan is called pre-incubation (3.3). In some regions observed within the CIE project, a dedicated pre-incubation programme has been setup to prepare the start-ups for the selection procedure. Intellectual Property Right (IPR) support (3.5) can be offered to state the uniqueness of the idea and to give competitive advantage when applying for a patent seems to be a realistic option. It can be offered in every phase of the incubation process, but it is recommend offering it at an early stage, such as the idea generation process, because after publication of the idea, applying for a patent is not an option anymore. Below is a visualisation of the process for the selection mechanism.

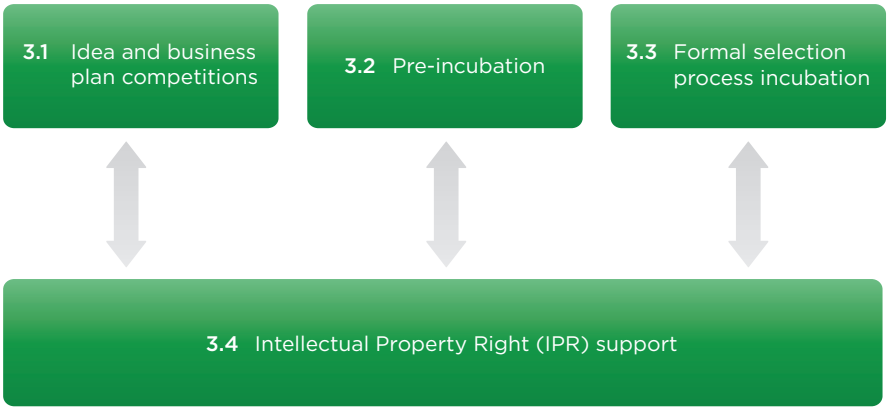

Figure 4 – Process for the selection mechanism

3.1 Idea and business plan competitions

The purpose of an idea competition is to promote entrepreneurship and to encourage teams to develop a viable business concept, to evaluate its appropriateness and potential success in the market, and to identify critical issues to resolve in the near future. Sometimes the incubator itself is a (co-)organiser of the competition. Start-up companies or individual inventors are asked to provide a short description of their innovative idea and the way in which they plan to commercialise it by means of a business plan or business model canvas.

The competition itself is an event, where a selection of the start-ups are asked to give a presentation or pitch in front of a jury. This one-off jury consists of experts with different profiles such as a private investor, banker, (serial) entrepreneur, and business coach and/or incubator manager. The assessment by the jury is mainly based upon the uniqueness of the idea and entrepreneurial attitude of the team. One or more start-ups are appointed as 'winners', and receive the winners' title, network possibilities, coaching and/or prize money, depending on the sponsors of the event. Besides the prize money and importance of exposure and network possibilities, the amount of competitors also depends on active marketing and promotion of the event. If the winners of a business plan competition are not yet following an incubator programme, they are often asked to apply. The idea competition is an excellent way to capture and select cleantech ideas on a local, regional, national and/or international level.

Start Cup – Regional business plan competition – Italy, Torino, I3P

In the Piemonte Region the competition for start-ups is divided into 2 steps: Idea Competition and Business Plan Competition:

1) Idea Competition is an "open call" running the entire year; everybody can participate, from all over the world. Every year on April 30th the call is "closed" and all the submitted ideas are carefully evaluated. The selection committee exists of I3P experts, such as coaches, tutors, experts from specific fields. In 2013 the Start Cup received 314 ideas. Only 139 were approved for the second step.
2) Business Plan Competition is a more selective step where all projects are re-evaluated, not just the idea, but also the team, the intellectual property management strategy, the business plan and the business model canvas. The selection committee is composed not just by I3P's "internal experts" but also by professors, external experts, managers from companies, investors andventure capitalists.. In 2013 I3P received 139 Business Plans and 15 were approved for the incubation process. The top 3 winners receive a small award (about 20,000 Euro) and the first 5 projects can compete in the national competition Premio Nazionale per l'Innovazione (PNI).

3.2 Pre-incubation

Pre-incubation is about the learning and development within the business plan environment, in which the participants can complete courses by developing their own business idea and getting the support needed for doing it. Pre-incubation occurs as a pre-filter for new feasible business ideas and thereby avoids greater costs and disappointments of setting up a company. The pre-incubation support addresses the obstacles that academics often have concerning entrepreneurship: insufficient economic knowledge, unknown market potential of the developed products and services, high financial risks and lack of capital, missing personal skills as well as unawareness of the value of their IP.

Some incubators or universities offer a dedicated cleantech pre-incubation or pressure cooker programme. These programmes are designed for companies and people with innovative cleantech ideas not ready for the incubation programme, because they do not meet all required selection criteria. During a few weeks the participants are provided with the support needed in developing the business idea and plan, testing the markets and building up the resources, by means to strengthen the integral business proposition and to prepare for the incubation selection procedure. Services of the pre-incubation for the **nascent** entrepreneurs are often free of charge or of nominal costs. Principally the services are based on the individual and independent work done by the participant so that the services consist mainly of training and guidance. Pre-incubation activities are a way to influence the quality of the business propositions of potential start-ups and to get to know the entrepreneurs. At the same time, it is an excellent method to promote the incubator facilities to students inside the university and external professionals.

Selection of start-ups *continued*

LaunchLab – the Netherlands, Delft, YES!Delft

The YES!Delft LaunchLab is a unique programme developed specifically for start-ups with a technical idea, a strong B2B focus and a preference for professionals and scientists. The purpose of the programme is to test the idea in the market, evaluate the associated business model and to find a launch customer in 3 months. The programme is based on successful methods such as Lean Launch Pad, the Business Model Canvas and Business Model Generation. Participants will work together with 9 other teams to test the assumptions of their business model. The main focus is to 'get out of the building', meet their future customers, business partners and suppliers. Participants meet up every week, during a 12 week period, to have peer-to-peer presentations and discussions (in the morning), presentation of an interesting management book, 1-to-1 coaching sessions and start-up story (in the afternoon). The costs for participating in the YES!Delft LaunchLab are Euro 750, - for each first team member, the following team members pay Euro500, - a person. The programme is worth at least Euro 2,500 a person, the extra costs are covered by YES!Delft. One dedicated 'climate change' LaunchLab is sponsored by Climate-KIC (a European programme)

3.3 Formal selection process incubation

Potential start-ups willing to join an incubation programme often have to go through a selection and evaluation process, consisting of the following general steps:

1) Application: submit an idea, business model and/or plan.
2) Presentation: give a (pitch) presentation in front of an (inter)national selection committee.
3) Acceptance and management of expectations: acceptance into the programme under condition of expected results, for example a plan with clear targets.
4) Monitoring: monitoring of expected results, which can result in a continuation or exit of the start-ups.

To effectively allocate resources available to support start-ups a formal selection process could be instated. In general two tools can be defined in order to standardise the selection process: selection committee and selection criteria. Next, different selection strategies can be distinguished, because selection is not only a matter of criteria, but also a matter of flexibility or strictness in applying them. In this paragraph two important strategies are described.

Selection committee

The selection committee members have similar profiles as the one-off jury judging idea during an idea and business plan competition, such as a private investor, bank, (serial) entrepreneur, business coach, incubator manager and/or TTO employee. In contrast with the one-off jury, the composition of the section committee is for the longer term and can exist of national or international members. Often experts in a particular field, such as cleantech, matching applications in the same field, are consulted to give their advice. Deadlines for applying for incubation support depends on the amount of annual meetings the selection committee decides upon.

Selection of start-ups *continued*

National selection committee - the Netherlands, Delft/Rotterdam cluster, YES!Delft

The selection committee consists of six members. Two members are from financial institutions (one banker, one investor), two are established/experienced entrepreneurs, and two university representatives (Director of the TechTransfer Office at the TU Delft and start-up policy manager)

International selection committee – Austria, Graz, Science Park Graz

There is a strict selection process before the coaching of the project starts. A selection advisory board evaluate the business/start-up plan and decide whether the project is suitable to enter the Incubator of Graz Science Park. The selection advisory board consists of members from the Science Park team and two international experts in incubation/start-ups; there are delegates from different cities who are experts in start-ups, e.g. the Board Member from Manchester who started a similar Science Park in Manchester and is a worldwide consultant. They are an important link of the incubation programme and the Science Park Graz also tries to use them for networking.

Selection criteria

The selection committee uses a set of criteria in order to standardise the selection procedure and to make sure the allocated resources are invested in the start-ups with the highest chance of 'potential success'. Two important factors are critical for the potential success of the start-up and therefore the committee always pays close attention to both the 'product/service' and the 'entrepreneur(s)'. Product/service contains topics such as value proposition, innovativeness/IPR, scalability and growth potential. The criteria for the 'entrepreneurs' covers topics such as the composition of the team, combination of skills, network and attitude. Specifically for cleantech projects, an expected selection criterion is return of investment. Since cleantech sometimes require a long-term approach, usually in the range of 4-6 years, it is very important for the proposing team to carefully estimate such a period.

Selection criteria – Germany, Munich, UnternehmerTUM

UnternehmerTUM provides hands-on support for start-ups in various aspects. They are a technology oriented incubator, innovator and business creator. Each of the entering start-ups will go through a several multi-phase selection process including evaluation in:

- Technology: how cutting-edge the technology is. Is it novel? Can you file a patent? What is the advantage it provides?
- Business model: is the business model convincing and compelling?
- Market and scalability: how big is the potential market? Is it global?
- Team: is the team strong, experienced and entrepreneurial? Are they capable of running the business?
- Fitting into ecosystem: what is the added value for the big companies in the region? How do they fit into TUM's network?

Selection strategies

When taking the broad definition of an incubator as a starting point, including non high tech and high tech incubators, two selection strategies can be distinguished:

1) Picking-the-winners approach, incubator managers try to identify a few potentially successful ventures ex ante. When this approach is taken to its extreme, incubators resemble private venture capital firms.
2) Survival-of-the-fittest approach, incubator managers apply less rigid selection criteria, take on a larger number of firms and rely on markets to provide the selection processes that over time will separate winners from losers.

Among incubator managers of high tech incubators, there seems to be an on-going discussion whether it is possible to separate potential success from potential failure. Nevertheless, the majority of incubator managers interviewed apply the picking-the-winners approach due to scarcity of means to spend on support of individual start-ups, such as money and time. In addition, these potential show winners have a high news value, which positively influences the image of the incubator.

'Picking the winner' – Accelerace programme – Denmark, Copenhagen, Symbion.

The incubator Symbion offers high growth start-ups and entrepreneurs a unique combination of business development, business training and capital. Symbion offers the Accelerace programme to start-ups (duration of 6 months). The selection of start-ups for the Accelerace Programme is a typical 'picking the winners' approach. The first step consists of a rough screening of around 100 business plans each year. Every six months 20-30 start-ups are picked out to participate in a 'selection camp'. The selection camp has a jury/board with members of all VCs in Denmark that evaluate the selected business plans. 10-15 start-ups are selected to participate in the Accelerace programme. After 6 months the VC board selects 1 or 2 start-ups that will receive their first investment from the Symbion fund. The VC's must also be prepared to follow-up this Symbion investment in the future (after 12-18 months). The start-ups do not have to pay for the Accelerace Programme – the costs are covered from the Management fee of the seed investment fund – the Accelerace programme is 'similar' to the 'due diligence phase' for a regular investment fund and as such is covered.

3.4 Intellectual property rights support

Intellectual property (IP) is intangible property that is the result of creativity and innovation, which can be owned in a similar way to physical property. IP law regulates the ownership and use of creative works. Some intellectual property rights (IPRs) exist without the need for registration, such as copyright. However, other IPRs, such as patents, come into existence only when an application to register a right, is successful. Some IPRs, such as design rights and trademarks, may exist in either an unregistered or registered form. IP law is territorial, meaning that IPRs may vary from country to country. Ideas cannot be patented after publication of the unique elements.

In the university context, IP can be seen as the results and outcomes of research. Unique, high-tech ideas are suitable for IP registration and can give high-tech start-ups a competitive advantage. Therefore, IP it is often used as an informal filter or formal selection criteria. As with other property, there may be commercial value in IP, which may be realised via various routes, including licensing or selling IPRs. Due to the complexity of the IP law, most universities have an IP Rights Management Team responsible for IP policy, for example setting out the university's claims over IP generated by its employees and students.

VTT Technical Research Centre – Finland, Espoo.

In the Global Cleantech Innovation Index, Finland was ranked no. 1 in public R&D work, and 2nd best in supporting innovations. This achievement could be related to the VTT Technical Research Centre of Finland, founded in 1942. It is the biggest multi-technological applied research organisation in Northern Europe, with 3,000 employees and a turnover of 316 million Euros (31.12.2012). VTT is a not-for-profit organisation and part of the Finnish innovation system under the domain of the Ministry of Employment and the Economy. The organisation provides high-end technology solutions and innovation services and due to its wide knowledge base, it can combine different technologies, create new innovations and a substantial range of world class technologies and applied research services thus improving its clients' competitiveness and competence. Six impact areas are addressed by the organisation as grand challenges: bio economy, resources efficient industries, clean globe, digital world, low carbon energy and people's wellbeing. Research at VTT generates inventions, software and other protectable technologies, some of which are transferred to the client according to contract terms, while others are added to VTT's IPR assets. The VTT patent portfolio (2012) holds 363 patent families, 1250 patents and applications, 2 million Euros€ patenting costs (1,7 million Euros investments and 0,3 million Eurosmaintenance costs), 2,5 million Euros annual revenue from licensing and 17 high tech companies. VTT employs 4 main methods to commercialise technologies to capture the maximum value from the invention: 1) Commercial R&D Services 2) IPR licensing 3) Technology Transfer Services and 4) New Venture Creations. The chosen route will depend on the nature of the technology, the strength of the IPR, customer relationships and team competencies VTT uses commercial pricing for their fee-based services.

DTU TechTransfer Office – Denmark, Copenhagen, University of Technology Denmark

DTU Tech Transfer has a dedicated support programme for cleantech inventors as part of the Copenhagen Cleantech Cluster (CCC) programme. For academic start-ups or spin-offs the TechTransfer Office of the university deals with IPR. Students own 100% of the IP and any revenues realised from the IP. For employees at the university that come up with an invention, the university will apply for the patent and owns the patent, but revenues on the patent are equally shared among 3 parties: the university, the department and the inventor (33% each).

3

3.5 Recommendations

To conclude this chapter it should be mentioned that no best practice was found on a selection procedure or selection criteria especially designed for cleantech start-ups. Cleantech start-ups seem to follow the same selection and incubation processes as any other high-tech start-up. A selection criterion such as '(in)direct climate benefit' could be expected to be an important factor for the selection process of start-ups in the field of cleantech. Nevertheless in none of the analysed regions had the criteria been applied during the selection procedure. Motivation behind the absence of climate-criteria could be the (EU) subsidy rules to only spend the money on generic support for start-ups and to prohibit support of a cluster of start-ups working in a specific field. Another reason for not including climate-criteria is that it is sometimes difficult to evaluate cleantech criteria such as a CO2-reduction benefit, less energy consumption, etc. The impact is highly dependent on the actual adoption in the market, such as market share and actual usage of the product in 5 to 10 years.

Ideas selection, such as an idea and business plan competition, and pre-incubation seem to be suitable tools for theme specific support such as a particular network or funding possibility, by clustering start-ups within similar fields, for example medical, ICT and of course cleantech.

Team composition and entrepreneurs are very important as a point of discussion when it comes to selection criteria. Due to the lack of entrepreneurial attitude in Europe compared to, for example the US, the best timing to start a company is a complex matter. Graduates from a (technical) university seem good candidates due to their low standard of living and open-minded attitude, but are lacking work-experience. People with work-experience seem good candidates due to their network and skills, but are often lacking the entrepreneurial attitude and often have high expenses, such as a mortgage. The 'sweet-spot' is somewhere in the middle.

A clear and strict selection procedure could turn into a trademark of the incubator on which other authorities, such as private investors or banks would be able to rely.

4 Incubation infrastructure and business services

The main goal and one of the success factors of any excellent and high performing incubator is to accelerate the development of the hosted start-ups and to create successful young entrepreneurs through a structured incubation programme. This programme is put into practice through an array of physical support on the one hand, such as office spaces (4.1) and test and demonstration facilities (4.2), and on the other hand business services such as mediation and networking tools (4.5), training & coaching (4.4), business support (4.3) and other related services, which are usually provided by the incubator management team (4.6) and external experts. Below a visualisation of incubation infrastructure and business services can be found.

Beyond this simplification, it is important to remember the complexity of the incubator ecosystem and activities. In fact, within the examined case studies, the most successful incubators acted as multi-tenant facilities, as centres of knowledge transfer and stakeholder networks with complex on-site management and business support strategies that direct diverse business incubation programmes.

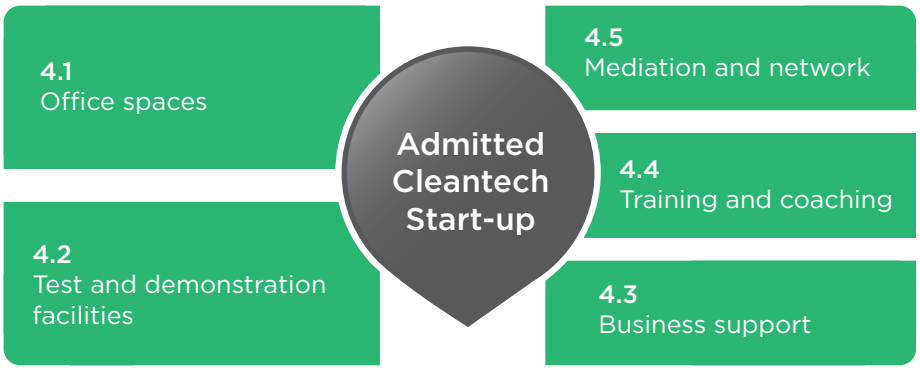

Figure 5 – Incubation infrastructure and business services

In this chapter various kinds of supporting tools are described, relating to best practice found in CIE case studies and which have been personally experienced and promoted by incubator directors, researchers and programme coordinators. Some best practice from different incubator services are described in detail, in order to underline how these important services can attribute to the start-up's success.

4.1 Office space

An incubator usually provides facilities to the start-ups that enter the incubation programme after a selection process (chapter 3). The basic incubators usually have one small office for each start-up with general office equipment, common meeting rooms, relaxation areas, access to economic and management literacy and ICT devices, such as high-speed Internet and telecommunication. In the examined case studies during the CIE project, either in a university campus, within a science park or in a shared office, the average size of an office space for start-ups varies between 500 to 6,000m^2. Typically, incubators dedicate about 60-80% of their facilities for start-up companies, in some cases 10-20% for business tenants, and roughly 10% to common areas and administrative offices. The use of the office spaces, laboratories and other facilities within the incubator can be free of charge since they are included in the benefits offered by the incubator or conversely it can subject to a fee payment. The average price of office space rented in an official incubator in the Netherlands is-between 100 Euros to 140 Euros per m^2 per year. Some cases have been identified, such as SciencePark Graz, where office space can be used for free. An incubator that is too expensive will put off young start-ups.

There could be spaces available in the incubator building itself or in many cases within the stakeholder network, at another company or research centre premises. Further logistical infrastructures are also important both for the start-up and for possible clients and investors, such as a strategic location in the area and the transportation to the site. These infrastructures are all considered not to have lesser importance than the basic ones and still prove to be fundamental to the start-ups' comfort and success.

Hungary, Gödöllő cluster.

There are two incubators in the region: OKISZ Inkubátor and MOHA Ház. OKISZ Inkubátor has more experience (original organisation founded in 1923) and 7 FTE staff, but covers innovation only partially. MOHA Ház is a relatively new incubator, but has a professional approach, and is definitely taking the role of an incubator seriously. Moha Ház offers large scale infrastructure, high level of flexibility in real estate management, no special labs yet, but server room is available, data management facilities and very good IT infrastructure is provided.

Strong and historical links between incubators and universities, Torino cluster.

The Torino cleantech cluster is mainly based on three components: knowledge production (Politecnico di Torino and Università degli Studi di Torino), start-up creation (I3P and 2I3T) and market acceleration (Environment Park). There are two different universities, one dedicated to engineering and architecture, but including management disciplines as well (Politecnico di Torino) and the other one (Università degli Studi di Torino) dedicated to all other knowledge fields. They both have an incubator that has a strong link with the funding institution. The competences offered to start-ups during and after this process are of high level and there is a reiterative benefit coming from the close location between the education institution and the incubator.

I3P is located in the campus of the Polytechnic University of Torino that is the main source of ideas and entrepreneurs, directly deriving from engineering studies and academic research. This university was also one of the founders and actual shareholders, together with the local institutions, the Chamber of Commerce, the regional association for innovation policies development FinPiemonte and Torino Wireless.

4.2 Test and demonstration facilities

Some specific infrastructures can be provided as access to equipped laboratories, prototyping, testing and demonstrating facilities. The start-ups can sometimes benefit from discounted fees to use laboratories and testing facilities in universities or at other company locations, due to the relationship between the incubator and its stakeholders. Whether these facilities are present or are made available to be used, they are extremely important for cleantech start-ups. Nevertheless the total size of the facilities is a poor predictor of the incubator's performance, which is therefore analysed through better indicators (chapter 8).

Prototyping and laboratory facilities - Germany, Munich cluster

The Technical University of Munich has several different kinds of prototyping facilities and laboratories with high technology facilities, like multimillion Euro wind channels and test facilities for fuel cells. These test facilities are readily available for UnternehmerTUM incubator, located in the same region.

Bioprocess pilot facility - the Netherlands, Delft/ Rotterdam cluster, YES!Delft

Delft University of Technology (TU Delft), DSM, Purac, local and regional governments with ERDF funding have established the Bioprocess pilot facility (BPF) to enable scaling-up research of industrial bio (technology) processes. Start-ups which need space for small-series manufacturing and assembly, and have a link to transport, building industry, and marine/off-shore related products, can make use of manufacturing space at the RDM (Port of Rotterdam) Campus in Rotterdam. The RDM Campus has 11,500 square meters available for innovative and technical driven companies for relatively low commercial rental fees.

4.3 Business support

In addition to offering office space and test and demonstration sites, every incubation programme also provides business support to help the start-ups in approaching market and business related issues. Business support includes activities carried out by the incubator management team or by external experts or consultants, such as services in business strategy development, sales and marketing, or web design. Often general legal services are also provided, for example about intellectual property rights (see also 3.5) of the new product, the establishment of the new company as a legal entity and on regulation compliance.

4.4 Training and coaching

Another incubation service is training and coaching, which gives the start-up tools to tackle start-up specific challenges on a daily basis, for example; technology commercialisation, presentation/pitch skills, human resources, identifying market opportunities, and customer relation. External experts and/or experienced entrepreneurs can be appointed to act as a mentor and coach during the incubation phase. The mentor is also involved to provide assistance in obtaining the necessary knowledge about the product and the market to be addressed.

Denmark, Copenhagen cluster, Symbion incubator.

At Symbion an average of 25-30 start-ups go through all support programmes each year with 3 to 6 months of coaching. Symbion offers Accelerate to start-ups which includes:

- Collaboration and coaching, where by an experienced business developer joins the team and contributes strategically and operationally to collect and validate the market, expert and customer input
- Network: access to clients, experts and investors to bring the start-up business successfully to the market. Both when it comes to getting the product validated with potential customers or finding vendors.
- Training and workshops about the latest trends within business and entrepreneurship, insights about useful tools and methods such as segmentation, business models, IPR and sales & marketing.

Germany, Munich cluster, UnternehmerTUM

At UnternehmerTUM candidates and start-ups can attend similar, well-structured programmes, as:

- Start-up night: events offering the participants an opportunity to hear experiences and tips from alumni from the Technical University of Munich (TUM) about their successful business launches. Also providing information about support opportunities as well as concrete offers of assistance.
- Technology entrepreneurship lab: Evaluation of research findings' or technologies' market opportunities.
- Workshop "Spot your opportunity": Identifying possible applications for technology and developing an understanding of the market.
- Start-up Coaching: Advice and active implementation support to start-ups.
- Executive MBA in innovation & business creation.

4.5 Mediation and networking

Fundamental for the future of the company is the access to the incubator stakeholder network to get in contact with professionals and alumni associations, to establish long-term and professional relationships with higher education institutions in the region, to enter a strong and strategic network of companies and institutions and to start nurturing links with strategic partners. A successful high tech incubator, often applying a strict selection process (see chapter 3), sometimes has the advantage to attract investors or investment funds and have access to (non) commercial loans.

The Netherlands, Delft/Rotterdam cluster, YES!Delft incubator.

Mediation between start-ups and relevant parties (e.g. investors, research institutes, business partners, launch customers, consultants/experts, fellow entrepreneurs) is one of the core activities of the incubator of the Delft University of Technology (TU Delft), named YES!Delft. Mediation for start-ups is taken into account in almost all activities organised by YES!Delft for the start-ups. The following activities are organised in addition to the traditional coaching and consulting that are part of the incubation programme:

- Each year YES!Delft organises the annual "YES!Delft network event" where start-ups meet formal and informal investors, researchers, consultants, governmental organisations, business partners and launch customers. Each year around 700 people attend the network event. At the event, promising start-ups are able to pitch their business to a large audience and demonstrations of new products/services are given.
- Each year YES!Delft organises a "Meet the VC-event" where more than 40 leading VC and investor funds are invited to meet relevant start-ups. Selected start-ups can pitch their business proposition and investment needs.
- When start-ups need access to certain targets of clients or investors, the incubation manager of YES!Delft can bring them into contact with the established network of partners and friends of the incubator, on an ad-hoc basis.

Germany, Munich cluster, UnternehmerTUM

When it comes to networking, UnternehmerTUM sees close connections to industry vital. The close location of large international companies' headquarters is one of the success factors of UnternehmerTUM. Start-ups participating in their incubation programmes are linked to a wide and international value chain. The access to established and successful companies – in Munich case in example to big energy provides like EON and RWE.

An important role of a cluster or incubator is to make individual start-ups, or a group of start-ups operating in the same sector, more visible to the outside world. When a cluster or incubator is successful it can become a trademark which has a positive impact on the start-ups supported.

Finland, Helsinki cluster

Viikki Environment House is Finland's most energy-efficient office building which is used by the City of Helsinki Environment Centre and the University of Helsinki. This innovative building has benefited from energy efficiency solutions and products developed by Finnish cleantech SMEs. By working with the users of the space and adopting good practice, the Environment Centre aims to become completely carbon neutral by 2015. Total energy consumption of the building is only half of what is required by construction standards. Low energy consumption is implemented mainly by means of commonly-used technical solutions.

United Kingdom, Cambridge, St John's Innovation Centre

Investors are the most important external stakeholder of the Cambridgeshire region, as well as the mentors and coaches who are providing support alongside the investors. The interactions are usually led by the mentors, coaches and staff at St John's Innovation Centre. The most successful companies are those that have had support from experienced mentors who can work with the companies on their development and identification of key skill gaps (e.g. where they lack commercial skills). St John's has a strong and in depth Alumni directory which is extensively used.

4.6 Incubation and cluster management teams

The personnel needed to run an incubator and incubation programme differs from 1 to 5 fulltime equivalent (FTE) in-house staff. In general, a few different roles can be distinguished such as managing director, marketing manager, incubation manager, event manager, office manager(s) and receptionist. The investigation of cleantech incubation case studies in Europe revealed that most incubators do not have permanent cleantech experts as staff-member.

A governing board, consisting of representatives from every relevant stakeholder, assess the performance and effectiveness of the incubation programme carried out by the incubator management team on a regular basis. Critical to the long-lasting reputation of an incubator is also the ability to provide an appropriate synergy in management guidance, technical and strategic assistance and training, consulting tailored to young companies. The role of incubators in start-ups creation and entrepreneurial development is crucial and the reputation of an incubator might rely on the above-mentioned elements.

The organisation of a cleantech cluster seems to be a more complex matter due to a larger amount of relevant stakeholders with their own interests. Cluster organisations operating well distinguish themselves through strict division of roles and tasks, and clear communication about this division to the outside world.

Austria, the Science Park Graz and ECOWorld Styria

Incubators offer a training and education programme for start-ups dealing with sales, marketing, law, finance, investor readiness, IPR, project management, team development, and pricing. The Science Park incubator has also developed a mentoring programme for its start-ups. Concerning access to the network and tutors, the Science Park has a network of experienced CEO's and managers from almost all the large companies in the region. An experienced manager is invited to mentor the start-up during the incubation programme and coaches the start-up at least once every quarter of a year. Secondly, the Science Park also invites an academic expert to mentor the start-up with respect to R&D. Usually, academic experts (or professors) are found via the TTO Office of the TU Graz (or other universities), depending on the necessary field of expertise. The Science Park also mediates between start-ups and investors and other financial institutions that could fund or invest in the new company. They mediate with the most important governmental funding agencies, but also have set up a business angel network at the regional (and national) level to interest angels to invest in start-ups (see funding for more information). ECOWorld Styria offers start-ups many networking opportunities with potential business partners, investors, and consulting companies. They organise different networking events (e.g. Cleantech Innovation club) and pitching events for start-ups.

Strength of the Styria cluster is the cooperation and communication between the different stakeholders, visible in a strict division of task and respect for each other's domain in the entrepreneurial and innovative eco-system.

Responsibility cluster management - France, Essonne cluster, Incuballiance

Here, on the Plateau de Saclay, we are lucky that the environment exists and is favourable. We can form groups around topics. We are the central point (focus) of this. Without us, the competences exist, and may be complementary but actors do not meet. About the Cleantech topic, we put a lot of actors together who would not have met otherwise.

Why sometimes it does not work? The principal problems are a cultural and a behavioural one. Everything which is structured from the academic world and under State control is based on the absence of risk taking and on the slowness of the decision making, comparing to the active management of the risk and short time of decision process in business. Some people want to help others while they don't have the same mental map. For projects take off, we need speed rather than power. The public authorities bring the power. We are forced to fight in order that the two worlds understand each other. For this it is useful to put many professionals in the heart of the public incubator working.

4.7 Recommendations

Not all of these services may be necessary to create a successful incubation programme, but it has to be a comprehensive synergy between multiple practices and business services that can produce and maintain optimal start-up performance. The requirements of a dedicated cleantech incubator can be different, but it is very important to ensure that an incubator offers relevant, practical and comprehensive services.

As mentioned in chapter 2, almost all important breakthrough ideas happen at the conference table during the weekly lab meeting. Therefore an incubator building with enough areas to socialise is an excellent place to exchange ideas, knowledge and network. One of the main challenges in any region with respect to infrastructures and facilities is to build and/or furnish a building suitable to encourage cooperation, specifically for the incubation phase and growing start-ups. Quite often the office spaces available at the incubator are not big enough for fast growing start-ups. Where there are no specific facilities for cleantech start-ups, usually start-ups that need more space for their tests and experiments,look for alternative operative settlement outside of the incubator and sometimes outside of the cleantech cluster or country.

It is thus recommended to the regional cleantech cluster including local governments and universities together with the cleantech industry, to set up suitable and specific facilities for these types of cleantech start-ups, with a high effort about prototyping, manufacturing and demonstration sites. In that way these new companies are more likely to stay in the region, with added benefits of further jobs creation and to support local economies. Due to the financial and real estate crisis, investors and project developers are hesitating to participate in the development of such infrastructures. This may take time to realise, but such cluster facilities seem to be key success factors of best practice incubators and very important in case of cleantech success.

Next, it is recommended that the incubator management team develop all services according to start-ups needs. Sometimes big events are planned at the incubator building, influencing the work atmosphere of the start-ups in a negative manner, but contributing to the exposure of the incubator itself. A task of the incubator management team is to find a good balance between the interests of start-ups, stakeholder and incubator.

Interviews with the incubator managers demonstrate that in addition to providing a full array of general incubator services, the majority of best-in-class programmes had either linkages to research universities and laboratories, or developed locations in areas that had a high concentration of technology based companies and associated business support firms. Industrial and professional networks are also key factors of cleantech incubation clusters alongside well-established prototyping, manufacturing and demonstrating facilities. Therefore, it is recommended to nurture cluster industrial infrastructure and network in the region for cleantech start-ups by the incubator.

In parallel, it is recommended involving a dedicated cleantech cluster organisation, which supports services for incubation and post-incubation (foster growth of SMEs). Their task is to improve the cleantech specific network of existing institutional and entrepreneurial resources around the incubator itself, such as industrial partners and higher education institutions to deliver critical infrastructure and business support services. Due to the complexity of a cluster network with all relevant stakeholders it is advised to make strict division of roles and tasks, and a clear communication about this division to the outside world. It is recommended to review the current array of services provided through the incubation programme and assess the effectiveness of those services continuously, in relation to the team incubator management and stakeholders, for example by a steering board.

To conclude, it is good to always take other complementary strategies into consideration, once an incubation business support programme is implementing cleantech best practice. Such complementary strategies may include providing extra funding and more space for exiting entrepreneurs, offering extra regional support for start-ups leaving the protected environment, supporting the development of a business service provider network, and encouraging more higher education institutions to support business incubation programmes. This means the cluster and incubator organisations do not only provide core incubation programmes, but pre- and post-incubation services as well.


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5 Incubation exit

Once the formal incubation period ends, the company should be strong enough to survive outside of the incubator and within the competitive marketplace; this is one of the most critical phases of its life. However, a limited number of best practice examples that support start-ups to achieve a smooth exit from the incubation programme exist. Often the incubator has a monitoring tool (5.1) to determine the "health" of start-ups in the incubation phase and their readiness to exit the programme. However most incubators or incubation programmes have a fixed maximum duration (5.1) for providing support to start-ups. Some incubators and incubation programmes offer so-called 'growth' support services and facilities to start-ups that have high-growth potential but still are not ready to fly on their own after finishing the incubation programme (5.2). All incubation programmes and the involved stakeholders offer mediation activities to support start-ups in their exit, especially if investments in the start-up have been made by these stakeholders (5.3)

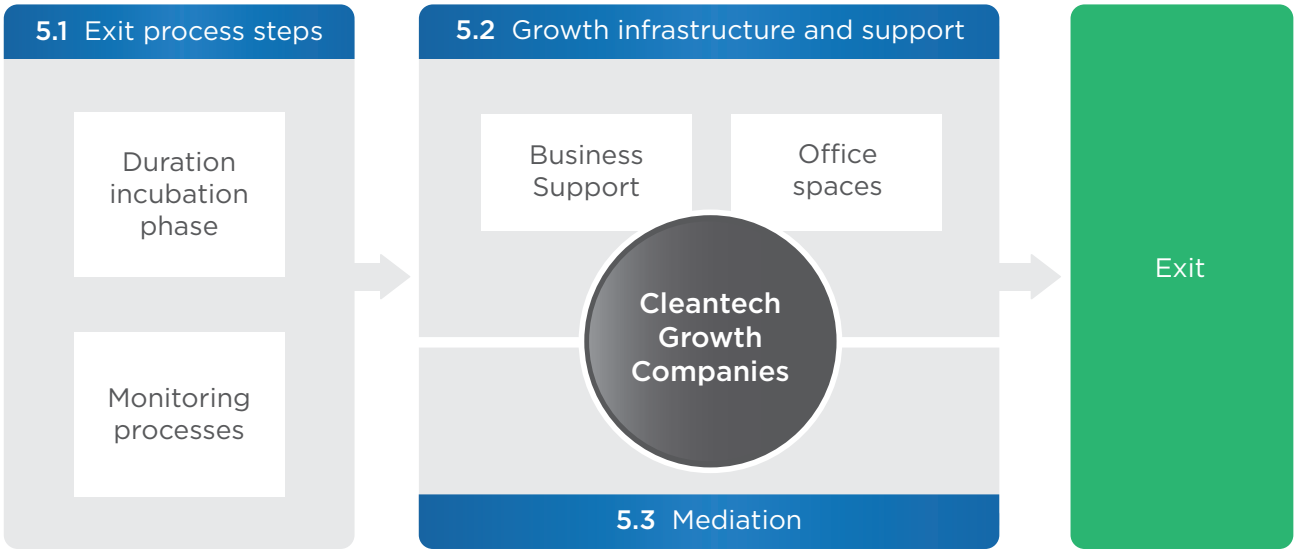

Figure 6 – Incubation exit

5.1 Incubation duration and monitoring

Duration of the incubation phase

In almost every incubation support programme, there are regulations and restrictions in the length of time that a start-up can be part of the incubator and most parties have time limitations on incubation support. The length of an incubation period is different according to the incubator rules and the best moment for the exit is different between start-ups, but depends on the project's maturity and can vary between 6 months to 3 years. Start-ups developing products with a relative short 'time to market' period, such as ICT and consumer products, follow shorter incubation programmes. The majority of cleantech start-ups have longer 'time to market' periods and therefore incubation programmes for cleantech start-ups are commonly between two to three years.

Germany, Munich cluster, UnternehmerTUM

The incubation phase has a flexible duration, depending on the start-up and the incubation programme in which it is participating. There are several evaluation points throughout the incubation programme. UnternehmerTUM is also providing post-incubation activities, i.e. in supporting the companies to find funding in scaling. They also have an alumni-network where the successful companies give advice to the start-ups.

United Kingdom, Cambridge, St Johns Innovation Centre

There are no policies about maximum duration of incubation support. The average duration tends to be around 6 months although there can be exceptions. The start-ups are very keen (with budget constraints) to get to market. The incubator offers some support to less successful start-ups, such as offering the opportunity to try different things. If this does not work they try to change the technology base or change the business model. However, the start-up team may be wrong or unwilling to change. It is during the initial selection that the incubator is usually able to identify these issues and considers potential failures as part of the process.

Sweden, Lund/Malmo cluster

Incubation covers 2 years, but start-ups are able to apply for an extra year if the incubator has spare office space and capability. The criteria for exiting the incubation programme are that the company is growing with a positive cash flow or at least has funding, customers and initial market share.

Monitoring tools

Some incubators have developed monitoring tools to measure the "health" of start-ups during and after the incubation programme. During the incubation phase, the incubation management team and/or coaches should regularly discuss the start-ups development plan and related milestones, as well as alternative directions if the start-up is not meeting pre-defined goals and milestones. To manage expectations, exit criteria should already be described within the incubation service agreement, and can be included in milestone planning or start-up benchmarking. After exit, the incubator should maintain contact with the incubated start-ups, collecting performance data more often and for a longer period of time in orderto analyse the obtained results. The data should include start-up sales and revenues, employment facts, survival rates and information on the success of start-up activities, products and services in the market (see also chapter 8 on incubation performance measurement).

5.2 Growth infrastructure and support

There are several ways for a start-up to exit the incubation programme. The start-up company exits the incubation programme and (1) continues independently, (2) is acquired by (or merged with) an established company, (3) discontinues its operations, or (4) is participating in a so-called 'growth' programme offered by the incubator or other involved stakeholders. These 'growth' support and infrastructure programmes aim to support start-ups with high-growth potential after the incubation phase that still need support or dedicated infrastructure (office space, R&D labs, etc.) that they themselves cannot yet finance or realise. This is especially prevalent for cleantech companies that need capital-intense infrastructure or have longer R&D development times and launch-to-market times.

Growth support programmes often consist of dedicated support to attract private investors, to recruit highly skilled employees, or to arrange regional tax credits for start-ups leaving the incubator. They can also offer incubation facilities and larger office spaces for a special fee, and support the development of a business service provider network. Planning of the growth infrastructure and support programme should start before the incubation programme ends in order for the start-up to be fully prepared when the time arrives to exit.

Post-incubation activities – Germany, Munich cluster

UnternehmerTUM is also providing post-incubation activities, i.e. in supporting the companies to find funding for upscaling its operations. They also have an alumni-network where the successful companies mentor start-ups.

5.3 Mediation

Across the European cases investigated in this project, no dedicated 'growth' organisations or institutions could be identified that are responsible for growth infrastructure and support. In most cases, the incubator is providing this service additionally. Often, although not always, in a very organised process all incubation stakeholders offer exit support where possible, especially stakeholders holding shares in the growth company, such as a TTO, university or investor. Incubators sometimes initiate and maintain an incubation alumni network that coaches or facilitates exiting start-ups.

"Business speed-dating" events – France, Esonne cluster, Incuballiance.

IncubAlliance connects the start-up to "business developers" (managers who have capital and free time, and that want to invest in start-ups). Currently seven sessions have been organised as well as 200 speed-dating meetings leading to20% of the projects finding developers. The initial idea is: there are many senior professionals that have difficulty on the job market after their long-standing careers. We sought from these persons those, which are interested in start-ups. We created a group on LinkedIn and recruited 80 managers with international careers. Firstly, we explained to the business leaders that in most cases they will not become the CEO of business they created. We selected developers who are in congruence with the projects, according to their career and presented the projects to the public. The team is consolidated when one developer integrates one project. It works well: all projects that are consolidated today had an immediate inflection in terms of commercial success.

5.4 Recommendations

The end of the incubation programme is a critical moment for the success of start-ups and needs to be carefully considered, supported and planned as much as the other activities provided during the incubation period. Different growth and development options are available for a start-up at the end of the period and the best support is bespoke.

Some best practice has been identified across Europe,however exit strategy and support practices are open to improvement in the future.

The first recommendation is to define explicit exit strategies and to discuss them regularly with the relevant stakeholders. This could also include specific strategies for longer-term access of dedicated infrastructures (offices, manufacturing facilities, labs, etc.) by post-incubation start-ups.

A good exit strategy for a start-up begins during the incubation period, with explicit goals and reviews about the start-up's performance and with expert support and advice. The new entrepreneurs should be informed about the possible scenarios and should consider and work towards their planned goals and milestones. The exit policy of an incubator also has a strong impact on the overall incubator performance and must ensure efficient and effective allocation of incubation resources to start-ups. Without a clear exit policy, there is a risk that incubation resources are allocated for too long to start-ups that in the end have a low growth potential.

Secondly start-ups should continually learn from private investors (like venture capital funds), which always develop a clear exit strategy for the start-up when it receives an investment. There may be certain private investor experiences and practices that can aid in this, and can be adapted to cleantech incubation processes.

6

6 Funding cleantech start-ups

One of the main inhibitors of start-up growth and success is a lack of early stage capital in the initial stages of a company's development. A lack of early stage capital limits start-ups to be able to cross the so-called 'valley-of-death' – which is the phase of a start-up where investments in R&D and business development still outweighs the sales and revenue generated (and thus profitability).

In this chapter we will describe eight best practice examples of funding tools to realise better availability of early-stage capital for start-up companies, specifically in cleantech. Part of this best-practice includes general funding tools to support all types of start-ups, but we also identified specific funding tools for cleantech start-ups being used in some of the European clusters investigated. The best practice identified is illustrated with examples from the cases.

6.1 Stages in start-up funding and cleantech specifics

In general, the type of funding for start-ups is different along the life cycle of the start-up and targeted at different risk profiles. In the very early-stage of the start-up (or even pre- start-up) where technology is created (invented and transferred) public funding is most important, as risks are still very high and business potential needs still to be validated. After initial technology creation, start-ups will focus on product and business development for real customers and markets, but revenues and profits still outweigh investments in prototypes, alpha/beta-series and pilot-production. During this so-called 'valley-of-death' stage there is a gradual shift from public funding to private funding (and sometimes combinations of both). When the start-up enters the stage of up scaling, commercialisation and growth, and has a proven business model, investment risks are smaller and private/market funding from venture capitalists leading to an initial public offering (IPO) or acquisition is more common and adequate **(see figure 7)**.

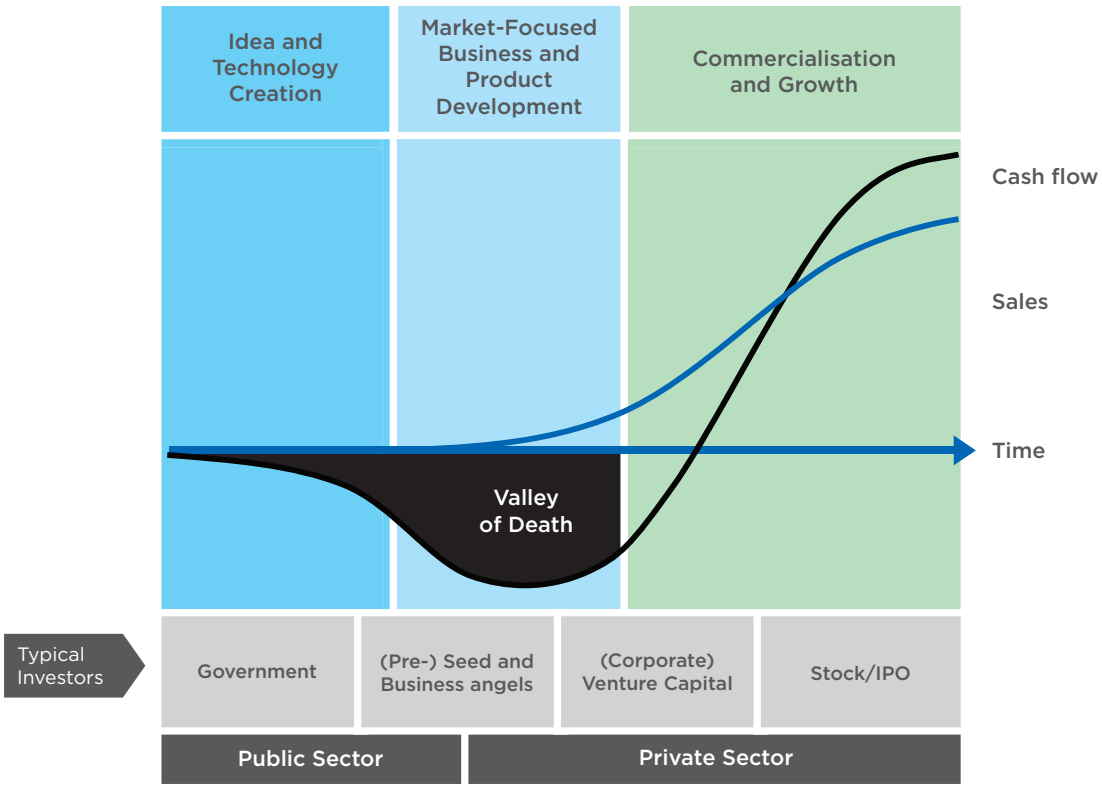

Figure 7. Start-up funding and the 'valley-of-death'

Certain types of cleantech start-ups face some additional difficulty in attracting capital to scale-up their business, cross the 'valleyof-death' and realise growth. Especially for start-ups in the fields of renewable energy or bio-fuels where innovations have an impact on large existing infrastructures and attracting risk capital is not easy. Three characteristics of cleantech start-ups create this difficulty:

1) Scale: Up-scaling of production or manufacturing (and even pilot-production) can be very capital intensive in cleantech. Building a new (pilot-)production line for bio-fuels, wind turbines or for solar cells, is extremely expensive (ranging from €5 million to €250 million), which creates high risks for investors when the business model is not yet proven and sales are low.

2) Large capital costs and long life cycles in the industry: New products or technologies that have to be integrated in large established infrastructures (energy, water, waste, etc.) or will act as a replacement, will face long infrastructure life cycles and large capital costs. Infrastructure owners will not frequently change infrastructures (avg. lifecycles of 30-40 years) and fixed costs are usually extremely high. Sales and growth for the start-up are thus not easily realised, and so investment risks are high.

3) Compliance with established regulations is necessary in order to access the market and thus creates entry barriers for newcomers, especially cleantech start-ups in the energy, waste andwater fields which operate in heavily regulated markets and sectors. This limits the opportunities for innovation in business models and creates larger up-front costs in product and business development to ensure compliance.

The above-mentioned characteristics (scale, large capital costs and long lifecycles, and regulation) of certain cleantech start-ups make it more difficult for them to attract (private) capital due to higher risks and much longer return-on-investment periods. In recent years we have also seen many other types of cleantech start-ups that do not have these limitations with respect to scale or lifecycles; in 'cleanweb' or 'smart-tech' where sensors, ICT and web-technology are applied for e.g. sustainable resource use, mobility sharing or renewable energy distribution. In these fields, scaling-up issues or large capital costs are less apparent.

6.2 Funding during idea and technology creation

One of the initial stages in turning innovation, or a new invention (for instance, developed at a university by a scientist or student) into a commercially viable product or service, is to build a prototype or proof-of-concept to assess its technological and commercial feasibility. After first prototyping and concept testing, entrepreneurs can assess viability and define improvements or, in the worst-case scenario, abandon the concept/prototype and business idea.

In the different cases of successful cleantech incubation in Europe we have identified two relevant best practice examples for funding at this stage: 1) national public funding of technology commercialisation, and 2) local proof-of-concept funds.

1) **National public funding tools for technology commercialisation**
   At the national level different countries within the EU have created public funding tools (subsidies) to support technology commercialisation from research at universities. Funding ranges on average from €100,000 to €300,000 (full costs covered) and is primarily dedicated to prototype development and economic and technical feasibility assessments. Typically only researchers from the university are allowed to apply for this type of funding and may collaborate with a launching customer or potential commercial partner (start-up or established company) in the project. Funding is primarily aimed at enabling the transfer of technology and knowledge from the university into a commercially viable product or service and to the market. This type of funding is often used by researchers/scientists at the university as the first step for creating a start-up or spin-off company by developing their prototype and assessing market potential, after which they decide to create a new company.

Public funding - The Netherlands, Delft/Rotterdam cluster, TU Delft

The STW Valorisation grant is a subsidy (phase 1/feasibility study: €25,000, phase 2/valorisation project: €200,000) for entrepreneurial scientists at universities that want to develop a commercially and technologically viable product/service on the basis of their inventions or knowledge. Scientists can apply twice a year for a Valorisation grant at the national Technology Foundation STW (government funding). Evaluation criteria are strict and competition is strong. Scientists usually use this funding to develop prototypes/proof-of-concepts either together with a first customer, or industry partner, or to prepare for the foundation of a start-up or spinoff company.

Public funding - Norway, Oslo

Norway has been putting a lot of effort into reaching national targets including; 60% of all energy from renewable sources by 2070; and becoming a carbon-neutral country by 2030. Governmental organisations and public funds have been successfully emerging innovations since 2000 in the field of cleantech. Many seminars, programmes and projects are organised for start-ups each year and it is estimated that about 15-25 % of Norwegian start-ups are related to the cleantech sector.

2) Local Proof-of-Concept funds

Another funding tool to fund prototyping and proof-of-concept activities before start-up creation is the so-called 'proof-of-concept' fund. The main difference with national funding of technology transfer is that it is organised and managed much more locally (usually at universities and established with local partners) to support initiatives/inventions that emerged from the organisation or institution itself. Either start-up companies that emerged from the university, or scientists from the university can apply for proof-of-concept funding. The main objective for this type of funding is to support the development of a first prototype (not yet market ready products) to assess its economic and technical feasibility.

Proof-of-Concept fund - Denmark, Copenhagen cluster

At the Danish Technical University (DTU) a dedicated support programme for cleantech inventors and inventions has been set up, as part of the Copenhagen Cleantech Cluster programme. This also consists of a Proof-of-Concept fund to bridge the 'valleyof-death' in the technology transfer and incubation process of cleantech solutions and start-ups. After careful selection by an internal board (consisting of scientists, business developers and IPR specialists) DTU will fund on average 8 proof-of-concept projects each year with €70,000 to €100,000. These funds have to be used for prototype and small-scale demonstration activities (proofing the concept), and for market research, and commercial and technical assessment. Only scientists from the DTU can make use of this fund.

6.3 Funding during market-focused business and product development

Pre-seed loans

When start-ups formally enter an incubation programme and incubator and have passed the selection process, the entrepreneur that starts up the company (and his companions/other founders) can/may receive a so-called 'pre-seed' or 'soft loan'. Usually, this is a relatively small amount of money (€15,000 to €25,000) that the entrepreneur can receive as a personal loan (not as a company) to support him/her in setting up the company. They may either use it for the personal life support (income) or to invest in R&D or company set up. The personal loan usually has a lower rate of interest than at the bank, has to be paid back after certain years (delayed payback), and can/may be absolved if the start-up fails (soft loan). In several cases, these pre-seed funds are established by the university, together with a bank, and partly supported/subsidized by national government (e.g. 50% of the granted loans are guaranteed by a subsidy).

Austria, Graz cluster, Science Park incubator.

The Incubator Science Park Graz offers a personal loan of €10,000 to the start-up entrepreneur, which has to be paid back after they have left the incubator programme (after on avg. 18 months) without any interest. This loan can be used for anything by the entrepreneur, but is mainly used to support the daily living expenses of the entrepreneur in the first phase of the start-up, when they do not usually generate enough revenue to pay their own salaries. The Incubator Science Park Graz is able to provide these pre-seed loans because they are member of the national Academia Business spin-off subsidy programme (AplusB).

Informal investors and business angels

During the first phase (avg. 1-3 years) of the start-up company an important source of funding can be informal investors or so-called business angels. These are usually senior entrepreneurs or executives that invest their own money in young and promising start-ups. On average, angel investments range between €50,000 to €500,000, usually in return for equity, or as a convertible loan. Business angels do not only bring in capital, but also usually (like to) support start-ups with their own experience as entrepreneurs and knowledge of the industry and customers. In most cases business angels are organised in local, regional or national networks that facilitate matchmaking and manage relationships with the major incubators in a country. Several incubators organise typical business angel investor matchmaking events between their start-ups and relevant informal investors.

UK, Cambridge, St. Johns Innovation Centre.

St. Johns Innovation Centre is the incubator of Cambridge University and was established in 1987. Yearly, it supports between 80 to 90 start-ups at its location, but also has around 300+ non-resident start-up members of its incubation programme. St. Johns has established a very dense network of both formal and informal investors linked to their incubation programme. The St. Johns business coaches and external mentors that support start-ups with business development, strategy, and so on, are usually also angel investors themselves. Angel Investors who pay tax in the UK have access to important tax relief schemes that have been provided by the UK Government in recognition of the risks that angel investors take and to show their backing for this important source of finance for small businesses. Tax relief schemes offer between 30% and 50% tax breaks to angel investors per investment.

Seed investment funds

During the early stage of the start-up (avg. 1-3 years) the company usually requires higher capital investments to develop their market-ready product or service, create a manufacturing process and establish their customer base. For venture capitalists the start-up is usually still too risky (small number of customers and low revenues). During this phase start-ups can attract informal investors, but there are also dedicated 'seed investment funds' that focus specifically on this phase of a new venture and often target a specific industry (like cleantech, health or ICT). Usually, multiple partners and investors combine capital and expertise within one seed fund to invest in high-risk early stage ventures. In several cases, the national government also supports the establishment of these seed funds, and contributes by providing subsidies. On average, seed funds can invest between €250,000 Euro and €1,000,000, in return for equity. If the seed fund is operated by (or linked to) a financial institution/bank, other formal investors, or venture capital funds, follow up investments are possible and connections are relatively easy made.

Netherlands, Delft/Rotterdam cluster, TU Delft

Start-ups can apply for a seed-investment (in return for a limited equity stake) averaging from around €500,000 to €1,000,000 from three specific funds. There are two dedicated cleantech funds (Dutch Greentech fund – €23,000,000, and ICOS Capital Cleantech Fund – €8,000,000) and one Airport/Transport fund (called Mainport innovation Fund – €8,000,000). These funds are set up between the Delft University of Technology (TUD) and partners from industry and financial institutions (VC and/or Bank), and every party contributes capital to the fund. The Ministry of Economic Affairs subsidises (i.e. backs) these seed funds for 50% of the total fund. The industry partners bring in their knowledge of specific industries and markets, and the financial institutions bring in their expertise in portfolio management and finance. The university and its incubator are an important source of potential start-ups, but the funds are open to start-ups from all around the Netherlands.

6.4 Funding during commercialisation and growth

Regional Investment Funds

At regional level the cases show that there are examples of investment initiatives that combine forces and capital of regional stakeholders to foster regional economic growth, create jobs and stimulate local entrepreneurship. This type of investment fund is usually part of a regional economic growth agenda developed by the government. Regional investment funds are able to invest in local and regional start-up companies and SMEs and focus on the early stage of a company and during the first growth stage (up-scaling production and market extension). Incubators are one of the important sources of potential start-ups to invest in.

Netherlands, Delft/Rotterdam cluster

The regional investment agency 'Innovation Quarter' (IQ) has a €30,000,000 investment fund to invest in regional start-ups and SMEs with high growth potential. The fund will grow to €100,000,000 in the years 2015-2016. IQ is able to invest in growth start-ups that (usually) have left the incubation phase, but still need higher-risk investments to scale up before they are interesting for the larger Venture Capital funds. The IQ fund is only accessible to start-ups (and SMEs) that are located within the Province of South-Holland. The Province of South-Holland, the major cities in this Province (Delft, Leiden, Rotterdam, The Hague, Westland), The Ministry of Economic Affairs, and the main knowledge institutes of the region (Delft University of Technology, Erasmus University, Leiden University) and its academic medical centres have created this fund. The focus of the IQ investment fund is Cleantech, Life sciences and Health, and Safety and Security.

Venture Capital and Corporate Venture Capital

When start-ups enter the growth stage and are able to extend into the market and scale-up, have a proven technology, product and business model, and reach solid break-even, venture capital funds and corporate venture capital funds become interested to invest (avg. €1,000,000 – €5,000,000 investments in return for equity). At that stage, these start-up companies have a need for larger capital investments (to extend production facilities and distribution networks). Usually, this means that start-up companies are near the end of the incubation process and turn, if successful, into 'growth' companies (so called 'gazelles'), and will leave the incubation programme. There are good examples of incubators (or incubator programmes) that support start-ups in making this transition and help them with matchmaking activities and training/coaching for 'investor readiness'. It is important to note that not only independent venture capital funds are relevant for (cleantech) start-ups, but also corporate venture funds that are part of established companies that look for promising technologies, products or businesses that can strengthen their own business. An advantage of a corporate venture fund is that usually the start-up is able to collaborate with the established company in a close way (as launching customer, in R&D, or in distribution and sales). The established company uses corporate venturing to identify and invest in promising start-ups/technologies and potentially acquire and integrate the start-up completely on the medium-term.

Copenhagen Cleantech cluster, Copenhagen, Denmark.

Start-up companies can participate in the Accelerace incubation programme, linked to the DTU Symbion incubator (part of Denmark's Technical University). During this Accelerace programme the start-ups get all the incubation support they need to grow and succeed. Both seed investors and VC investors are very well connected to the Accelerace programme and are already involved in the incubation process from the start (selection of start-ups). Every 6 months around 10 to 15 start-ups are selected to participate in the Accelerace programme and part of the jury (evaluating the business plans) consists of the major VCs from Denmark. After 6 months of being part of the Accelerace programme, this jury also selects the start-ups that will receive a seed investment from the DTU Symbion seed fund. After this round of seed financing, the VCs have to be prepared to invest themselves in these start-ups (after 12-18 months) with a first-round of VC investments (they have pre-emptive investment rights with respect to start-ups from the Accelerace programme). This configuration of the incubation and investment process ensures that follow-up VC investments are well aligned with the incubation process, and that VC investors are already involved in the process from an early-stage. This enables both the start-up as well as the VC investors to make a more reliable assessment of the value of an investment and 'partnership' between VC and start-up.

6.5 Recommendations

Attracting early-stage capital to grow and build a successful company in cleantech, is one of the main challenges for a cleantech start-up, especially if scaling-up investments are high and existing industry infrastructures are capital intensive. To enable cleantech start-ups to cross the 'valley-of-death' successfully it is necessary to have a balanced and aligned set of funding sources, both public and private, within the cleantech incubation ecosystem, which fits the different risk profiles at the different stages of the start-up lifecycle (see figure R). The key recommendations from the best practice and case studies investigated are:

- Facilitate easy access of start-ups to public R&D funding and Proof-of-Concept funding. This usually requires close collaboration between universities, the incubator, and national R&D funding agencies.
- Establish (small) low-interest pre-seed loan arrangements for individual entrepreneurs to support themselves during the first year(s) of the start-up. Organise this at the incubator in collaboration with banks, government and/or universities.
- Establish a close relationship between business angel networks, the incubator and the start-up community. Involve business angels as coaches, mentors or 'entrepreneurs in residence' to support the start-ups.
- Establish dedicated cleantech seed funds that better match the risk-profile of cleantech start-ups (longer investment periods, scaling challenges). Seed funds can be based upon combined public-private funding. Also involve or connect to VCs or corporate venture funds of established (cleantech relevant) companies to align follow-up investment deals and potential mergers or acquisitions.
- Build a well-informed network of venture capital funds and corporate venture capital funds around the incubator (e.g. involve them in the selection process, organise VC days). Offer training and coaching to start-ups to develop investor readiness. For cleantech start-ups it is important that the incubator connects well to corporate venture funds of established companies in the start-ups' industry (in e.g. energy, water, utilities, automotive) that can become, or are also the start-ups' main customers.

Based upon this best practice, a well aligned and balanced set of funding and capital sources for (cleantech) start-ups can be realised to support start-ups in their growth and success.

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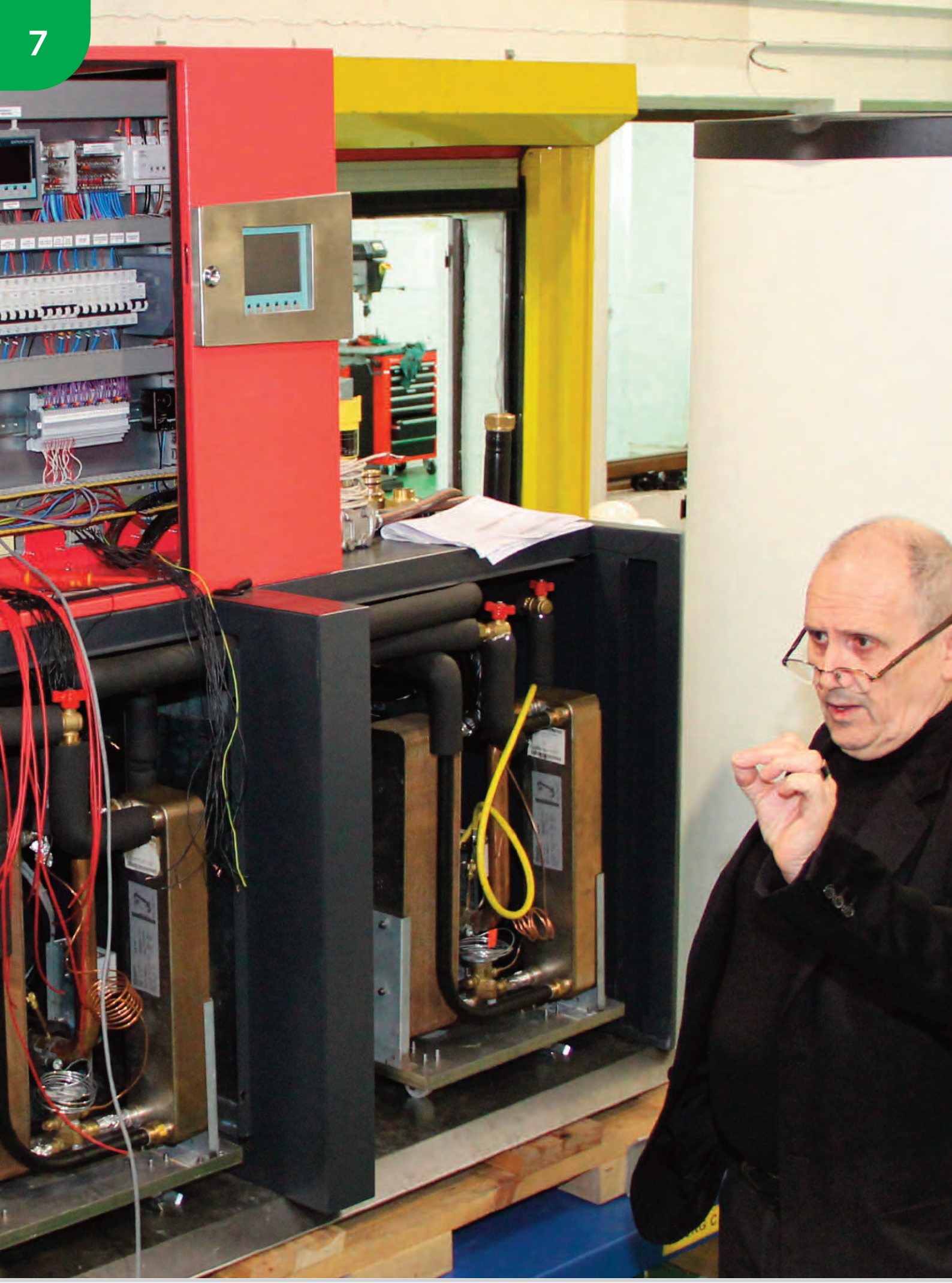


7 Business models of incubation

This chapter describes best practice relating to the business models of (cleantech) incubators that can be identified across Europe. The business model of incubators (or incubation programmes) describes the general approach of how an incubator captures value from its services, how it earns its revenues, or how it gets funded when direct revenues are absent. As the main customer of an incubator, i.e. the start-up company, is usually not able to pay for the full costs of services offered, incubators are in general funded by other public or private stakeholders that have an interest in the cleantech incubation process. This chapter will first describe four different types of business models of incubators (7.1), dependent on the source of funding (public or private) and the interests of its main stakeholders in the incubation process. The second part (7.2) will outline diversification strategies of incubators with respect to funding sources and revenue streams. The final section (7.3) summarises the business model recommendations for cleantech incubators and incubation programmes.

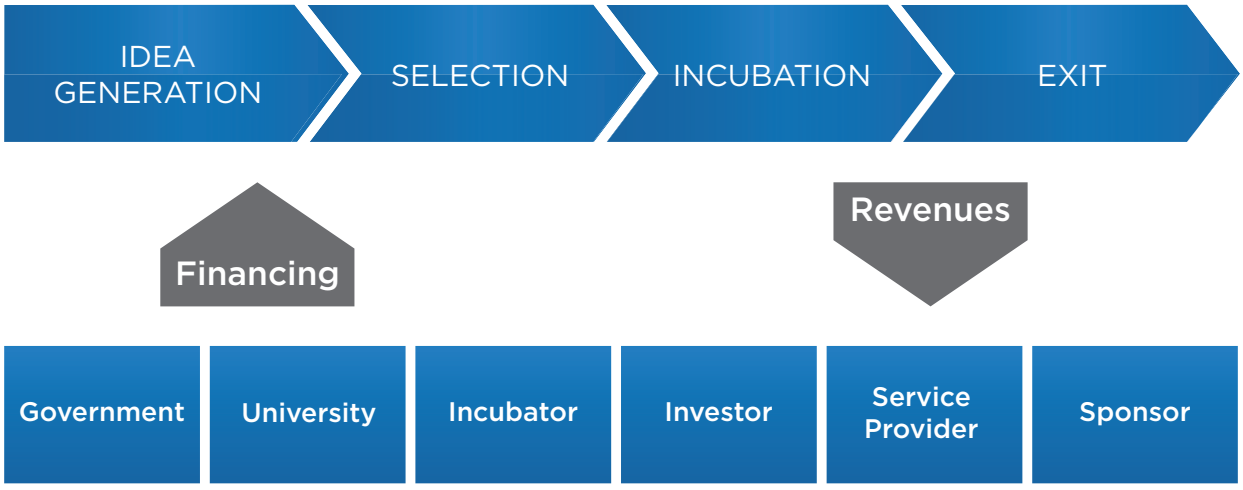


Figure 8 – business model of incubation

7.1 Four business models of incubation

The business model of an incubator (or incubation process) is often dependent on the organisation of the incubation process itself, and on the dominant stakeholders taking part in its organisation. For instance, universities are at the heart of the incubation dynamics when the valorisation of inventions and knowledge developed at the university is at the root of the process. Public authorities have a leading role when it comes to implementing a regional or national economic agenda at the local level. Private investors (like venture capital funds or business angels) play this role when operating profitable business opportunities is the goal that binds the incubation process. Sponsorship, for its part, is most often involved in incubation initiatives carried by others to provide additional facilities and services. The sources of revenues and funding (i.e. the business model) of cleantech incubation processes can differ considerably in each of these cases (see figure 9 for an overview).

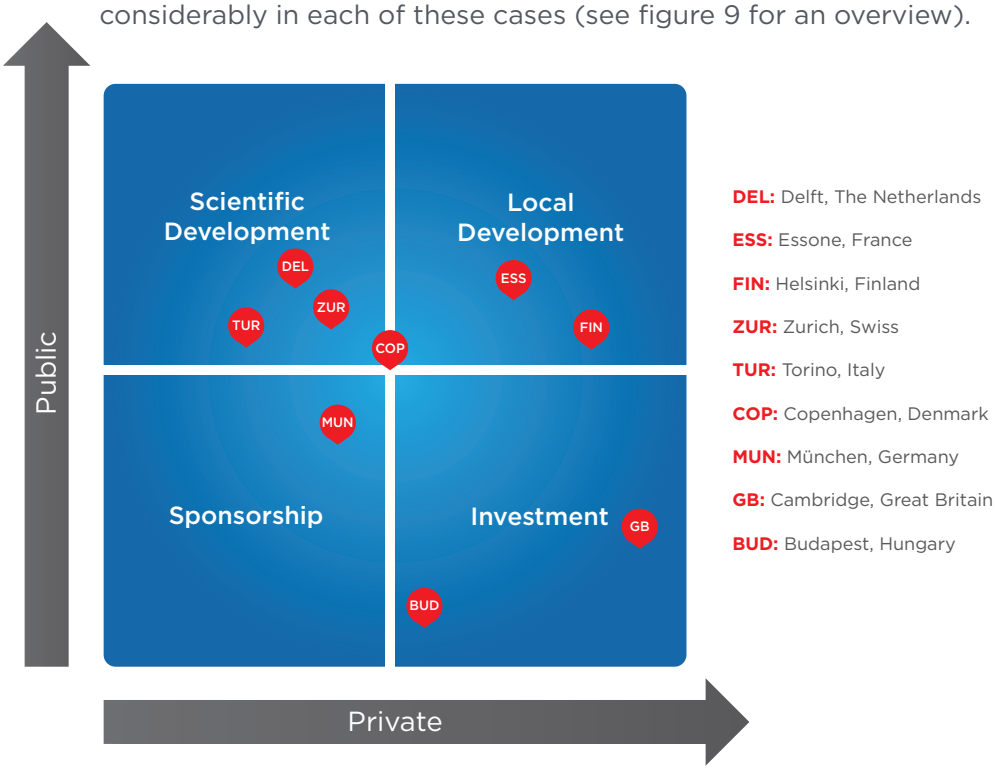


Figure 9: Public versus private involvement in the business model of incubation

In this chapter, four ideal-type business models for (cleantech) incubation processes are distinguished based upon various degrees of stakeholders' involvement and of public or private funding. It would be incorrect to state that there exists a "one best way" or one best-practice to which all business models of cleantech incubation processes should converge – instead these four configurations are in themselves consistent and fitting with its purpose and stakeholders' interests.

The business model of scientific valorisation gives rise to highly integrated incubation structures in which universities, research institutes, laboratories (often from a single institution), tech transfer offices, valorisation services (and industrial partners) collaborate closely. It relies mostly on incubation facilities and services geographically concentrated, often in the same enclosure of the institution of education and research. This model has the potential to deeply exploit commercially valuable scientific knowledge produced in the institution and turn this into start-ups and spin-off companies. Incubation activities are mainly funded by universities and research institutes.

YES!Delft Incubator, Delft, the Netherlands and I3P Incubator, Torino, Italy

The business model of scientific valorisation is present in the organisation and funding of the incubation process at the high-tech incubator YES!Delft of the Delft University of Technology, and at the incubator I3P of the Politecnico of Torino, where the incubators are both strongly connected to the university and to the output of university research and entrepreneurial students.

The business model of local development accommodates incubation and valorisation organisations and activities, scattered over the region, in which a form of consistency is established by the implementation of mediation structures responsible to identify and bring together the different stakeholders. By nature, this structure is sufficiently dispersed and flexible to take account of changes on the political agenda over time.

Copenhagen Cleantech Cluster, Copenhagen, Denmark and the Essonne Region, France

The business model of local development is particularly present in the Copenhagen Cleantech Cluster and associated incubation organisations and activities in Denmark and in the Essonne region in France, in which regional research institutes, universities, industries, regional development organisations (like NovaGreen for cleantech), local government and the IncubAlliance incubator are collaborating. The Finland cluster can also be characterised as one of local development.

Unlike the model of scientific valorisation, the performance of this model stems from the ability of mediation structures to screen the whole region (or cluster) in order to identify – well before the market stage – truly promising start-ups and guide them through the local incubation ecosystem. This requires strong networking and business skills. Funding of incubation activities is derived mainly from local and regional governments and the network of involved organisations in the incubation process.

The business model of private investment is based on a decentralised start-up investment approach where private investors take the lead and is much less rooted in the regional innovation cluster or territory. The start-up selection process is extended to all potentially profitable start-ups and business ideas, whatever their geographical or institutional origins. This is the process of selection and private investment, rather than subsequent start-up support, which is at the centre of the incubation process. Funding of incubation activities primarily comes from private investors that take a (minority) equity stake in the supported start-ups. Very malleable, and "success-oriented", the private investment model has the disadvantage of being disconnected from regional economic development activities and clusters.

TTP Ventures and St Johns Innovation Centre, Cambridge, UK:

The business model of private investment can be found in Great Britain, specifically at the Carbon Trust – TTP incubator (and St Johns Innovation centre at Cambridge) and, to a lesser extent, in Hungary specifically the Budapest region. In the British case, the incubation of start-ups takes a different form than those considered elsewhere; business angels, and private investors like venture capital and corporate venture capital, are much more strongly involved in the incubation process and at an early stage. This introduces greater market pressures and direct coupling with funding of start-ups by private investors, which also (partly) fund the incubation process. In the Hungarian case, interpersonal relationships are used to build specific ecosystems per projects, and the concrete final form the incubation ecosystem takes is thus not predefined.

The business model of sponsorship involves the execution of incubation activities and stimulating entrepreneurship that are primarily sponsored by stakeholders with an indirect benefit from the incubation process, but with a more general interest to promote entrepreneurship. Often the incubation phase itself is not the only concern, but also its upstream and downstream stages: awareness actions and training to promote entrepreneurial thinking; and intense interactions with the local industry (SMEs as well as large companies) to promote start-up development. Funding of these activities comes primarily from public or private sources that want to promote entrepreneurship to strengthen the national or regional economy.

UnternehmerTUM, Munich, Germany

The incubation cluster in Munich, specifically the incubator UnternehmerTUM is a not-for-profit organisation linked to the Technical University of Munchen to foster entrepreneurship and start-ups. The incubator is supported to a large extent by donations of Mrs. Susanne Klatten, a successful German entrepreneur and major shareholder of BMW.

Of course, in most incubators and incubation programmes across Europe, these different ideal-type business models are combined, dependent on more or less involvement of specific stakeholders. In Denmark, the Copenhagen Cleantech Cluster and in Switzerland, the Zurich incubation ecosystem, are examples that have elements of all these different business models. Also in Essonne, France, both public and private stakeholder involvements in incubation are increasingly combined, including their respective funding of the process.

IncubAlliance, Essonne Region, France

One specific best practice example identified in the region of Essonne, is to give investors a central role in the maturation phase of the local cleantech incubation process. As Pierre Perrot (Director of IncubAlliance) underlined, "the final output of the (start-up) project won't look like the initial project: either they are adapted to demand, or they disappear. This is a real Darwinian process: the survivors are those who are adapted. That is why we built business speed dating events. Each semester, we connect the start-up leaders to business developers. Seven sessions were organised until today, 200 meetings were taken, 20% of projects have found developers." This practice complements the traditional selection process in Essonne, which cannot fully play its role because the diversity of the cleantech ecosystem is not rich enough. IncubAlliance accepts today that cleantech projects are obviously missing both technical and commercial maturity. The main purpose of the incubation process at IncubAlliance is to build this corporate ability and link good ideas to interested business developers that believe in it, and corporate investors that are committed to invest.

7.2 Business model development strategies

Most incubation programmes and incubators in Europe depend heavily on public funding sources and lack private investor or private funding sources. Increasing the participation of private investors in a publicly driven incubation structure is a way to attract funding for the incubator, but also an opportunity to develop synergies to enhance the quality of the incubation process and accelerate the maturity of the start-up. The generated synergies are not necessarily only financial ones. Public and private actors possess specific competencies and cultures that complement each other and can be used to strengthen the incubation process. These "cultural synergies" offered by the collaboration between partners who possess different goals, ways of functioning, and languages could be easily exploited in the business model of scientific valorisation. Indeed, public valorisation centres (or tech transfer offices of universities) are already fluent in patent instrumentation and they can identify the relevant parties to promote commercial exploitation with minimal difficulties.

It seems that these cultural synergies are sometimes more difficult to exploit in the business model of local development. This difficulty has been one of the main drivers of the recent implementation of SATT in France (Sociétés d'Accélération du Transfert de Technologies – societies for the acceleration of technology transfer). The creation of the SATT Paris-Saclay (including Essonne) has the aim to increase the performance of the regional innovation ecosystem to the world's top 10 in 10 years. It specifically aims to double the number of start-ups and triple the number of patents. As part of this ambition, the incubator IncubAlliance has also included the maturation of start-ups to its mission, in addition to the incubation of innovative start-up companies.

The "exploitation of synergies" issue – publicly or privately driven, or both – is particularly intense when start-ups are capital intensive and require a long maturation time, as it is the case for cleantech. Some clusters have developed purely private initiatives and original coordination and development tools to support the growth and business development of start-ups.

Post-incubation community – Essonne Region, France

Durapôle is an example where the post-incubation process takes the form of an innovation community of start-ups: a group of young companies decided to pool their resources and experiences to create a cleantech cluster in the Essonne department by themselves. Thanks to this, start-ups feel better equipped to ensure their own economic development. Furthermore, from the public partners' point of view, these initiatives help promoting local development.

7.3 Recommendations

The recommendations in the field of cleantech incubation business models are:

- Mixing "local development", "scientific valorisation" and "private investments" models, to foster a more open selection process (enhancing diversity) and accelerate the incubation and maturation of start-ups. In order to do this, one should develop governance structures that enable constructive dialogues and cultural convergence and synergies between public and private funders of the incubator and incubation process.
- Facilitating the development of cleantech clusters of start-ups based on private initiatives and integrating these clusters in the governance structures of incubators. Promoting local development along with the diversification of funding sources for incubators.
- Forging closer links between local production systems, established industries and start-ups by diversifying contractual relationship that may be established between them.


umwelt arena

8 Incubation performance

One of the critical questions after organising and realising a cleantech incubation process and establishing an incubator or incubation programme is 'how does it perform and does it succeed in facilitating the growth and success of cleantech start-ups?' This question is important for all stakeholders involved in the incubation process that have invested and funded its creation and execution, both public and private parties. This chapter outlines a performance measurement approach that will aid in measuring the performance of the cleantech incubation process, and is linked to the specific interests and objectives of involved stakeholders. Because no clear best-practice in incubation performance measurement could be identified across the European cases, the proposed approach in this chapter is based upon general performance measurement principles applied to the context of (cleantech) incubation processes.

8.1 Performance measurement systems

The approach followed in practice to measure the performance of the business incubation process[6] corresponds in most cases to the "inputs-process-outputs" paradigm. It consists of establishing specific performance indicators linked to the objectives of each stakeholder both upstream and downstream of the incubation process (see figure 10). Within this framework it is easy to define effectiveness measures (degree of achievement of the stakeholders' goals), efficiency measures (results achieved on invested financial resources), as well as sustainability measures (coherence between innovative projects, incubator's management team, and the organisation of the process itself). One of the main advantages of this inputs-process-outputs framework is to measure performance that is directly linked to the objectives of each stakeholder and to initiate adjustments if necessary – when goals are not achieved or, on the contrary, when they are easily achieved. Another advantage of this approach is to develop a comprehensive understanding of the performance of the whole incubation process by articulating specific stakeholder's points of view and interest. .

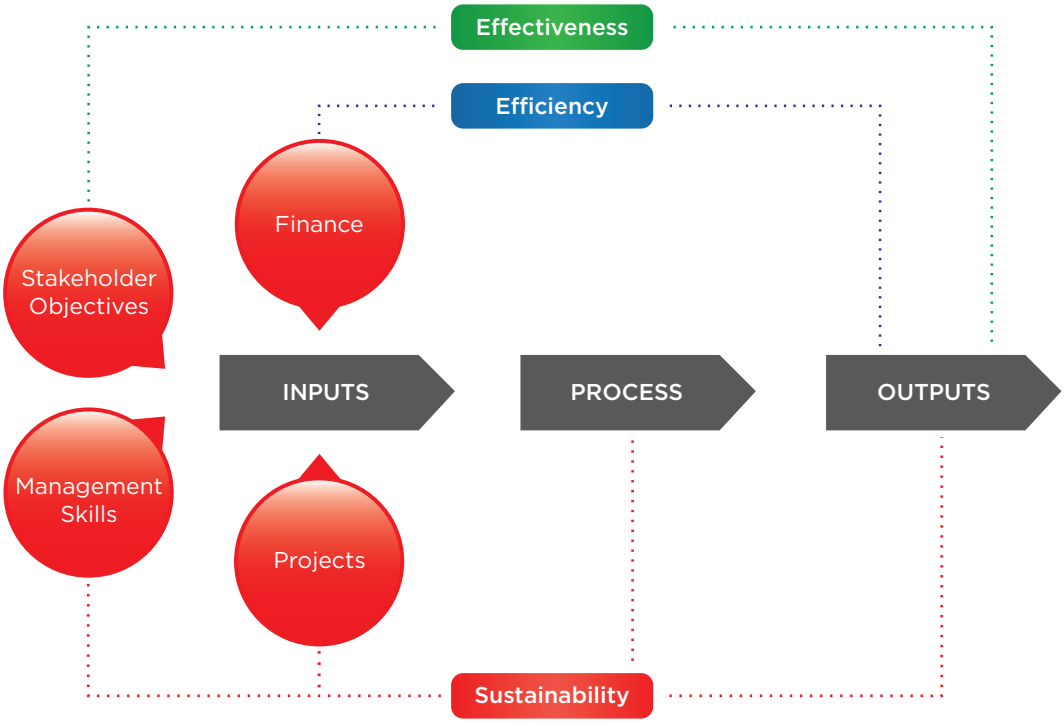


Figure 10. The business incubation performance system.

[6] *See Vanderstraeten, J. and Matthyssens, P. (2010) "Measuring the performance of business incubators: A critical analysis of effectiveness approaches and performance measurement systems" ICSB conference proceedings.*

However, this framework also has some limitations that have to be solved in order to be used effectively in the context of the incubation process. Firstly, practice shows that the correct data to measure efficiency, effectiveness and sustainability indicators is not identifiable or accessible to all stakeholders. For instance, if public authorities have to report on the effect of incubation on local economic development systematically (number of projects supported, number of jobs created, cost of start-up development, etc.) they are often confronted with difficulties in following the growth and impact of start-ups over the longer term. It can be complicated today – if not impossible – to measure indicators of long-term survival of incubated companies, as well as impacts on both direct and indirect employment and local economic development. Hence, the accessibility of performance data and indicators has to be aligned and optimised.

Secondly, not all stakeholders in the incubation process are involved in the same way at each stage of the process. Some stakeholders are not involved in certain incubation steps, which become a “blind spot” for them and for which they do not have any levers of control. All "triple helix" stakeholders are present in the phases of “idea generation” and “incubation stricto sensu”, but are not always fully represented in the “selection” and “post-incubation” phases. For instance, public authorities are not often fully involved in start-up selection, though they participate in events that promote the arrival of projects and start-ups at the doors of the incubators (contests, networking events, awareness actions, etc.). Universities are often absent during the post-incubation or exit phase. The incubation performance measurement system should therefore align performance measures, phases and levers of control.

To solve existing limitations of the inputs-process-outputs framework in the context of incubation, it is suggested to incorporate the performance measurement principles[7]. Summarised in the following table:

Performance measurement system output characteristics (Tangen, 2004)

PMS output characteristic	Explanation
Support strategic objectives	The PMS should support the organization's strategic objectives, and flexible enough to allow for strategic changes
Have an appropriate balance	The PMS should have an appropriate balance, and should incorporate: · Short – and long-term results, · Different types of performance (for example; cost, quality, delivery, flexibility and dependability), · Various perspectives (such as the customer, the shareholder, the competitor, the internal and the innovativeness perspective), and · Various organizational levels (for example; global and local performance)
Guard against sub-optimization	The PMS should guard for the "productivity paradox" (Skinner 1986)" Avoiding sub-optimization can be done by establishing a clear link between the company's top and bottom
Have a limited number of performance measures	The PMS should not constitute of too many performance measures, because this could result in ignoring data or information overload
Be easily accessible	The PMS should provide information "at the right time, to the right person" (p.728). The necessary information should be easily obtainable, it should be presented in an accessible way, and it should be easily understandable
Consist of performance Measures that have comprehensible specifications	The PMS performance measures' purpose should be clearly defined. It should be clear who will use and act upon the performance measure. This implies that appropriate targets and timeframes for target reaching should be developed. Skinner's (1986) "productivity paradox" refers to the fact that poor performance measures might have negative impacts on employee behavior.

[7] *Tangen, S. (2004) "Performance Measurement: From Philosophy to Practice," International Journal of productivity and Performance Management, 53 (8), 726-737.*

Based upon these principles, the cleantech incubation process performance measurement system, and the key performance indicators (KPIs) associated with it, should have two main purposes:

- The performance measurement system must be robust enough to mitigate against any strategic and technological changes in order to exist in the long run. It must accommodate changes and it needs to be a fairly flexible tool to adapt to new technological developments in the field of cleantech or in incubation.

- It should be sufficiently simple to be appropriated by all stakeholders, but sufficiently complex too to be useful for everyone: proper information source indicators should be a way to improve the organisation and routines of the local cleantech incubation process.

This means that the development of a limited number of performance measures is suggested to avoid information overflow and as well as the need to consider different types of performance measures to respect output characteristics and stakeholders' objectives. According to this, the performance measurement system should combine intelligently normal business indicators for start-ups (such as turnover, growth rate, etc.) and objective achievements for stakeholders (for example: number of incubated companies, of jobs created, etc. for local public authorities; number of spin-offs/start-ups, patents, contract research, etc., for tech transfer offices at universities) with certain key figures concerning the context of the local cleantech incubation process. In addition, it is important that the performance measurement system promotes systematic interactions between its stakeholders to cross the various points of views that arise at different organisational levels. This facilitates the development of synergies between the different types of involved institutions and actors and are the kind of results which are expected in a triple helix framework. This type of links could be a source of value creation in terms of ideas, technologies and products generation, jobs creation and exploitation of new business opportunities.

8.2 Key performance indicators for cleantech incubation processes

Based upon the guiding principles outlined in the previous section a first set of key performance indicators (KPIs) are proposed. These KPIs can be used to create an integrated view of the cleantech incubation performance highlighting the efficiency, effectiveness and sustainability of the cleantech incubation process. The KPIs defined are summarised in figure 11.

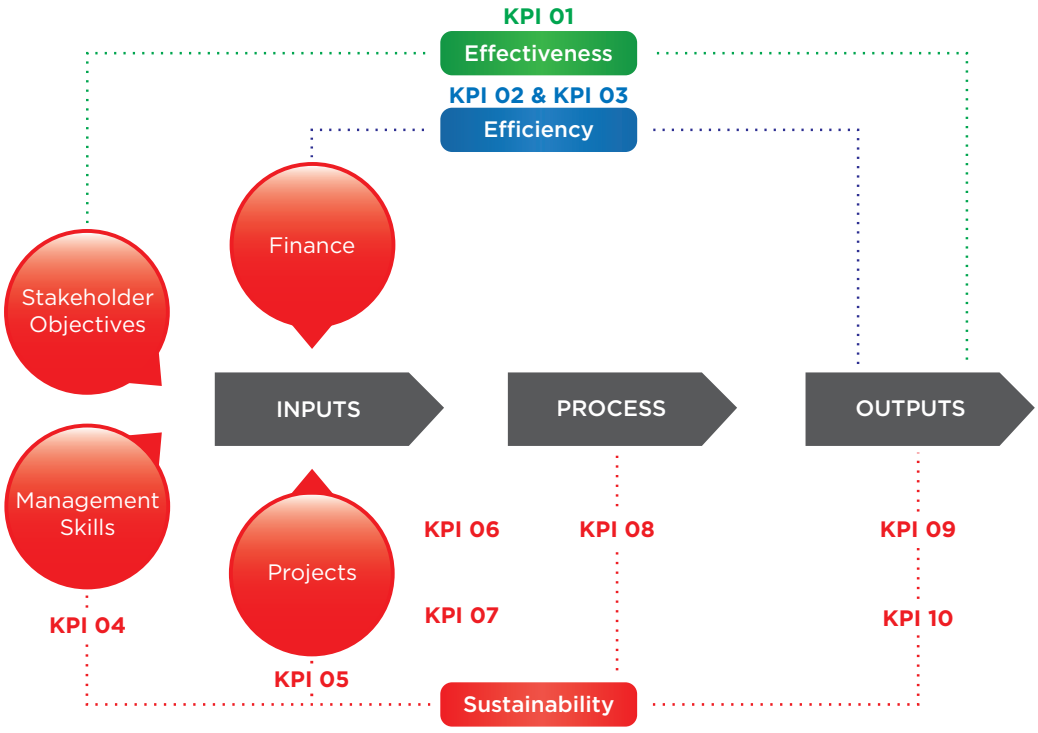


Figure 11. Cleantech incubation process performance framework.

Effectiveness KPIs

KPI 01: Private Funding / Start-up in [KEuro1}] - gives the average private funding attracted by each start-up per year, during the incubation process. This indicator is important because it is an indicator for measuring the ability of the cleantech incubation process to attract investors to its start-ups, i.e. to measure the importance of the economic opportunities associated with it. KPI 01 can usefully be associated with more traditional effectiveness measures, implying the diversity of stakeholders: number of incubated start-ups, of jobs created, of spin-offs, patents, scientific publications, etc.

Efficiency KPIs

KPI 02: Number of Start-ups created (€100,000) of Public Funding - gives the average number of start-ups created using public funding. It measures the efficiency of the incubation process for each €100,000 of public money spent and provides insight in the return on public investments in the incubation process.

KPI 03: Number of Jobs created / (€100,000) of Public Funding - gives the average number of jobs created using public money and provides insight in the societal return and impact of public money spent on incubation. This kind of "return on investment" indicator can easily be extended to every funder of the incubation process. Only the numerator has to adapt to stakeholders' objectives and interests.

Sustainability KPIs

KPI 04: Years since foundation - gives the "age" of the incubator (the years of experience). It is argued that a minimum experience is required for the incubator to effectively manage start-up development, to have a good view of what works and what does not work. It can take several years to develop a competency in the primary activities of an incubator, especially in a specific field like cleantech. KPI 04 serves as a proxy for "management skills".

KPI 05: % of Students / Population in the region. It approximates the potentiality of the local ecosystem to generate – in relative terms – new business and technology ideas and start-up projects.

KPI 06: Amount of New Start-ups / Year - gives the average number of new start-ups created and facilitated by the incubator for each year.

KPI 07: % Cleantech Start-ups / Total Start-ups [0-100%] gives the "cleantechness" of the incubator.

These last two indicators inform us about the exploitation of the incubation potential defined by KPI 05. Dividing KPI 06 and KPI 07 by it give a comprehensible efficiency indicator, providing evidence on emerging (cleantech) innovations in the region.

KPI 08: Support staff in fulltime equivalents (FTE) / Start-up ratio - gives the average number of specialists, consultants, mentors, tutors, etc., in FTE that the incubator has employed/hired to support each start-up. This general indicator assesses the "process" side of the incubation performance system. It can be partitioned according to the different stages of the process (selection, coaching, etc.).

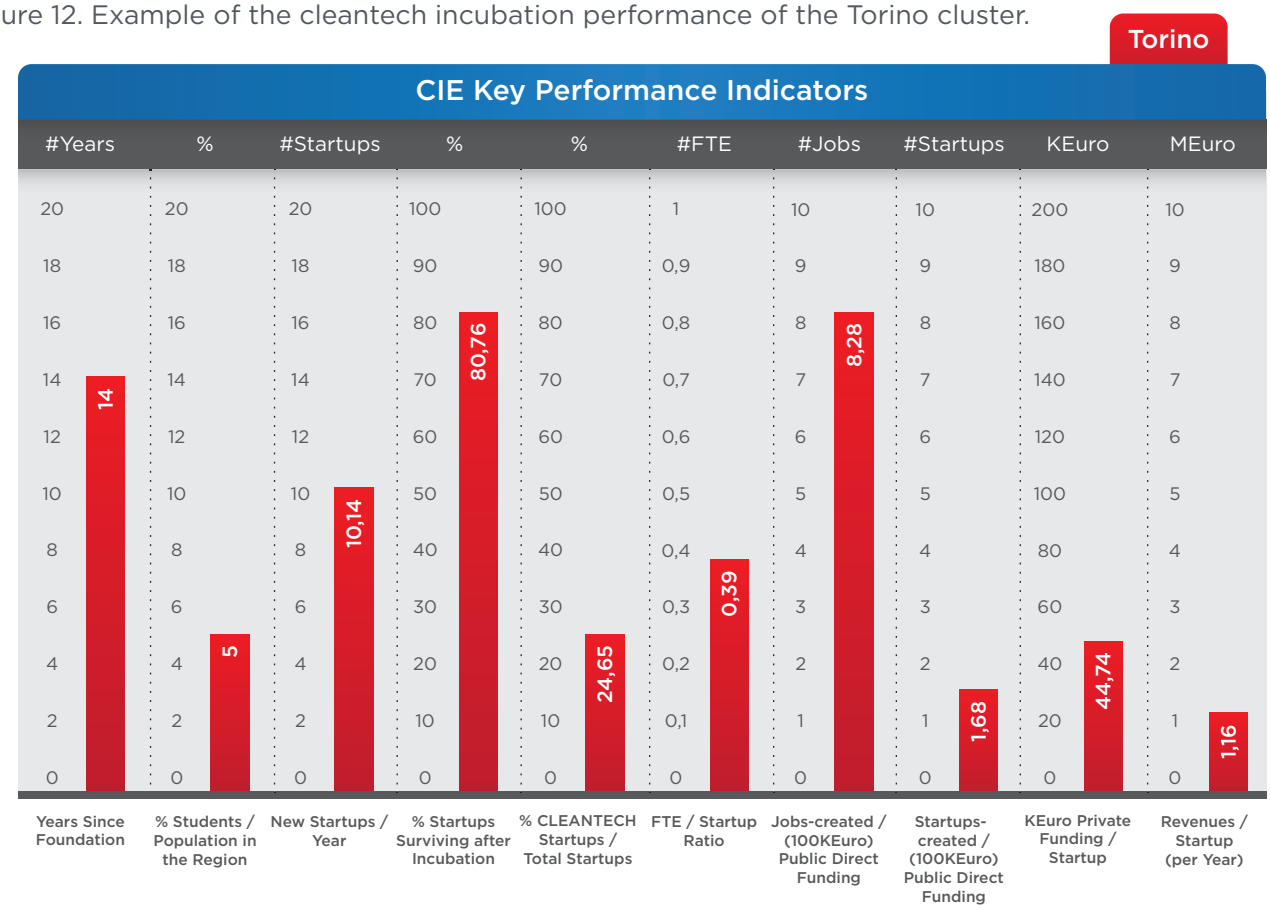
KPI 09: % Start-ups surviving after incubation - gives insight in the average survival rate of the start-ups once they leave the incubator. Start-ups are also surviving when they are acquired or merged with or by another company.

KPI 10: Revenues / Start-up (per year) - gives the average revenue (in Million Euro per year) generated by each start-up that is and has been part of the incubation process.

KPI 09 and KPI 10 are multi-stakeholder indicators and focused on the post-incubation phase. They assess two relevant issues: the global quality of the incubation process, as well as the ability of the region or cluster to generate a viable environment for the firms' growth strategies.

Based upon these 10 KPIs a comprehensive understanding of the performance of the cleantech incubation process can be realised, that is informative to all involved stakeholders. It also facilitates communication and interaction between stakeholders to take appropriate measures to improve the incubation process. In figure 12 an example is given of the integrated incubation performance of the cleantech cluster in Torino, Italy, specifically the I3P incubator.

Figure 12. Example of the cleantech incubation performance of the Torino cluster.



8.3 Recommendations

Based upon the "inputs - process – outputs" framework, a long-term systematic reporting practice has been defined to monitor start-ups, to standardise incubation cluster reporting tools, and to centralise information inside the main incubation structure – where all stakeholders are located and can get access to them. This framework can also facilitate regional comparisons, generalise the benchmarking approach at the European level, and facilitate the identification of best practice. A pan-European observatory could support this task.

9

9 Challenges for cleantech incubation in Europe

This handbook has provided an extensive overview of the many best practice examples from across Europe to facilitate and organise cleantech incubation processes. Starting up new companies in the field of cleantech is challenging, but there are many examples of cleantech start-ups that have been successful. The best practice in this handbook show how policy makers, incubators, universities, investors and industries can work together more effectively to support high-potential cleantech entrepreneurs and make them more successful. Although a lot can, and has been, learnt from the identified best practice, cleantech incubators and incubation programmes in Europe also face challenges in the near future. In this closing chapter several challenges are identified that require future attention of policy makers and the other stakeholders in the incubation process.

9.1 Consolidating cleantech incubation ecosystems for the long-term

As can be seen in this handbook, the incubation of cleantech start-ups is not a one-directional deterministic process, instead new ideas, start-ups and necessary resources like knowledge, funding and partners, flow in and out of the process at different stages. It is complex triple-helix ecosystem in which public authorities, universities, research centres, established industries, investors, and policy makers collaborate and participate. The challenge for the future is to consolidate this ecosystem of mixed public-private collaboration to spur cleantech innovation and cleantech start-up incubation and growth, especially in certain fields of cleantech like renewables, energy storage, bio-based fuels and materials, public utilities and infrastructures. Longer term incubation periods and longer term investment periods are necessary, due to relatively high capital intensity, regulated markets, and long infrastructure lifecycles. This requires a consistent and long-term view and commitment of participating stakeholders in the cleantech incubation process. It is not enough to ride on the current wave of interest in cleantech solutions, but needs long-term policy and resource commitment to build critical mass in terms of facilities, knowledge base, and funding of the cleantech incubation process and its start-ups. This requires long-term embedding (i.e. 20-30 years a minimum) economic development agendas of regions and nations.

9.2 Strengthening idea generation

A challenge in the generation of ideas in cleantech is to increase the amount of viable technological and business ideas that can be transformed into promising start-up companies. Currently, the majority of young researchers or students still develop business ideas in the areas of information and communication technologies (ICT), new media, social networks, mobile commerce, etcetera, instead of cleantech. Although there is a growing awareness and interest in cleantech and environmental-friendly solutions, developing marketable cleantech solutions requires much more time, capital and efforts before results are realised and rewards received. Developing a new business or technology in the field of ICT is more attractive to students and researchers, because it is easier to develop and test new ideas and see results (the proliferation of "hackathon" events where in 48 hours an idea is implemented and tested on the internet, illustrates this) and few of them have the patience of waiting for long-term results from a complex cleantech innovation project. There is an opportunity to make starting up in cleantech more attractive by combining cleantech with ICT and web-technology, so called 'cleanweb' solutions . Cleanweb aims to use IT to improve the efficiency of our use of natural resources, improve sustainable behaviour and enable the sharing economy. Often, these cleanweb solutions require less capital and time to develop, and marketable products and services are easier to realise.

9.3 Improving the availability of early-stage capital

Improving the availability of early-stage capital for start-ups in general, but cleantech start-ups in particular, poses challenges for incubators and incubation programmes across Europe. Attracting early-stage capital to cross the 'valley-of-death' is always one of the major challenges for start-ups and incubators, and incubation programmes that aim to support the growth and success of start-ups have organised all kinds of support and tools to help start-ups with this, as outlined in Chapter 4. Although the funding best practice identified across the European cases are important ingredients for successful incubation, there remain some specific challenges in funding cleantech start-ups.

For developing and establishing successful incubation processes and incubators two challenges are important:

- Cleantech start-ups that require large scaling-up investments and operate in capital-intensive industries with long lifecycle infrastructures (e.g. energy, biofuels, clean water, waste markets) have a very high-risk profile for investors due to these

characteristics (both for business angels, seed and VC or CVC investors). Because of this, there is a general shift of seed, angel and VC investments to a later stage in the life of the start-up, increasing the difficulty of financing the 'valley-of-death' gap. For these types of cleantech start-ups it is necessary that incubators support them with developing more capital-efficient business models to reduce capital intensity across their lifecycle and thus reduce their investment risk profile. Involving experts in finance and business modelling from these specific industries can help considerably. In addition, developing and realising shared pilot-production facilities where start-ups can scale-up their production (like in biofuels, or PV cells) without having to realise dedicated pilot-production plants themselves, can lower the capital intensity in the early stages of the start-up. Within Europe, there are still little examples of these shared pilot-production or manufacturing facilities that enable start-ups to grow successfully while reducing risk.

- During the different incubation stages of the cleantech start-up, different types of funding and investments are needed, matching the risk profile of the start-up and its stage of development. Although many incubators and incubation programmes across Europe have established funding tools and relevant investor networks, making sure that funding/investment sources do follow-up in the process and are aligned along the start-up lifecycle, is in many cases not well organised or stages and sources are missing. This hampers the efficient growth of cleantech start-ups and causes hiccups in their growth process. It is important to create a well-aligned and organised funding and investment process along all stages of start-up development, involving the right types of investors and funders at the right stage. This is especially true in the field of cleantech where capital-requirements can be high. It is also important to involve Corporate Venture Capital funds (CVC) from existing industries and companies that can also act as launching customer, or can act as major partner in sales, distribution or production.

Although in general it could be stated that the availability and volume of early-stage capital for cleantech start-ups in Europe should increase, this is not a challenge that incubators or incubation programmes themselves can directly influence. Supporting start-ups in developing more capital-efficient business models, reducing investment risks (for instance, by having shared pilot-facilities), and creating a well-aligned funding and investment process and network, are challenges that incubators and stakeholders in the incubation process can and should tackle in the coming years.

9.4 Dedicated infrastructures and incubation services

One of the challenges for cleantech start-ups is that they usually require more space and dedicated R&D lab facilities and prototyping and demonstrator facilities than other types of start-up companies (like in ICT, medtech, or consumer products). Realising shared cleantech-specific facilities (for prototyping, manufacturing and demonstration sites) is a challenge in many regions. Due to the financial and real estate crises, established research institutes, companies, investors and project developers are hesitating to participate in the development of such infrastructures. Such shared facilities seemed to be key success factors of best practice incubators and cleantech innovation clusters (like in Denmark at DTU and the National Energy Research Laboratory in Risø, or in Torino at EnviroPark).

Most of the highlighted best practice examples in Chapter Four are general tools to support all types of start-ups, but some challenges and recommendations for cleantech start-ups exist:

- Relatively small numbers of cleantech start-ups are trained in "cleantech"-specific business dynamics and business development. There are only a small number of specialised and dedicated business support programmes for cleantech start-ups, although their industry has challenging characteristics (with respect to for instance, capital-intensity or working with large established companies).
- Long-term relationships with triple-helix partners can be improved, to make it easier for cleantech start-ups to access innovation clusters and supportive and strategic networks (NGOs, regional government, incubators, universities, science parks, banks, pension funds, companies, research institutes, consultancy companies, and VCs).

9.5 Exit strategies for cleantech start-ups

For cleantech incubation a specific strategy is required for supporting the acceleration of start-ups companies after the formal incubation phase. Exiting cleantech start-ups is challenging because in most cases these start-ups operate in established business-to-business markets with strong entry barriers. It is often necessary to partner with large established companies (like utilities companies, or global companies) to get cleantech solutions implemented, or get access to a global service and sales network. If partnership is not an option, an established company often acquires the start-up. Supporting cleantech start-ups in this critical phase with advice on partnerships, mergers and acquisitions is in most (cleantech) incubation programmes not foreseen

9.6 Diversifying incubation business models

One of the future directions in the business models governing cleantech incubators is based on the growing importance of local (or regional) development. Local public authorities will be involved in the search for a kind of "genius loci", a typical strength of the region that can be exploited to create cleantech start-ups: a solar or water resource, a wind or a sea wave resource,. This will enable them to create "clean" jobs locally and will reinforce the willingness to fund these sectors from local investors. Identifying and building on local strengths in cleantech related resources facilitates the diversification of the business model from scientific development or private investment, into a mixed model integrating local development. This diversification makes the business model of the incubation value chain more robust and resistant towards shifting interests and political agendas.

9.7 Enhancing cleantech incubation performance measurement

Chapter 8 on the performance of cleantech incubation argues for a more concise, reliable and structured reporting system that accommodates the interests of the different 'triple-helix' stakeholders in the incubation process. At the moment, cleantech incubation performance is measured in very different ways across the European cases that have been investigated, and performances cannot be easily compared. This hampers benchmarking, learning and improvements to cleantech incubation programmes and processes. It is recommended to develop and implement a concise performance-reporting tool at the different cleantech incubators across Europe and initiate a benchmarking pool of incubators to learn and improve. This will help policy makers and practitioners identify how well they are doing and where interventions are needed in the incubation process. The suggested performance measurement framework in Chapter 8 can be the basis of this reporting tool.

9.8 Concluding remarks

This handbook has provided an extensive overview of best practice in cleantech incubation across Europe. Helping policy makers and practitioners quickly identify what already works and has been tested across Europe, aiding them in making the right decisions for investing in cleantech incubation processes and programmes. Of course, the list of identified best practice is not exhaustive and policy makers and practitioners are discovering and developing new components of cleantech incubation programmes and processes on an on-going basis. In order to keep learning and sharing experiences and best practice in cleantech incubation to boost Europe's economy in cleantech and green growth, it is necessary to foster European collaboration in this field and consolidate the best practice exchange networks in incubation that have been developed during this INTERREG IVC project.

Appendix A: Methodology and questionnaire

The questionnaire follows two complementary ideas. In fact, one of the ways to investigate the structure of the cleantech incubation in Europe is to use the model of Triple Helix which is a concept proposed for modelling the transformation processes in university-industry-government relations. Additionally, we analyse the Regional Innovation Systems, as complex systems in which components are strongly dependent on each other. We opt for an assessment of the "Cleantech Incubation Process" (CTIP) rather than assessing "the incubator". So, this choice allows us to integrate a richer description and deals with comparisons even when cleantech-specialized incubation structures are absent from the regions.

From a methodological perspective, we favour a double entry including two analytical frameworks. On one hand, the actors and their relationships are focused through the behavioural approach of organisational processes: the aim is to identify the process of acquiring resources and synergies between actors. This approach leads to a structural representation ("network") of CTIP by aggregating egocentric networks. On the other hand, we concentrate the research on the actions and their functional links by a strategic approach of organisational processes: the aim is to identify the stages of the value chain of the CTIP and the places where value is created. The different stages of the incubator's function are identified by Anna Bergek and Charlotte Norrman, Incubator best practice: A framework, 2008, Technovation, (28), 1-2, 20-28. The identification of the linkages between stages is appreciated by the explanation of concrete CTIP processes.

This dual input provides two visual representations of CTIP that can be used to create a benchmark and identify the strengths and weaknesses of each territory according to their institutional environment. By retaining these two inputs, one can make assumptions about effective organisation of a CTIP and the process capability to generate sustainable business solutions quickly.

From this perspective, the questionnaire is structured in five sections:

1) The first section is about generic data with the aim to get a snapshot, at the time of the interview, of the interviewee. We focus on her socio-demographic data. Some details about her education and career, function in the organisation and job location are collected. When it is relevant, we gather more information about the organisation. The CT supported sectors are extracted from the list opposite.

The CT supported sectors are extracted from the list below.

Green energy
- Hydro energy
- Wave energy
- Wind energy
- Solar energy
- Geothermal energy
- Biomass energy
- Biogas
- Biofuels

Energy infrastructure
- District heating
- Smart grid
- Pipes
- Cables
- Insulation
- Natural gas or biogas distribution

Energy efficiency
- Light-saving technologies
- Low energy buildings
- Low-energy water supply
- Measuring equipment
- Energy saving electronics
- Industrial equipment and processes
- Cooling equipment

Energy storage
- Fuel cells
- Fuels
- Accumulators
- Batteries and battery management

Sustainable materials
- Sustainable building materials
- Bio plastics
- Biological based materials
- Biodegradable materials
- Materials using nanotechnology
- Recycled materials
- Noise-reducing materials

Water and wastewater
- Water supply
- Water treatment
- Sewerage drainage
- Wastewater treatment
- Desalination technologies
- Water filters
- Water saving technologies

Air and environment
- Air purification
- Air and particle filters
- Ventilation
- Soil treatment
- Advice about green accounting
- Environmental monitoring
- Agricultural technologies

Waste and recycling
- Waste incineration
- Recycling of resources
- Landfill sites and dumps
- Waste separation
- Handling of hazardous waste

Mobility
- Electric and hybrid car and transport solutions
- Shared car/transport services
- Energy-efficient engine and drivetrains
- Smart charging for electric vehicles
- Aerodynamics solutions

Appendix A: Methodology and questionnaire *continued*

2) The second section has the main goal to identify the objectives, motivations and resources of the CTIP. The aim is also to provide information about the emergence of a CTIP approach in the territory. We ask if the process is either highly institutionally oriented or market-oriented. We proceed in three steps. Firstly, we determine the objectives of the participation of the organisation in the CTIP by understanding what goals are assigned to it, as well as the main criteria for success. Secondly, we appraise the motivation of the interviewee for participating in the CTIP, considering in particular her personal background. Thirdly, we focus on the resources that are made available for the CTIP and their specificities relatively to other incubation project developments (concerning dedicated staff, budget, etc.).

3) The third section takes an interest in the identification of the relevant stakeholders and their interactions (the forms they take, the objects on which they apply, their quality) inside the CTIP, in agreement with the list of actors categories below:

Start-up/project developer University/Incubator:

Incubator director
Business advisors/experts/coaches to start-ups
Science/business parks
Industry incubators (part of company)
Research institute/laboratory
University technology transfer office
Other

Public authorities:

City/town
Region
Province
Chamber of commerce
National/ministry
Other

Industry:

Industrial association
Large established companies
SME
Other

Civil society:

Grassroots associations for buying cleantech
Environmental associations
Other

Capital/funding:

Cleantech investment funds
Banks/loans
Venture capital/Business angel
R&D funding agency
Other

In this way, we are able to define the egocentric networks, highlighting the strength (weak or strong), the nature (formal partnerships or not), the form (face-to-face vs. at distance) and the utility of the connection with other organisations, taking into account the material, financial and information resources adding to the knowledge transfers and expertise. Finally, we try to know the point of view of the interviewee about the way to improve or to add to the existing relational network.

4) The fourth section concerns the actions and links in the CTIP. The actions are divided in seven points and include the selection process of the start-ups (profiles, privileged partnerships, criteria and skills), the mediation between the start-up and the external stakeholders, the business support (specificities of the training programmes and coaching), the infrastructure offered as part of the incubation process (in general and for cleantech start-ups), the duration of incubation support (and policies about the exit), the funding (procedure, geographic scale and kinds, type of investors and attractiveness), the evaluation and monitoring tools (statistics and criteria for success). About the links, the main idea is to elaborate the value chain essentially by identifying the division of labour inside the incubation ecosystem.

5) The fifth section is about the overall assessment of the CTIP. We ask the interviewee the main challenges the CTIP in which she contributes has to cope. A constantly going back and forth between the effective results (number of jobs created, investment and turnover of the companies, etc.) and the power of the intervention felt, leads to underline a gap which permits the identification of coordination problems and areas for improvement.

A spreadsheet is used with the questionnaire to gather additional data to measure KPI and assess the performance of the cleantech incubation system.

Appendix B:

1. Austria - Graz
2. Denmark – Copenhagen
3. Finland – Helsinki
4. France – Essonne
5. Germany – Munich
6. Hungary – Budapest
7. Italy – Torino
8. Netherlands – Delft/Rotterdam
9. Norway
10. Spain – Barcelona
11. Sweden – Malmo/Lund
12. Swiss – Zurich
13. United Kingdom – Cambridge/Peterborough

Disclaimer:

The following case descriptions are based on interviews conducted in the period 2012-2014. Information given might be outdated.

1. Austria - Graz

ECOWorld Styria and Science Park Graz

Country/region:
Austria/Styria province

Population in the Region:
1,2 million

Global Cleantech Innovation Index 2012: 15

Regional economic agenda:
bio-energy, solar thermal and material flow management

Students/Academic staff TU Graz/TTO/TTO startups:
12.000/1900 (1160 scientific)/18/2

R&D investment: 4,3%

Interviewees:

Christoph Adametz – Director	TU Graz Technology Transfer Office
Emmerich Wutschek – Director	Incubator Sciencepark Graz
Bernhard Weber - Consultant	Incubator Sciencepark Graz
Otmar Khüner - Consultant	Incubator Sciencepark Graz
Christian Köberl – Project development manager	Ecoworld Styria
Stefan Ponsold – Director	Sunnybag AG
Elisabeth Pirker – Marketing manager	Sunnybag AG

Year of Foundation	1998	2002
Total FTE (Tutors, etc.)	10	2 office managers & PR + 3 coaches
FTE Dedicated to CLEANTECH Start-ups	1	No FTE dedicated to CT start-ups in particular
Total Start-ups Created	NA	197 coaching projects
Amount Start-ups inside organisation	180 CT members: 80% SME's, 15% Large companies and around 5% Start-ups	60 applications -> 10-15 pre-incubation -> maximum 10 start a business each year
Established Companies surviving after Incubation	NA	84
Out-of-Business	NA	115
Cleantech themes	Biomass and bioenergy, Solar (thermal) energy, Material flow and waste management	No specific CT themes. Branch categories on the website: general technologies, life science, information and communication technology, services
Cleantech Start-ups Created (number/percentage)	NA	Approximately 8 / 10%
Total Jobs Created by Companies	34248 (in 2011)	380
Total Funding/ Start-ups	€1.000.000 / €50.000 per year	NA
Shareholders	NA	50% TU Graz, 30 Medical University and 20% general university
Public Direct Funding	50% public: City of Graz, SFG (Land Steiermark), 50% membership fees and special projects.	Ministery Innovation (A+B program: 3,6 million for 10 years), 3 universities including TU Graz, SFG (Land Steiermark), FFG (Austrian research promotion), Steiermark bank, City of Graz
Start-ups Contribution	Membership €500	NA
Public Cost per-job Created	€30	NA
Years of Support	NA - membership	18 months

2. Denmark – Copenhagen

Copenhagen Cleantech Cluster, Denmark.

Country/region:
Denmark/region Zealand and the Capital region

Population in the Region:
Zealand: 0,8 million;
Capital region: 1,7 million

Global Cleantech Innovation Index 2012: 1

Regional economic agenda: intelligent energy; energy efficiency; heating & cooling; water; bioenergy; wind power; solar & other renewables; resources & environment

R&D investment: 2.9%

Patents: 25% of the CT companies has 1 or more approved patents

Interviewees:

Jens Thornsen - Chief of Business Affairs	Roskilde Kommune
Helle Bunkenborg - Innovation Manager	Technical University of Denmark (DTU)
Rune Rasmussen – Head of secretariaat	Copenhagen Cleantech Cluster (CCC)
Palle Weidlich – Project manager	Clean Tech Partnerskab Vækshus Hovedstadsregionen
Peter Torstensen – CEO	Accelerace Management & Symbion

Numbers:	CCC	Vaeksthus	Symbion	CAT Science
# Year of Foundation	2008	2007	1986	1998
# Total FTE (Tutors, etc.)	78,000	60	45	17
# FTE Dedicated to CLEANTECH Start-ups	NA	NA	5	1
# Total Start-ups Created (since foundation)	NA	NA	220	NA
# Inside Incubator	NA	100	7	10-20
# Established Companies (surviving after Incubation)	30	NA	NA	250+
# Cleantech Start-ups Created (since foundation)	12	NA	NA	17
# % Cleantech Start-ups (%)	100%	NA	NA	NA
# Total Jobs Created (since foundation)	500	NA	NA	NA
# Total Funding (since foundation) (Euro)	20 Million Euro's	NA	NA	600 million DKK by the end of 2006 2 billion DKK by 2014
# Public Direct Funding (since foundation) (Euro)	75% from EU, 25% from climate KIC	NA	132 million DKK	NA
# Start-ups Contribution (since foundation) (Euro)	NA	NA	1,595 DKK per month in shared office	
# Years of Support (Incubation's Years)	6 months start-up + 18 months proof of concept	NA	NA	NA

3. Finland – Helsinki

Finnish Cleantech Cluster, Cleantech Innovation Ecosystem in Uusimaa

Country/region:
Finland / Helsinki (Uusimaa)

Population in the Region:
1 000 000

Global Cleantech Innovation Index 2012: 4

Regional economic agenda:
Eco- and energy efficiency in urban environment, environmental monitoring

Students in the Region:
appr. 100 000

R&D investment:
2.1 billion € in 2011

Interviewees:

Juha Vanhanen - CEO	Gaia Consulting
Kari Larjava - Executive Vice President	VTT
Lauri Hietaniemi - Managing director	Green Net Finland)

	OSKE Programme (Centre of Expertise Programme, coordinated by Ministry of Employment and The Economy)	Green Net Finland (Uusima/ Helsinki region)
Year of Foundation	2007 -2013 (fixed term programme)	2001
Total FTE (Tutors, etc.)	NA	6
Total Startups Created	Nearly 1500 projects launched when comprising all clusters (not only the cleantech cluster)	22 development projects with total volume of 28 million euros in 2007-2013
Established Companies surviving after Incubation	NA	Focus in SMEs and business development of existing companies, so amount of new startups fairly low
Cleantech themes	4 regional centres of expertise specialized in clean technology with their own focus area within cleantech; - Developing and internationalizing business operations - Environmental health and informatics - Water & air purification - Environmental monitoring & energy efficiency	Combining ICT with environmental monitoring and eco- and energy efficiency in urban areas
Cleantech Startups Created (number/percentage)	Cleantech business has been growing ~10 % annually in Finland.	50-100 new projects started during the past 10 years
Total Jobs Created by Companies	Estimation of 100 jobs created during 2007-2013.	NA
Total Turnover Created by Companies	Cleantech business has been growing ~10 % annually in Finland.	
Total Funding/ Startups		For Helsinki region (coordinated by Green Net Finland) around 220.000 € annually
Shareholders	NA	60 (member organisations in the cluster network)
Public Direct Funding	NA	220 000 € annually 2007-2013
Years of Support	2007-2013	2007-2013
Funding	50% funded by Finnish government and 50% by regional authorities	OSKE funding has generated development projects with about 20 times bigger funding volume during 2007-2013 (when comparing project funding / OSKE funding)

4. France – Essonne

CT Incubator IncubAlliance - L'incubateur Technologique du Campus Paris-Saclay-Ile-de-France

Country/region:
France/Essonne

Global Cleantech Innovation Index
2012: 19

Main players: Incuballiance, Nova Green, Durapôle, Conseil Général de l'Essonne, Région Île-de-France, Scientipôle Initiative, Université Paris-Saclay

The main objective for CT start-ups' creation and development in the Essonne region is to create new jobs and economic growth. Dedicated structures were created to achieve this goal (the main being NovaGreen). A lot of scattered structures enabling start-ups creation exist in the Essonne region, and many more will be implemented during the coming years (creation of the Université Paris Saclay, future location of big Parisian schools – Agro ParisTech, Télécom ParisTech, etc.). Most part of them possesses their own incubation structure. The aim is to inventory and to create synergies between them.

Interviewees:

CLIMMOD, Jacques Zegbeu POUSSI (CEO)

Conseil Général de l'Essone, Julie KEIRSSE, DDER
(Direction du Développement Economique et de la Recherche)

ENNESYS, Jean-Louis KINDLER (CTO)

Incuballiance, Pierre PERROT (start-up executive adviser),
Jean-Michel LEROUX (Chairman), Philippe MOREAU (Managing director)

Nova Green, Marie-Pierre DIGARD (Director),
Guillaume EBEL (Program officer "eco-businesses")

Cleantech Incubation Context & Performance (KPI)	Value	Comment
# Year of Foundation	2000	Incuballiance
# Total FTE (Tutors, etc.) (N)	8	
# FTE Dedicated to CLEANTECH Start-ups (N)	0	
# Total Start-ups Created (since foundation) (N)	176	
# Inside Incubator (N)	0	
# Outside Incubator (N)	176	
# Established Companies (surviving after Incubation) (N)	137	
# Out-of-Business (N)	39	
# Cleantech Start-ups Created (since foundation) (N)	25	
# % Cleantech Start-ups (%)	14,20	
# Total Jobs Created (since foundation) (N)	1100	Still active today
# Total Turnover Created (Euro) 2011	67 000 000	340 million cumul.
# Total Private Funding to Start-ups 2011	30 000 000	210 million cumul.
# Total Funding to Incubator (since foundation) (Euro)	14 200 000	
# Public Direct Funding to Incubator (since foundation) (Euro)	13 000 000	
# Start-ups Contribution to Incubator (since foundation) (Euro)	1 200 000	
# Public Cost per-job Created (Euro)	11 818	
# Public Cost per start-up Created (Euro)	73864	
# Years of Support (Incubation's Years)	2	
# Students in the University Campus (N)	48 000	Essonne + south Yvelines
# Students in the Region (N)	33 732	Essonne only
# Population in the Region (N)	1 215 340	2010
# Regional Educational Level (%)	2.78	

Appendix B: 5. Germany – Munich

5. Germany – Munich

Country/region:
Munich – UnternehmerTUM – Germany

Global Cleantech Innovation Index 2012: 6

Interviewees:

Helmut Schönenberger - Director UnternehmerTUM
Jakob Müller UnternehmerTUM

Cleantech Incubation Context & Performance (KPI)	Value	Comment
# Year of Foundation	2002	
# Total FTE (Tutors, etc.) (N)	50	Including for-profit services,
# FTE Dedicated to CLEANTECH Start-ups (N)	12	
# Total Start-ups Created (since foundation) (N)	600	
# Cleantech Start-ups Created (since foundation) (N)	120	estimated
# % Cleantech Start-ups (%)	20.00%	estimated
# Total Jobs Created (since foundation) (N)	9000	
# Years of Support (Incubation's Years)	4	
# Students in the University Campus (N)	32000	TU München
# Academic Staff (N)	9700	TU München
# R&D Funding (Euro)	276.000.000	TU München
# Patents (N)	300	TU München
# Students in the Region (N)	60.000	Bavaria Region (College and University)
# Population in the Region (N)	12.500.000	Bavaria Region

6. Hungary – Budapest

MOHA Ház and OKISZ Inkubátorház

Country/region:
Hungary, Budapest (capital)

Population in the Region:
1,7 million

Regional economic agenda:
solar thermal, energy efficiency, process efficiency

Students/Academic staff TU Budapest (BME)/TTO/TTO startups: :
18.000/ 1900 (1160 scientific)/18/2
Students in the Region:
approx. 65000

R&D investment: 2,3%

Interviewees:

MOHA Inkubátor Ház, Ms. Katalin M. Csizmadia
OKISZ Inkubátor Ház, Ms. Enikő Evert

	MOHA Ház	OKISZ Inkubátorház
Year of Foundation	2006	1996
Total FTE (Tutors, etc.)	6	2 office managers & PR + 1-5 coaches depending on needs
FTE Dedicated to CLEANTECH Start-ups	No FTE dedicated to CT start-ups in particular	No FTE dedicated to CT start-ups in particular
Total Start-ups Created	About 40	About 45
Amount Start-ups inside organisation	45 members: 80% SME's, 15% Large companies and around 5% Start-ups	60 applications -> 10-15 pre-incubation -> maximum 10 start a business each year
Established Companies surviving after Incubation	NA	84
Out-of-Business	NA	115
Cleantech themes	Renewables and supporting IT solutions.	No specific CT themes
Shareholders	Private ownership.	Association of Industrial Companies
Public Direct Funding	ERDF- Central Hungary Operative Programme Project „Üzleti Hálózatok Inkubátorháza", KMOP-1.5.3/A_2.kör-2008-003	ERDF- Central Hungary Operative Programme Project -A Magyar Iparszövetség „Inkubátorházának" fejlesztése KMOP-1.5.3/A-09-2009-0004.
Start-ups Contribution	Rental costs + service costs	Rental costs + service costs
Years of Support	36-60 months	36 months

7. Italy – Torino

Torino; I3P (CT incubator) & 2I3T (incubator)

Country/region:
Torino, Piemonte, Italy

Population in the Region:
4,4 million

Global Cleantech Innovation Index 2012: 27

Students in the Region:
68.000 students from Università degli studi di Torino, 32.000 students from Politecnico di Torino

Interviewees:

Mario Vittone, Director I3P incubator, Torino
Massimo Davià, Employe Environment Park, Torino

	Environment Park (Science and Business park dedicated to Cleantech)	I3P (Incubator), derived from Politecnico of Torino	2I3T (Incubator), derived from University of Torino
Year of Foundation	1996	1999	2007
Total FTE (Tutors, etc.)	10 FTE permanent (+ 14 FTE temporary, +1 part time)	11 (5 senior experts, 6 junior analysts)	5
FTE Dedicated to CLEANTECH Start-ups	10 FTE permanent (+ 14 FTE temporary, +1 part time)	1,5 (one senior expert and 1 junior analyst)	
Total Start-ups Created		160	30
Cleantech themes	Biomass to energy, hydrogen and fuel cells, nanotech coating and eco-building	All areas of innovation	Pharma, chemical and biotech-nologies
Cleantech Start-ups Created(number / percentage)		25%	2
Shareholders	Province of Torino, City of Torino, Chamber of Commerce, Torino Wireless (also founders)	Province of Torino, City of Torino, Chamber of Commerce, Torino Wireless (also founders)	Province of Torino, City of Torino, FinPiemonte (also founders)
Public Direct Funding	Activities financed by private funds, R&D programmes (Italian, national, EU), own funds (from real estate and renewable energy activities)		
Public Cost per-job Created		10.000 €	
Average cost for a start-up		50- 60.000 €	
Cleantech budget	3 M € yearly budget on average (45% of Environment Park annual turnover)		

8. Netherlands – Delft/Rotterdam

Delft-Rotterdam (CT Cluster) and Yes!Delft (CT incubator)

Country/region:
Netherlands, Delft/Rotterdam

Population in the Region: 715.358

Regional economic agenda:
Water and deltatechnology, biobased economy and transport& mobility
Cleantech (water/ deltatechnology & industrial biotechnology),
MedicalTech and Safety & Security

Students in the Region
41.000 (Erasmus University Rotterdam & University of Technology Delft)

R&D investment: 150.000.000 €

Patents: 44

Interviewees:

Annemiek Wisse - Director	YES!Delft
Paul Althuis - Director Valorisation Centre	Delft University of Technology (TU Delft)
Pieter Guldemond - Elderman Knowledge	Economy department City of Delft
Jan Nijhof – Director	Clean Tech Delta
Chris van Voorden - Director Science	Port Holland (current name is InnovationQuarter)
Willem Trommels - Interim-director	ROM (current name is InnovationQuarter)

Year of Foundation	2005
Total FTE (Tutors, etc.)	4,2
FTE Dedicated to CLEANTECH Start-ups	0
Total Start-ups Created*	120
Amount Start-ups inside organisation	63 (every year around 15 start-up companies enter the incubation program)
Established Companies surviving after Incubation	117
Out-of-Business	3
Cleantech Start-ups Created (number / percentage)*	24 start-ups, 20%
Total Jobs Created by Companies*	700
Total Turnover Created by Companies*	45.000.000 €
Total Funding/ Start-ups	85.000.000€
Shareholders	Delft University of Technology, City of Delft and TNO (also sponsored by selected business partners)
Public Direct Funding*	Several incubation program modules are subsidized by the European Union.
Funding from other actors	150.000 € annually from City of Delft, 250.000 € annually from Valorisation Centre TU Delft
Start-ups Contribution*	For pre-incubation program (3 months); 750.- € per entrepreneur
Public Cost per-job Created	9.142 (based upon total funding)
Public Cost per start-up Created	54.700 € (based upon total funding)
Years of Support	3

9. Norway - Oslo

Government of Norway

Country/region:
Norway/ Oslo region

Population in the Region:
617242 (Oslo, 01-04-2012)

Global Cleantech Innovation Index 2012: 11

Regional economic agenda:
hydropower, offshore windfarming, green transport, recycling and CO2 capturing

Students/ Academic staff TU:
26,869 / 3,344 (University of Oslo, 2012)

R&D investment:
country provides public funding

Interviewees:

Desk research

	Government of Norway
Year of Foundation	2006: created a target of reaching 60 percent of all energy come from renewable sources by 2070.
Cleantech themes	Energy efficiency, clean energy, water technologies, carbon capture and storage, the management of pollution and waste and related sustainable growth projects.
Cleantech Start-ups Created (number/percentage)	15-20%
Total Jobs Created by Companies	During the past 10 years all together 600 companies established employing around 10 000 people.
Total Funding/ Start-ups	$3,1 billion dollars (2013)
Public Direct Funding	Strong public funding

10. Spain – Barcelona

KIC InnoEnergy (CT incubator)

Country/region:
Spain/ Greater Barcelona region

Population in the Region:
3200000 (Universita Barcelona+Universita Politecnica de Catalogna)

Global Cleantech Innovation Index 2012: 21

Regional economic agenda:
bio-energy, solar thermal and material flow management

Students/ Academic staff:
30000/ 2634 (only Universita Politecnica de Catalogna)

Students in the Region: 130000

R&D investment:
78266782 (Turnover 2011 for R&D projects only Universita Politecnica de Catalogna)

Patents: 74 (Only Universita Politecnica de Catalogna)

Interviewees:

Oriol Pascual, Director of Enviu Barcelona, Spain
Josep Miguel Torregrosa, Business Creation Officer, KIC InnoEnergy Iberia, Spain

Year of Foundation\	2011
Total FTE (Tutors, etc.)	6
FTE Dedicated to CLEANTECH Start-ups	6
Total Start-ups Created	4
Amount Start-ups inside organisation	14 (6 in 2011, 4 in 2012 and 4 in 2013)
Established Companies surviving after Incubation	10
Out-of-Business	0
Cleantech themes	Renewables, Energy Efficiency, Smart Cities, Smart Grids, Energy Management, Energy Storage, Mobility, Low Emissions solutions, etc.
Cleantech Start-ups Created (number/percentage)	4 (100%)
Total Jobs Created by Companies	4
Total Funding/ Start-ups	500000 (2 loans received by 2 supported ventures)
Shareholders	30 shareholders in the field of innovation and sustainable energy. The shareholders finance the incubation programme. Between 50.000 and 100.000 € are available for each successful start-up.
Start-ups Contribution	0 (They don't pay anything but the incubator share 10% future incoming)
Public Cost per-job Created	0
Public Cost per start-up Created	0
Years of Support	1,5 – 2 years (2 years for CT start-ups)

11. Sweden – Malmo/Lund

IDEON Science Park (Incubator) and MINC (Incubator)

Country/region:
Sweden/ the Øresund region (Malmö , Lund and Copenhagen)

Population in the Region:
3.5 million (of which two thirds live in the Danish part)

Global Cleantech Innovation Index 2012: 3

Regional economic agenda:
service industries, ICT, medical technology, tourism, manufacturing industries and agriculture

Students/ Academic staff: about 25 000 students / 1,500 employees Malmö University

Students in the Region: 45.000 (Lund)

Interviewees:

Ulrika Cattermole – Project manager, Lund University Innovation System
Hans Möller – Director, Ideon Science Park & Ideon Innovation
Jakob Economou – Project manager, Malmö Cleantech City

Year of Foundation	1986	2002
Total FTE (Tutors, etc.)	5 (1.6 FTE creative piot)	8 board members
FTE Dedicated to CLEANTECH Start-ups	0	0
Total Start-ups Created*	NA	65-70
Amount Start-ups inside organisation	30-40 high-tech + 5 creative	24 firms + 50 mature firms
Established Companies surviving after Incubation	NA	90%
Cleantech themes	None	None
Cleantech Start-ups Created (number/percentage)*	0	0
Total Jobs Created by Companies*	NA	870
Total Turnover Created by Companies*	NA	€97.2 million
Total Funding/ Start-ups	NA	Overall annual budget of MINC is over €1.9 million (includes income from rents)
Shareholders	IKEA (50%)	Owned by Malmö City Council.
Public Direct Funding*	Ideon Centre	Partners: Moll Wendën Advokatbyrä (legal advice), Deloitte (accountancy), Ström Gulliksson (intellectual property counselling) and Swedbank
Start-ups Contribution		0
Years of Support	No fixed programme but menu according to incubatees' needs	24 months

*since foundation

12. Swiss – Zurich

ETH transfer-Swiss federal Institute of Technology Zürich (CT "light structure") and Impact Hub Zürich (CT incubator)

Country/region:
Switzerland/ Zürich region

Population in the Region:
372000

Global Cleantech Innovation Index 2012: 15

Regional economic agenda:
City Planning and how to integrate environmentally friendly planning

Students/ Academic staff:
17187/4664 (employees) according to the document ETHtransfer_linking science and business

Patents:
80-100 applications per/year

Interviewees:

Impact HUB Zürich, Niels ROT (Program Director)
Climate-KIC Zürich, Anaïs Hannah SAGESSER (Director)
ETHZ Spin-Off, Matthias HOLLING (Resp.)

Year of Foundation	1996	Created in 2010 and began in 2011
Total FTE (Tutors, etc.)	3	8
FTE Dedicated to CLEANTECH Start-ups	None dedicated to CT	2-2,5 working on CT specifically
Total Start-ups Created	300	50-60
Amount Start-ups inside organisation	22 (2013) 80%	
Established Companies surviving after Incubation	90%	NA
Out-of-Business	10%	NA
Cleantech themes	Green energy, energy infrastructure, water and wastewater, air and environment, energy efficiency, mobility and sustainable materials.	Green energy, water and wastewater, energy infrastructure, air and environment, energy efficiency, waste and recycling, energy storage, mobility and sustainable materials.
Cleantech Start-ups Created (number/percentage)	20-30 over 300 start-ups (10% growing to 20% today)	60%
Total Turnover Created by Companies	NA	+ 30.000 CFH monthly in 2011/2012 (http://zurich.new.impacthub.net/wp-content/uploads/sites/48/2013/11/HUBZ_ImpactReport2013_web.pdf)
Total Funding/ Start-ups	More than 2 million CFH	No specific budget for CT. An annual budget of 1 million CHF and more than one third of our budget is CT-related.
Shareholders	NA	1. The initial supporters. They brought in 600 000CHF in capital and we got an additional 300 000 from grants, plus more low interest loans. 2. The corporate partners. Swisscom provides us with the infrastructure, and AXA- Winterthur insurance is another financial partner. 3. The program partners. They are all on specific programs and they support our actions. For instance Climate KIC or Blue Lion. 4. The network partners. There are about 50 network partners. They make for instance a mutual communication tool, like Ashoka for instance.
Public Direct Funding	More than 2 million CFH	0
Start-ups Contribution	0	Membership fee
Years of Support	2-3 years depending on how they grow after incubation	Average 1.5 years

13. United Kingdom – Cambridge/Peterborough

TTP Ventures (CT incubator) and St John's Innovation Centre (CT incubator)

Country/region:
United Kingdom/ The Greater Cambridge-Greater Peterborough region

Population in the Region:
1.34 million

Global Cleantech Innovation Index 2012: 10

Regional economic agenda:
the fields of energy generation and energy efficiency, water supply and wastewater treatment, contaminated land remediation, biodiversity management, waste management and recycling and expert environmental consultancy

Students/ Academic staff:
18812/ 3175 Academic Staff (July 2013 University of Cambridge)
1.34 million

R&D investment:
The largest scientific & industrial R&D clusters outside of London are based around Cambridge and Peterborough

Patents:
43.1 patents per 100,000 population

Interviewees:

Clennell Collingwood, TTP Cambridge - Carbon Trust Incubator
Gareth Jones, Opportunity Peterborough/EcoCluster
David Richards, St John's Innovation Centre

Year of Foundation	2006 (CT investor)	1987
Total FTE (Tutors, etc.)	300 employees as a whole	4 people
FTE Dedicated to CLEANTECH Start-ups	NA	NA
Total Start-ups Created	Over 75 companies since 2006	Around 450 CT companies have been supported
Amount Start-ups inside organisation	NA	Around 90 resident companies and around 450 non-resident UK and non-UK companies
Cleantech themes	Green energy, energy storage, air and environment, energy infrastructure, sustainable materials, energy efficiency sector, ICT for the environment, mobility, water and wastewater.	Green energy, energy storage, environmental monitoring, smart grid, sustainable building materials and biological based sustainable materials, energy efficiency sector, ICT for the environment, mobility, desalination technologies and water saving technologies.
Cleantech Start-ups Created (number / percentage)	50+	450 CT companies have been supported and the percentage is growing up to around 15%
Total Jobs Created by Companies	NA	90 FTE jobs created per year (residents) 20 FTE jobs created per year (non-resident or virtual members)
Total Turnover Created by Companies	50+ companies who raised £50 million	Average turnover: £900,000 (residents) Average turnover: £300,000 (non-residents or virtual members)
Shareholders	TTP is 88% employee owned	NA
Public Direct Funding	TTP Ventures takes fund money from Banks, pension funds, corporates and investors. £1.75m for supporting cleantech start-ups between 2006-2012	Publicly funded (regional and local)
Start-ups Contribution	NA	It depends on the programme http://stjohns.co.uk/programmes/
Years of Support	3-6 months	2-3 year

Appendix C: Project description

The Cleantech Incubation Europe (CIE) project is funded by INTERREG IVC (www.i4c.eu) and executed from January 2012 to December 2014.

The Interregional Cooperation Programme INTERREG IVC, financed by the European Union's Regional Development Fund, helps Regions of Europe work together to share experience and good practice in the areas of innovation, the knowledge economy, the environment and risk prevention. The goal is to share knowledge and potential solutions for regional policy makers. The CIE project is based on a partnership between six European regions, with representatives from:

1) The Netherlands: City of Delft, Delft University of Technology (Lead Partner, Lead of Component 1: Management and Coordination);

2) UK: Peterborough City Council, Opportunity Peterborough (Lead of Component 2: Communication and Dissemination);

3) Italy: Municipality of Torino, I3P (Incubator of Politecnico of Torino, Lead of Component 3: Exchange of Experiences, Good Practice);

4) Finland: City of Helsinki, Green Net Finland;

5) Hungary: Szent Istvan University;

6) France: ParisTech, Essonne Region, Novagreen.

The CIE project involves researching policies and best practice that enhance cleantech incubation to make start-up companies in cleantech more successful. Through facilitating the exchange of best practice, policy development and experiences with policy makers and cleantech incubator organisations, the CIE project will create suitable policy interventions to benefit entrepreneurs working in this sector. The CIE project enables complementary policies to be established to create a positive business climate. CIE helps authorities to choose suitable policy interventions tailored to their own local and regional situation.

During the project many Cleantech Incubators were visited and interviewed for collecting and sharing their best practice. In addition to the regions participating in the project that were investigated, several other cases were added to get a richer overview of European best practice:

- Copenhagen Cleantech Cluster in Copenhagen, Denmark
- Ecoworld Styria and TU Graz incubator in Graz, Austria
- Cleantech Malmo, and Ideon Science Park and incubator, in Malmo and Lund, Sweden
- St. Johns Innovation Center and TTP Ventures and Carbon Trust Fund, Cambridge and London, UK
- Barcelona Cleantech clusters and incubators, Barcelona, Spain
- UnternehmerTUM incubator in Munich, Germany
- Cleantech cluster and incubators in Norway
- Cleantech incubation at the ETH Zurich, in Zurich, Switzerland

The experiences and best practice from these additional cases were also shared at the seminars. Based upon the results from all seminars, visits and interviews across European cases and partner regions, this handbook has been published to showcase the best practice identified and enable further dissemination of the project results.

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Appendix C: About the authors

Stephan van Dijk (TU Delft, Delft, Netherlands)

Stephan van Dijk is programme manager at the technology transfer office of Delft University of Technology since 2008. He is responsible for the acquisition and management of research and innovation projects in the field of a.o. sustainable mobility, renewable energy and smart cities. Besides this, he is senior policy advisor at the university with respect to tech transfer, innovation and start-up incubation. From 2009 to 2011 Stephan was managing director of a cleantech incubator in the city of Rotterdam and committee member of a seed investment fund for start-ups. Stephan received his PhD from Eindhoven University Technology in 2008 in the field of business administration and innovation strategy. He graduated cum laude in Operations Research and Systems Sciences (MSc), from Wageningen University in 1999. Stephan is an expert in innovation strategy, and has advised about and authored many reports and articles on tech transfer, innovation and technology strategy.

Lianne Sleebos (TU Delft, Delft, Netherlands)

Lianne Sleebos is project manager at the Delft University of Technology since 2007 and currently working at the technology transfer office. She is active with entrepreneurship education and coaching, start-up support and applied research in incubation strategies on regional and European level, in the fields of high tech, creative and cleantech industries. At the moment she is involved in two European projects: ClimateKIC and Cleantech Incubation Europe (CIE) to motivate climate innovation and one regional project: 'valorisation programme Delta and Water technology', to boost innovation from research institutes and start-ups within this sector. In parallel, she started her own company 'Studio Sleebos' in 2007. As a consultant/expert, often in cooperation with other consultants/experts, she works on a broad range of research & development projects in the field of IT innovation, energy efficiency and human behaviour product interaction. She graduated in Industrial Design Engineering (MSc Design for Interaction) at the Delft University of Technology, the Netherlands.

Pauline van der Vorm (TU Delft, Delft, Netherlands)

Pauline van der Vorm is project manager at Delft University of Technology. She coordinates the university's role as lead partner for the INTERREG IVC programme Cleantech Incubation Europe (CIE) since it was launched in 2011. Since 2008 Pauline coordinates research and innovation projects in the field of electric mobility, renewable energy and system integration at TU Delft. Before this, Pauline obtained her MA in Theology and Art History at Universiteit Leiden in 2008.

Valeria Branciforti (I3P, Torino, Italy)

Valeria Branciforti has a technical background characterised by a cross sector and interdisciplinary approach. She holds a degree in Architecture, with a focus on integrated planning, accessibility and sustainable buildings and a doctorate in Technological Innovation for Built Environment from Politecnico of Torino, with a thesis focused on the rational use of energy and materials in factories. During Valeria's academic career, she has worked closely with SMEs and large enterprises, utility companies and public institutions, in cooperation with owners, managers, technicians and final users. Since July 2013 she started working at UKERC, UK Energy Research Centre, Imperial College London, as Knowledge Exchange Associate, to deliver different networking, coordination and information activities towards other research institutions, Government and Industry representatives (Energy Generation and Supply Knowledge Transfer Network), both at national and international level (European Energy Research Alliance). She supports as a consultant the I3P in CIE project.

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Norberto Patrignani is Senior Associate Lecturer of "Computer Ethics" at Graduate School of Politecnico of Torino, where also collaborates with I3P (Innovative Enterprise Incubator of the Politecnico di Torino) for International Projects. From 1999 to 2004 he was Senior Research Analyst with META Group. From 1974 to 1999 worked at Olivetti's Research & Development (Ivrea, Italy). He graduated (summa cum laude) in Computer Science at University of Torino and published many articles in international journals and several books on the subjects of responsible innovation.

Didier Lebert (ENSTA ParisTech, Palaiseau, France)

Didier Lebert is Associate Professor in Economics at ENSTA ParisTech. He is deputy director of the Applied Economics Department. He joined the School in 2009 working for the development of entrepreneurship programmes. Didier received his PhD from Paris 1 University in the field of institutional economics. His research focuses on the dynamics of industrial systems and the sociology of innovation.

Appendix C: About the authors *continued*

Akos Bartha (SZENT ISTVAN UNIVERSITY, Gödöllő, Hungary)

Akos Bartha is Project coordinator and PhD student at Szent István University dealing with low carbon models, cleantech innovations, food sciences and sustainable agribusiness. He is a former Board member of the ClimateKIC Alumni Association and co-founder of the Hungarian Transition Thinking concept. He has worked in many countries with various organisations and has a background in low carbon economies, transition management and entrepreneurship support. He was winner of the Erasmus for Young Entrepreneurs scholarship, co-mentor for various ClimateKIC innovation programmes, and currently also a mentor of SEED Foundation supporting young entrepreneurs reaching their goals by providing trainings, coaching sessions and incubation services.

The CIE Project team