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Portuguese Clean Tech Acceleration: A Comparative Analysis of Fit

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Abstract

The current work project intends to reach a deeper understanding of the features of current acceleration programs directed at clean-technologies as well as their fit with the start-ups challenges. By semi-structured interviews the study draws conclusions on main challenges. By case benchmarking analysis of 9 clean-tech accelerators, it analyses current options in Portugal and makes a comparison with the International Landscape. Finally by analyzing the fit between the models and the challenges the study concludes that current acceleration models in Portugal are not fit to the clean-tech innovation challenge and that alternative solutions are needed. Furthermore, the study draws some conclusions on basic features to be included in this alternative solution.

Keywords: Clean-tech, Acceleration, Portugal, Start-Ups

List of Abbreviations:

EIT European Institute of Innovation and Technology

FP For-Profit

NP Non-Profit

PPP Public-Private Partnership

TRL Technology Readiness Level

1. Introduction

"Today, our highly optimized, venture-capital-driven innovation system is simply not structured to support complex, slower-growing concepts that could end up being hugely significant—the kind that might lead to disruptive solutions to existential challenges in sustainable energy, water and food security, and health…."- L. Rafael Reif, President of the Massachusetts Institute of Technology- May 22nd 2015

Portugal is witnessing a booming start-up culture, with its capital, Lisbon, being listed as an upcoming international start-up hub. With hundreds of tech startups, establishment of Web Summit and overall cosmopolitanism and welcoming environment, Lisbon alone is hosting today around 15 to 20 acceleration and incubation programs. Despite its infancy, the Portuguese ecosystem is delivering very high-qualified entrepreneurship resulting in the birth of deep-tech innovation start-ups. (Startup Genome, 2017) Deep-tech innovations are disruptive solutions built around unique, protected or hard to reproduce technological or scientific advances. Diverging from typical tech associated to apps and digital platforms, deep-tech will advance the technological frontier providing solutions to the world's most pressing issues (Boston Consulting Group, 2017). As a result of the climate change global challenge, a branch of deep-technologies has emerged, usually referred to as clean-technologies. Clean-technologies constitute the new technology and related business models offering competitive returns for investors and customers while providing solutions to the climate change challenge.[1] (Cleantech Group, 2014). Given the particularities[2] as well as relevance of this type of technologies, new models of acceleration directed at clean-tech have emerged in the global ecosystem. As most acceleration companies around the world are focused on software based or mobile app type of start-ups, this new models still constitute outliers in the scene and a novelty in terms of academic research.

[1] See Appendix V, Figure 1 for Scope Definition
[2] See Appendix V, Figure 2 for Development Timeline Description

1.1. Goal of the Work Project

The current work project searches a deeper understanding of the clean-tech start-ups challenges, needs, as well as current clean-tech acceleration options worldwide. Ultimately it intends to understand whether or not current options in the Portuguese landscape are responding to the clean-tech innovation challenge. Given this, the research intends to answer the following questions: “What are the current challenges of clean-tech startups in Portugal?”; “What are the current acceleration solutions in Portugal?”; “How do they compare with the international solutions?” This will lead to answer the ultimate research question: “Are Portuguese acceleration models fit to the clean-tech innovation challenge?”

1.2.Structure of the Work Project

The present work is divided into six main parts. The first part intends to give the reader a brief overview of the subject at hand and the importance of the research for its discussion. The second part provides a review of the existing literature connected with the topic, the identified literature gaps and how the study will fill them. The third part explains the methodology utilized to conduct the study. The fourth part consists on the discussion of the results dividing the analysis into: clean-tech challenges and acceleration models evaluation. The fifth part summarizes the main findings of the research analysis. The sixth and last part consists of limitations regarding the study at hand and provides suggestions on interesting future study directions.

2. Literature Review

Business incubators, firms or non-profits organizations that focus on helping start-ups, have existed since at least 1959 with the launch of the Batavia Industrial Center. Business Incubators rose to prominence in the late 90's during the tech boom, and typically offered office space, funding and basic services such as recruiting, accounting and legal support (Lassiter III & Richardson, 2014). Recently, new models to foster the development of start-ups have emerged, the so-called accelerators. Accelerators are defined as organizations that support early-stage companies through mentorship and exposure to the wide entrepreneurial ecosystem (Talmor, 2017). The first accelerator program, Y Combinator, was born in 2005 in the US. Since its launch Y Combinator has funded over 1464 start-ups with a combined valuation of over $80 billion (Y Combinator, 2017). Others have followed such as Techstars born in the US in 2006 and the European SeedCamp born in London in 2007. According to the Global Accelerator Report, in 2015 there were already 387 accelerator companies registered globally. (Fundacity, 2015)

2.1. Venture Support Tools: Accelerators, Incubators and Hybrids

Miller & Bound (2011) state the general features of an accelerator being: an application process that is open yet highly competitive; provision of pre-seed investment, usually in exchange for equity; a focus on small teams not individuals; time-limited support comprising programmed events and intensive mentoring; startups supported in cohort batches or "classes".

Through case-study based analysis, Barrehag, et al. (2012), investigate further the characteristics of the seed accelerator model in order to contribute to a definition. The study findings support the definition by Miller and Bound. In addition, the study concludes the main stakeholders that allow an accelerator to function are startups, investors and mentors. The most important stakeholder is the investors although the

absence of any single one of the stakeholders makes it impossible for an accelerator to function. Methods such as Lean Startup and Customer Development are widely practice, and this concepts are considered to be fundamental at the point of being trivial. Lastly, the paper develops a framework for the accelerator process defining generally the most important stages that start-ups go through during the program.[3]

Dempwolf, Auer, & D'Ippolito (2014) create a taxonomy for startup assistance organizations. Three categories of startup assistance organizations are identified: incubators and venture development organizations; proof-of-concept centers and accelerators. Accelerators are further subdivided into social accelerators, university accelerators, corporate accelerators, and innovation accelerators.[4] A key distinction constructed by the study is between *accelerator programs*, which can be run by multiple entities, and *innovation accelerators*. The latter are defined in the study as entities with a clear value proposition and for-profit goals: *"business entities that make seed-stage investments in promising companies in exchange for equity as part of a fixed-term, cohort-based program, including mentorship and educational components, that culminates in a public pitch event or demo day."*

Regarding efficacy of accelerators, academic research consistently finds evidence that some, not all, accelerators help and accelerate venture development. By a triangulated analysis, Hallen, Bingham, & Cohen (2016), conclude that accelerator participants seem to perform better across multiple outcomes. Accelerators' selection processes are imperfect, as both the participating and almost accepted ventures are of similar quality. In addition, there may be a sorting effect as higher-quality ventures are more likely to apply to certain accelerators. The study results indicate the observed effects are not only

[3] See Appendix V, Figure 3
[4] See Appendix V, Figure 4

due to selection and credentialing, but driven largely by indirect learning from others. Furthermore, it concludes acceleration participation complements rather than substitutes previous founder experience.

Other studies focus on differentiating accelerators from other early-stage institutions such as incubators, angel investors and hybrid models. The following table summarizes the key differences between the main players in the ecosystem by Hathaway (2016):

	Incubators	***Angel Investors***	***Accelerators***	***Hybrids***
Duration	1 to 5 years	Ongoing	3 to 6 months	3 months to 2 years
Cohorts	No	No	Yes	No
Business Model	Rent; non-profit	Investment	Investment; Can also be non-profit	Investment; Can also be non-profit
Selection	Non-competitive	Competitive, ongoing	Competitive, cyclical	Competitive, ongoing
Venture Stage	Early or Late	Early	Early	Early
Education	Ad hoc, human resources, legal	None	Seminars	Various incubator and accelerator practices
Mentorship	Minimal, tactical	As needed, by investor	Intense, by self and others	Staff expert support, some mentoring
Venture Location	On-site	Off-site	On-site	On-site

Figure 1: Early-Stage Organizations Key Differences

2.2. Clean-Technologies Acceleration

Malek, Maine, & McCarthy (2013) by case benchmarking analysis create a typology for clean-energy commercialization accelerators (CECA). The study takes into account the accelerator capabilities dimensions (strategy, governance, business model, operations and finance) as well as performance measures (number of ventures and impact on community). Looking at these dimensions the study identifies four types of CECAs capabilities: R&D Focused, Technology Enabled, Market Enabled, and Network

Enabled.[5] In addition the study concludes the applicable performance measures to be: financial returns; quality and speed of project development and execution; overall impact on communities and relevant industry sector; exit rates[6] and ability to attract foreign capital. This metrics should be looked at in a pragmatic matter as for example younger programs may experience low exit rates, so there needs to be a link between the acceleration typology and its performance measures.

Since accelerators are a rather recent business model, the literature on the subject matter is not very extensive. Most of the literature has been focused on defining boundaries for the concept of accelerator as well as identifying the differentiating variables between the existing alternatives. As accelerators have been around for 12 years, recent studies have focused also on the performance and efficacy analysis of this venture development model. A literature gap is observed in what regards the understanding of emerging models that depart from the common software-based approach that seems to characterize most accelerators. An example is of clean-technologies acceleration. Clean-Tech is associated with deep-innovation with high degree of technology intensity, usually connected to hardware and long development timelines. This means typical acceleration models are not fit for this type of ventures resulting in the recent birth of vertical accelerators directed at the development of clean-technologies.

The present work project intends to deepen the knowledge on this new types of models by comparing Portuguese clean-tech accelerators with successful international clean-tech accelerators and understanding the key differences. Finally it intends to respond to the question of whether or not Portuguese accelerators are responding to the start-ups needs.

[5] See Appendix V, Figure 5 for description of the types of CECAs

[6] Exit Rates are defined as the total historical number of client exits in proportion to the total historical number of hosted client ventures.

3. Methodology

In order to study the existing models of acceleration in the international landscape a sample of 105 accelerators was selected from screening platforms such as AngelList, CrunchBase and F6S. This sample was withdrawn using keywords such as cleantech, startups, accelerator(s) and incubator(s). After this selection, the sample was then analyzed and filtered for fit in two different stages.

- Filtering Stage 1: Elimination of programs not directed at clean-tech ventures. Accelerators such as Y Combinator can take applications from clean-tech but are not directed at them. These would therefore be eliminated in this filtering stage.
- Filtering Stage 2: After analyzing the 44 accelerators based on differentiating variables depicted from literature[7], 9 where then selected based on information availability and KPI strength. The information was collected from screening the accelerators websites, social media as well as articles.

After the determination of the final sample, primary data interviews where then conducted in order to validate the retrieved data and ensure study reliability.

In the Portuguese landscape this was done by face-to-face interviews while in the case of the international accelerators, it was done by e-communication, via e-mail.

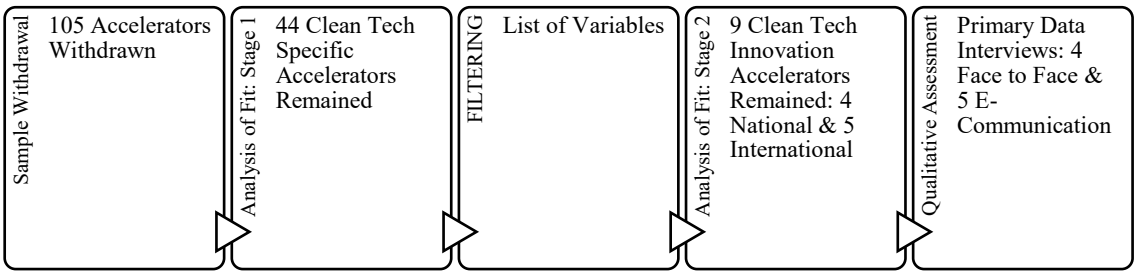

Figure 2: Methodology Scheme

[7] See Appendix V, Figure 6 for list of variables analyzed

The following table summarizes the accelerators being analyzed in the study:

Name	Birth Year	Geography	Location
Building Global Innovators (BGI)	2010	Europe	Portugal
CohiTEC	2010	Europe	Portugal
KIC InnoEnergy	2014	Europe	Portugal/Spain
Climate KIC	2016	Europe	Portugal
Elemental Excelerator	2013	United States	California
Accelerace CleanTech	2008	Europe	Denmark
CleanTech Open	2005	United States	California; Runs 8 regional programs across all 50 states.
Cyclotron Road	2015	United States	California
PowerHouse Accelerator	2013	United States	California

Figure 3: List of Studied Accelerators

Furthermore, the semi-structured interviews served to understand and depict key challenges faced by clean-tech ventures that condition their growth in the Portuguese ecosystem. This allowed an understanding of the start-ups needs as well as main differences between the acceleration models in Portugal. In addition to the studied Portuguese accelerators, further interviews were conducted to deep-tech incubator Tec Labs and to the big utility corporate EDP Innovation Branch. The interview guide as well as transcribed interviews can be found in Appendix 1 of the Work Project. The following table summarizes the semi-structured interviews done:

Organization	Name	Position	Type of Organization	Type of Clean Tech
Tec Labs	Bruno Amaro	Innovation Center Coordinator	Incubator	Clean Tech
EDP Innovation	António Vidigal	CEO	Corporate Accelerator	Clean Energy
BGI & Climate KIC	Teresa Fernandes	Head of Marketing and Communications	Innovation Accelerator	Smart Cities & Industrial 4.0 Solutions
CohiTEC	Marisa Loureiro	Communication and Operations Manager	Innovation Accelerator	Industrial Sciences
KIC InnoEnergy	Renato Braz	Business Creation Manager for Portugal	European Accelerator	Clean Energy

Figure 4: Semi-Structured Interviews of Portuguese Landscape

4. Data Analysis

The first chapter of the data analysis will be focused on the analysis of the conducted semi-structured interviews to the Portuguese industry experts. This chapter will have as main objective the understanding of the main challenges faced by the clean-tech startups in Portugal. The second chapter will be focused on the analysis of the sample of selected accelerators and their fit with the challenges depicted.

4.1. Interviews Analysis- Clean Tech Challenges

Early Stage Challenges- In a very early stage, one of the obstacules identified is passing the technology developed in the research centers to a practical and functional prototype. As pointed by one of the interviewees "A difficulty is to pass from investigation to a prototype. And this implies not only the technological part but also the part of looking at the market. (…) the discoveries are a small part of a product. To pass from a method that you can sell but the value is residual, to a product. So there is a lot to do besides the science part." Furthermore, the fact that the technologies can have multiple applications in completely different markets means startups need an extensive market knowledge in order to understand what can be the best fit. "Since these are platform techs, (...) that can have many applications, most times the technologies can have applications in completely different sectors." Chosing the correct application is paramount in the success of the deployment of the technology and a crucial part of the early-stage acceleration program of the Portuguese pre-seed accelerator CohiTEC "what we do here is to explore the different aplications to reach the one that makes more sense."

Market Validation- After understanding the best possible applications, startups pass towards the stage of market validation/pivot. In this stage the obstacules are to attaine clients to performe the proof of concept as well as funding opportunities. In this stage, cultural features such as the market risk aversion as well as slow decision processes make

the validation stage more complex. “The main issue is that, in this industry in particular, the clients are very risk averse and they are extremely afraid of trying something that hasn’t been very tested and not completely validated. (…) So the whole process of convincing them takes a lot of time. (…) The risk perception and the decision making process passes through , I don’t know how many people, and all of them don’t want to risk their neck for something that has no proven record, that’s the reality.”

Furthermore, the heavy hardware component of clean-tech makes iteration more costly as well as complex, with implied longer development timelines “each time I want to do an iteration, takes longer, costs more money. The prototype itself or the first units are more expensive, so I can’t, I mean it’s harder to offer the client a “try and buy” than in a software (…) To install a fancy transformer or monitoring system, an aerogenerator, it’s complex, hard systems to install and expensive. So it’s harder to use this client acquisition strategies, so it implies that my investors also have more availability to finance this kind of amusements”. This leads to a funding challenge in this particular stage as there is still technological risk, and financing is harder due to that matter - what is called the technological valley of death.[8]. “(…) a time that science doesn’t finance, because it is no longer a scientifical project, it is already applied. But companies don’t like to finance as well because there is still a lot of risk.”

Furthermore, the specificity of the start-ups requires specialized capital which is harder to find especially in the Portuguese Ecosystem. “ (…) there is a lot of financing now in Portugal, a lot is going to ICT what makes it harder to get financing in this early stages and in industrial technologies (…) there is a smaller number of investors that invest in this technologies. Not only because it is riskier but because it is something more

[8] See Appendix V, Figure 2 for Valleys of Death Description

technological they are a bit more afraid. It is harder to understand the project and because they don't understand they prefer not to invest." Due to this, companies direct themselves towards foreign capital, but the fact that clean-tech needs local adaptation focus may limit this type of investment. "Even though there are some foreign investors, because this is something very based on people and in localization, it makes it harder to get financing than in ICT also because the ecosystem is different. It is less dynamic."

Given this and considering the financing challenge in clean-tech, the interviewees identify that clean-tech is an area that has been receiving a lot of governmental support especially from EU initiatives. Still the money is associated with a lot of covenants and burocracy, which doesn't facilitate the funding process for start-ups "(…) in terms of incentives, with investigation scholarships and so on clean-tech is receiving a higher support especially after a Paris Agreement, so there is a lot of pressure for the government to look good in the picture. (…) In Europe, we have a lot of money being directed towards this low carbon initiatives, from the government. (…). But from this money there is a lot of bureaucracy (…) this could be facilitated."

Specific Knowledge Teams- All interviewers pointed out the importance of the team in the success of the startups. Due to the complexity of the technologies connected with clean-tech, the start-ups' teams background tends to be very specific. Given this, all interviewees pointed out the lack of business background in the teams as a pitfall which transfers in weak sales competency by the teams which tend to focus on the technology and not on its practical value proposition "(…) there is a very big difficulty in management , and management can be anything, including sales (…) because the sale is focused in the value proposition and the scientist is focused on the technology, which the other side can't understand sometimes." On the other hand, managers need to understand how to handle this type of deep-tech businesses to be an added value in the team "(…)

the mentality of a CEO of this type of company has to be much different. It has to be able to talk with investigators, to pass from the science language to the investors language, to be able to handle this regulatory barriers."

The Portuguese Ecosystem - Due to the size of the Portuguese market as well as the specificity of this technologies, portuguese startups need an immediate global outlook. "(…) Portugal would always be a small market. (…) But still, we have technologies and products that are so specific that in Portugal you don't have exactly clients for them." Despite this fact most startups do their pilot in Portugal. "The standard is to look immediately to the global market.(…). Despite of, in fact, in reality it is easier to start with regional pilots. Start with clients close by that give us feedback so we can do alterations in the product. It's more comfortable, and cheaper."

Regulatory Component- Even though clean-tech is not demarked by heavy regulamentation, feature that could be attributed to biotech, this is still an aspect not verified in the ICT case and that shouldn't be forsaken. "The areas are very regulated. Even in clean-tech, there is regulation, even though not as strong. In terms of the security and certification of the products, that also takes some time (…) There are regulatory issues and of scale that are important to take into account, that may not exist in other areas. And sometimes it is not black and white (…) you need to speak with the regulatory institutions to discover which tests are necessary to do and then customize them. And to negotiate with them which complexifies this."

Other Remarks from the Analysis- Although the study focuses on acceleration of clean-tech innovation, a problem at the source of this innovation was also identified during the research. When observing the portuguese ecosystem, current research is still very directed towards life sciences/ biotech innovation, given that this still constitutes the majority of technology-based startups accelerated. One interviewee pointed out "People more

connected with engineering had more ease in finding jobs. So they turned less towards investigation (…) if you look at the life sciences labs, they are more. So there is already this problem in the input which is that the science that comes from the areas of cleantech versus the science that comes from the areas of life sciences." This indicates that, in the first place, greater incentive towards the creation of clean-tech innovation is needed in the ecosystem. [9]

4.2. Acceleration Models Evaluation

4.2.1. Sample Accelerator Taxonomy

In order to compare the different acceleration models inside the sample, the analysis starts by categorizing the accelerator sample. Assuming Hathaway (2016) definition of accelerator, the study creates the first category: accelerators. A second category is then defined as long accelerators that differentiate by longer durations. Inside this category, a differentiation is done in terms of target stage between pre-seed and seed. Accelerators that don't fall on any of these categories are described as outliers and are analyzed individually. Given this and organizing the sample of accelerators into a taxonomy assuming the above described characteristics:

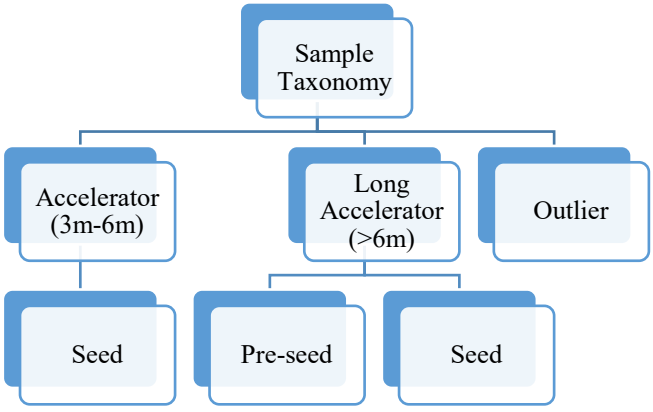

Figure 5: Categorization of Accelerator Sample

[9] See Appendix V, Figure 7 for summary of main conclusions from the interview analysis on clean-tech challenges

Types of Clean Tech Enablers in Sample	Structure Dimensions
Accelerator - Climate KIC - Accelerace - Clean-Tech Open - PowerHouse Accelerator (Hathaway, 2016)	Duration: 3 to 6 months Cohorts: Yes Investment: Yes Venture Stage: Seed
Long Accelerator - Cyclotron Road Accelerator (pre-seed) - Building Global Innovators (seed) - Elemental Excelerator (seed)	Duration: 9 to 24 months Cohorts: Yes Investment: Yes or No Venture Stage: Seed or Pre-Seed
Outlier Accelerator - CohiTEC - KIC InnoEnergy	May vary in all dimensions

Figure 6: Types of Accelerators and Structure Dimensions

4.2.2. Analysis of Fit between Challenges and Value Proposition

When combining the clean-tech challenges identified in the first chapter of analysis with the existing value propositions of the studied accelerators:

Clean-Tech Start-Up Challenges	Value Proposition by Clean Tech Accelerator
From Technology to Prototype	Access to Research Facilities and Expertise
Choosing Target Market	Intensive 1:1 Mentorship with Industry Specific Mentors
Getting Clients for Proof of Concept	Technology Testing with Corporate Partners
Funding Challenge	Connection to Public Organizations including European Institutions; Demo Day; Networking Opportunities; Cash; Accelerator Internal Fund (Follow-On)
Lack of Business Oriented Backgrounds in Teams	Personal business training, mentoring, learning labs and workshops
Regulatory Aspect	Legal & Advisory Services; Connection with Public Organizations
Global Outlook with Local Adaptation	Global Partners; Connection with Target Markets; Soft-Landing Services

Figure 7: Start-Up Challenges and Value Proposition by Accelerator

4.2.3. Analysis of Accelerator Models

For each defined category of accelerator the study evaluates the degree of fit between the determined start-up challenges and the accelerators value proposition. Furthermore, the concept of distance is introduced to understand the state of the Portuguese Accelerators when comparing with the studied international best case practices. The following tables rank the accelerators in terms of fit with the identified challenges. The ranking divides fit into low, medium and high. If the accelerator doesn't approach the challenge then it is indicated as Non Applicable (N/A). The levels of fit where attributed according to Figure 6 in this work project. The current categorization refers to levels of approach to the challenges and not quality of approach, so it should be looked at with pragmatism. The variable "*Investment Captured per startup*" post acceleration program is introduced as a key performance indicator of the level of quality in addressing the start-ups funding challenge.[10]

Challenges	**Accelerace Cleantech**	**CleanTech Open**	**PowerHouse Accelerator**	**ClimateKIC Accelerator**	**Distance**
From Tech to Prototype	N/A	N/A	High	N/A	N/A
Target Market	High	High	High	High	Low
Proof of Concept	High	Low	Low	Low	Medium-Low
Funding	High	High	Medium	Medium	Medium
KPI: Investment Cap. per startup	$906K	$1.1M	$362K	$447K	Medium-High
Business Background	High	High	High	High	Low
Regulation	Medium	Medium	High	Medium	Medium-Low
Local Adaptation	Medium	High	Low	Medium	Low

*Figure 8: Start-Up Challenges and **Accelerators** Fit*

[10] Ranking Description: Low – Indirect Approach to Challenge; Medium- Direct Approach but doesn't touch all points; High- Direct Approach Touching all points; Points are described in Figure 6 of the present study. The full description of the KPIs calculated as well as complete analysis of fit can be found in Appendix IV of this Work Project.

Challenges	Cyclotron Road	Elemental Excelerator	Building Global Innovators	Distance
From Tech to Prototype	High	N/A	N/A	N/A
Target Market	High	High	High	Low
Proof of Concept	Low	High	Low	Medium
Funding	Medium	High	Medium	Medium-Low
KPI: Investment Capt. per startup	$2.5M	$6.6M	$1.9M	High
Business Background	High	High	High	Low
Regulation	Medium	Medium	Medium	Low
Local Adaptation	Low	Medium	Medium	Low

*Figure 9: Start-Up Challenges and **Long Accelerators** Fit*

4.2.3.3 Outlier Accelerator Assessment- CohiTEC & KIC InnoEnergy

CohiTEC is the only Portuguese pre-seed accelerator being evaluated in the study. Their unique university focus, lack of investment, as well as goals that go beyond start-up creation, characterize CohiTEC Program as an outlier in the studied sample.

KIC InnoEnergy sets itself apart from the analyzed sample as it doesn't run a structured acceleration program, working with an ad-hoc approach providing instead a set of "business creation services" for startups with a goal of fostering commercialization. [11]

	Tech to Prototype	Target Market	Proof of Concept	Funding	Business Background	Regul.	Local Adapt.
CohiTEC	Medium	High	Low	Medium	High	Medium	Low
KIC InnoEn.	N/A	High	Low	Medium	High	High	Medium

*Figure 10: Start-Up Challenges and **Outliers** Fit*

[11] See Appendix IV for full description of Portuguese Clean Tech Accelerators Analyzed

5. Main Findings

5.1. Remarks on Challenges Fit

In all categories described above, the Portuguese Accelerators are more *distant* than the international best case practices in what concerns addressing the challenges of: proof of concept, funding and regulatory advisory. Furthermore they do not address the start-ups challenge of transferring technology into a functioning prototype.

In what concerns the later, programs such as CohiTEC are focused in concept stage but only address this challenge through provision of expertise and mentorship. Programs such as Cyclotron Road score high in this perspective as in addition to expertise they offer very early stage funding as well as access to research facilities in a 2 year time-fixed fellowship. Powerhouse Accelerator is also an example as it runs an incubator in parallel to its accelerator.

In what regards the regulatory aspect as well as need of local adaptation, the EIT Programs based in Portugal seem to address this issues, as they are part of an extensive network of organizations and have close connection with public organizations. Still, this network is only a unique value added when the start-ups target markets are within the European Ecosystem.

Proof of concept is something that is scored overall low for Portuguese accelerators as they don't offer technology testing projects with corporates. The challenge is indirectly approached through networking opportunities and partnerships. Accelerators such as Accelerace and Elemental Excelerator are good benchmarks for the approach to this challenge.

Lastly, the funding challenge, when comparing the defined KPI of investment captured per venture post acceleration, Portuguese accelerators are still distant from numbers

verified in the international landscape, though the international sample is geographically biased towards the US funding ecosystem. When comparing Portuguese accelerators such as BGI with European options as for example the Danish Accelerace, the Portuguese BGI scores much higher ($1,9M vs $909K). This settles Portuguese clean-tech accelerators are competitive in what regards the European Ecosystem but not as much when comparing with US alternatives.

Furthermore, the study concludes long accelerators seem to be performing better in addressing the start-ups funding challenge with much higher levels of investment captured per start-up accelerated. Given this, the study's results indicate that longer acceleration timelines could be connected with higher levels of capital raised in clean-tech firms post acceleration.

5.2. Remarks on Accelerator Structure

International solutions are characterized by more specific focus (industry based focus) as Portuguese Initiatives have more general focuses. Furthermore, international solutions comprise more stages of development as acceleration in Portugal is still much focused on the seed/commercialization stage. Examples are PowerHouse Accelerator having both an incubator and an accelerator and Cyclotron Road focus completely on prototype phase with adequate funding focused on helping start-ups surpass the technological valley of death.

Furthermore, the international landscape of clean-tech acceleration programs seem to be exploring more diverse sources of revenues which is not verified in the Portuguese case. Internal Funds are a common practice, and almost inexistent in Portugal. Other examples are program fees as well as corporate sponsors. This is tied to the fact almost all Portuguese clean-tech accelerators are derived from public initiatives, non-profit, with

the exception of the very particular case of CohiTEC which is managed by a group of corporations/associates. This also results in bigger investments from the part of international accelerators, given that upfront investment in acceleration is only verified in the forms of European grants by the initiatives Climate KIC and KIC InnoEnergy.

6. Conclusions

Given this, the study concludes current acceleration options are not completely fit to the Portuguese Clean-Tech Innovation Challenges. The challenges identified call for a more industry specific approach, as well as more directed towards the global ecosystem and not only just the European one. Furthermore, successful models such as PowerHouse or Cyclotron Road may indicate that a comprehensive solution would need to cover all clean-tech stages of development. In addition, longer accelerators seem to perform better in addressing the start-ups funding challenge.

A higher level of involvement between corporations and accelerators is required, as the example of the Hawaiian Elemental Excelerator that differentiates through provision of local demonstration projects.

Government involvement is verified in the ecosystem but there is a lack of private initiative. This lack of private initiative could be attributed as one of the key reasons why this programs are not funding this technologies. As accelerators where born in the financing landscape due to their ability to fund by taking higher risks, the creation of a public-private for profit partnership, with the above mentioned characteristics could be a solution to solve lack of financing as well as address a broader range of challenges.

In addition, the study concludes Portuguese Clean-Tech Accelerators are competitive in the European Landscape in what regards addressing the clean-tech funding challenge but are still distant from US based acceleration solutions.

7. Limitations

Limitations can be attributed to the two stages of the research methodology. Firstly, the qualitative approach can present some degree of subjectivity that may affect the validity of the main findings. The fact that the study is built entirely on the perspective of Portuguese accelerators representatives can also bias the results. In what regards the second stage of the analysis, the small sample as well as lack of available information can constitute a limitation. All Portuguese clean-tech accelerators are analyzed but not all models in the international landscape, which can decrease the richness and conclusions of the study. As the international landscape is in majority composed by US initiatives this may not represent completely the European reality, which is something to be taken into account. In addition, the lack of available information and willingness to disclose on the behalf of some of the studied accelerators constitutes a limitation.

8. Future Outlook

The hypothesis tested in this paper is that "current clean-tech acceleration options in Portugal are not fit for the clean-tech innovation challenge". As the study validates the hypothesis, the next reasonable step is to understand which model(s) would be. Using the current paper and studied models as basis, future researchers can investigate deeper the perceived efficacy of the international solutions and how they could be transferable or not to the Portuguese landscape. One example of this would be to test quantitatively the hypothesis that longer accelerators have higher perceived efficacy.

Annex

General Clean-Tech Challenges	Portuguese Ecosystem Characterization
From Technology to Prototype	Cultural Features: Market Risk Aversion, Slow Decision Processes
Choosing Target Market	Lack of Specialized Capital
Getting Clients for Proof of Concept	Need to Focus on External Market but the Technologies need Local Adaptation
Funding- Technological Valley of Death	Governmental Support mainly due to EU Funding Initiatives
Lack of Business Oriented Backgrounds in Teams	Lack of research directed towards development of clean-techs
Regulatory Aspect	

Annex 1: Summary Table- Results of Interview Analysis on Clean-Tech Challenges

Name	BGI	KIC InnoEnergy	Climate KIC	CohiTEC
Stage	Concept & Commercialization	Concept & Commercialization	Commercialization	Concept
Time (months)	9	-	3	6
Avg Equity	3%	5%	0%	0%
Investment	-	50K€ (Grant)	€15K (Grant)	-
Fee	-	-	-	-
Batch Size	15- 20	-	8	
Vertical	Smart Cities & Industrial Tech , Water Economy	Energy Related Technologies	Urban Areas, Land Use, Production Systems, Climate Metrics & finance	Deep-Tech including Clean-Tech
Cohorts	Yes	No	Yes	Yes
Governanc	NP Public Org.	NP Public Org.	NP Public Org.	NP Private
Revenue	Public Funding	Public Funding	Public Funding	Associates Model, Fund
Selection	Competitive	Competitive	Competitive	Competitive

Annex 2: Sample of Clean-Tech Accelerators Description (Portuguese Landscape)

Annex 3: Sample of Clean-Tech Accelerators Description (International Landscape)

Name	Power House Accelerator	Cyclotron Road	Clean Tech Open	Accelerace Clean Tech Accelerator	Elemental Excelerator
Stage	Concept & Commercialization	Concept	Concept & Commercialization	Commercialization	Commercialization and Scaling
Duration (months)	6	24	5-6	6	12-18
Avg Equity	5%	0%	0%	0%	4%
Investment	$ 10K	$500K	$	$	Up to $1M
Fee	0	0	$1,200.00	0	$3000-5000
Batch Size	3.25	6	100-150	-	12-15
Vertical	Solar Software (storage, integration and uptake)	Advanced materials or manufacturing related energy technology	Energy ,Chemicals, Advanced Materials, ICT, Green Building and Materials Transportation Agriculture, Water, and Waste	All Clean-Tech	Energy, Water, Agriculture, Transportation and Cybersecurity
Cohorts	Yes	Yes	Yes	Yes	Yes
Governance	FP Private	NP PPP	NP Private	FP Private	PPP (NP & FP)
Revenue	Grants, Corporate sponsors & Rental Fees	Public Funding	Sponsors & Fee	Fund (65M)	Fund
Selection	Competitive	Competitive	Competitive	Competitive	Competitive

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A Work Project, presented as part of the requirements for the award of a Master of Science Degree in International Management from NOVA School of Business and Economics

Portuguese Clean Tech Acceleration: A Comparative Analysis of Fit

Appendix

Inês de Sousa Ribeiro Rodrigues
Student Number: 2747

A project carried out on the Masters of International Management Program, under the supervision of: Leid Zejnilovic

May 2017

Appendix to Work Project

Appendix I: Interview Guide

General Questions on Interviewee and their activity
This portion focuses on the understanding intrinsic features of the organization

1- Can you talk to be a bit about your accelerator/incubator/company/ONG and what is its main activity?
2- How many start-ups do you support and how many of clean-tech?
3- What is your unique value proposition?
4- What is your relationship with corporates/government?
5- How is the program sustainable?

External Assessment: Portuguese Environment and Conditionings for Start-Ups
This portion focuses on the interviewee assessment of the Portuguese environment and how it affects the startups performance

1- How would you describe the clean- tech industry in Portugal and its evolution across the years?
2- Regarding conditionings, what do you think are the conditionings that the current Portuguese context presents to the introduction of this type of technologies?
3- Regarding the European and global context of the clean-tech industry, how do you see Portugal's positioning?

Internal Assessment: Conditionings for Start-Up Survival and Growth
This portion focuses on the challenges faced by startups during its journey and how the organization helps in this aspect

4- How would you describe the typical journey of a clean-tech start-up from the moment the idea is born till it's introduced in the market and what are the main obstacles faced in this journey?
5- Regarding obstacles that start-ups face, what do you think is the main difference between launching a "normal" technology and launching a clean-technology?
6- What are the type of competencies needed to survive in the marketplace and how does your program help in this aspect?

Appendix II: Interview Transcripts

Renato Braz: Business Creation Manager at KIC InnoEnergy

I: When was this accelerator born, what does it do and where does it act geographically?

RB: We started in 2013 in different offices in Europe. The headquarters are in Holland but we also have offices in France, Germany, Poland, Sweden, Spain and in Portugal. Here in Portugal we only began with the business creation activities, there is acceleration, with more exclusivity in 2014.

I: What kind of start-ups do you support and in which development stage?

RB: We search for start-ups exclusively of clean-tech, related to energy. We search for start-ups that bring something innovative for the market. We don't want a start-up that brings something that already exists, that is a different approach to something that already exists.

In terms of maturity it can be in a phase of pre-revenues and if it is developing a technology we pretend it to be at least TRLC6. I don't know if you are familiar with the scale? [No, but...]. It's a scale that measures the development of the technology since the investigation till it reaches the market. It was initially used by NASA and it is now commonly used when talking about technological development.

We want them to have has estimated time to reach the market inferior to two years. And obviously that it has growth and expansion potential. We want to help bring innovation to the market and stimulate entrepreneurship but we are not Santa Casa*, so we need this investments to have really good growth perspectives.

I: You accompany the start-ups till they launch?

RB: Meanwhile we become shareholders of this companies and we stay with them till it's convenient to leave. We don't have a mandate, we are not a structured fund in the sense that we need to leave in five years for return. We leave when it is more strategic to do so. Or when one of the original partners wants to buy, or when an external entity invests and needs to buy shares and we can decide to leave or accompany.

We don't have a mandate for exiting after a certain amount of time. In that aspect, it's another liberty.

I: What types of services do you offer start-ups?

RB: We have two pitches. One we think it's the main one, but in reality the one that captures more the attention of the entrepreneurs is the other one.

What we believe is the main one is all our potential of networking, in a European level and in this specific industry, because we have as our shareholders some of the main players of the sector. So we can easily create connections, put the start-ups in contact with the right people, because those people can be their main clients and that's the main point for a start-up to be able to endure and grow, to have clients that pay.

So all of this part of the services we have to help them reach the market, whether it is training or networking events with potential clients, I think is essential because it really makes a difference.

We have other services as well, of soft-landing in markets that they may identify as appealing. Imagine, a Portuguese start-up identifies as the most appealing market the German market. We have offices in Germany and a team there that can help.

When the start-up arrives there it was a desk, an address, people that know the local ecosystem and that will put them in contact with the right people, whether they are clients or support services. I am talking about from the accountant to the rest. All of this helps in fact that if they want to expand it is more efficient, in terms of time and resources and that they can reach it faster.

This is the component we say is intangible, and that we want it to be more and more perceived in the market as the KIC InnoEnergy brand is also becoming more known, as the main value proposition.

Then we have the other component, completely tangible, more financial, which is the seed capital investment we make in this companies in exchange of a stake in their capital, which is usually what grabs more the attention of the entrepreneur.

All of them say they don't want just money, they want smart money. But in reality firstly they just want money. Then if it is smart or not, we'll see. And if it is great but what they want firstly is money and in fact, I think when they start working with us it is always a bit on that perspective "cool, you guys are in the sector and maybe can help but what we really want is the money". If you go and interview now, some people that are with us for a year or two, I think you will be able to see that they already know how to point out that in fact – and I think it would be an interesting exercise, to hear the other side- they already know how to point out in fact there were here several moments in which we intervene that were critical.

Whether it is finding a specialist from a Portuguese start-up which is developing a very specific area and that they weren't being able to find in all of their network, including their investors. Since it was something energy related, we went to our network and found the person which was the perfect fit and that is giving us right now a super valuable feedback. Of course this person has costs but the value is far superior to the costs. In fact, having found in our network this person, for them has a value that is perhaps half of our total tangible investment.

So this little things are the ones I consider to be very interesting and I hope they are more and more valued and perceived.

I: What differentiates this accelerator from others in the market that also focus on clean energy?

RB: Firstly we don't have an acceleration program. There are many that have structured programs. We don't have a structured acceleration program. There is no intake in February and then meeting till April, and then meetings with investors. We don't have that.

We have a set of tools that are in our disposal. We are always evaluating, always considering projects. We have evaluated over 1500 since we started. And when we decide to support a project, we make an analysis and see what it really needs.

We are not there stuffing the project with things it doesn't need. In a more structured acceleration program they all have to pass through those specific stages.

We see what they need and help them in what is in fact their weaknesses and their needs to evolve. So not everyone is getting the same training or the same international accompaniment. It is more tailor-made. And then the fact we are specialized in a sector, completely focused, but there are others of clean tech indeed.

I: Now moving on to the industry. How would you describe the clean- tech industry in Portugal and its evolution across the years?

RB: My perception is that all of this reality, of having entrepreneurs wanting to develop projects in this areas is quite recent. Obviously, there were always entrepreneurs, now more since it's the trendy topic, but in reality most people that had an entrepreneurial drive and capacity to develop an idea, I think in this area, and particularly this area embarked on the big companies that exist and tried as much as possible to do that job there.

Or they stayed in the universities, or they worked together with companies in punctual collaborations.

I think this phenomena of a person with specific knowledge and entrepreneurial drive to do their own company and want to work more autonomously with the eyes more on the global market is something that is quite recent.

Also because, everything else, in terms of support systems one needs to make this happen, didn't exist and starts to exist nowadays. Nowadays we have a net of incubators, people willing to help, a financing system that is beginning to be more or less aligned, specialized lawyers that know what they are talking about, a great international connection. So there is a big focus on … we are developing something but if I need a patent lawyer in Holland, I go there and there is no problem in this. If I need to go to Poland for a meeting, I go because that's what needs to be done. And all of this is a pretty recent phenomena and I think a very positive one.

I: Regarding conditionings, what do you think are the conditionings that the current Portuguese context presents to the introduction of this type of technologies?

RB: I have a postal example. Last week, here in this office, there was a meeting with a start-up that we are thinking about investing or that we are very interested in investing, and with a German investor, also interested in investing in this start-up.

This German investor started telling the story, of how he met this start-up and that LIR had just arrived to the company- a huge fund- and that their colleagues immediately refused to look at the project because they saw it was Portuguese.

This was now in August, August of 2016, "Portuguese we are not interested". And he, because he had worked on that area in his previous professional life, said "wait a minute, this actually makes some sense, this is interesting let me look at it", like I am grabbing the newspaper but instead "no, let me look at this. This makes sense, this guys seem to have here a good idea."

And he investigated it deeper, and sent an email and arranged a skype. And then he came here, met the whole team and was impressed, met the investors. And this convinced him so he pushed the rest of his team to invest in this Portuguese start-up.

But how many cases do exist in which they say "oh it's Portuguese, let's not even look at it" and they get left behind.

I: Why do you think this happens?

RB: The tendency is to happen less and less, I think. I hope cases like this, and there are others for sure throughout the years, help change a little bit the perception.

I think it is a question also that, much of the industry capital is in the center of Europe and looking at the center of Europe which also makes them think "oh now if I go to

Portugal, it's a regulatory system I don't know and I have the idea that the with the legal system there everything takes 500 years, and they also speak a weird language, and they're from the south of Europe, disorganized".

So there is this cultural aspect and in fact, of comfort. Let's stay here in what we know and in what is working. And when they now the reality, of course we have our weaknesses but we also have our strengths. And when they know us they see we are capable of competing with the others.

In my job at KIC, I deal with start-ups from all over Europe and I have colleagues of mine all over Europe and events several times a year and I am always very proud of the performance of the Portuguese start-ups because in fact they are as good or even better.

There is no difference whatsoever. None, none, none.. And well, I am talking about a fraction of the population which is highly specialized, highly educated people that were abroad most of the times… that had experiences. We are not talking about, perhaps, the average Portuguese.

From my understanding, at least in what regards the people that found this start-ups and that have this drive, the level is perfectly competitive.

With the difference that, there is a capability to stretch that maybe in other countries that have more resources don't. When they need 500 thousand to do to something and if they don't, they don't do it. The Portuguese has 250, and stretches those 250 till he does what needs to be done.

Sometimes this is bad but most of the times I think is quite good. We have to do the things with the tools we have and we are very used to doing so, so for us it is quite natural.

I: How many companies here, when they launch their technology in the market, launch it immediately abroad?

RB: Well I don't have numbers here (no need for numbers, just a broad overview, if its common or not)- The standard is to look immediately to the global market. In fact, we don't even consider investing in a start-up that has a very local focus. Despite of, in fact, in reality it is easier to start with regional pilots. Start with clients close by that give us feedback so we can do alterations in the product. It's much comfortable, and cheaper.

But a lot of times, it doesn't work like this. Sometimes the client that is more, low hanging fruit, is not here and they go abroad with no problem whatsoever. But yes, it is easier, even though the focus is global, to start around here.

I: Regarding the European and global context of the clean-tech industry, how do you see Portugal's positioning?

RB: Well, there are in fact a lot of industries that touch the definition of clean-tech. Here in Portugal we are an extremely tiny market, so we can't have the ambition to touch all instruments.

Of course, there have emerged some stuff regarding renewables and the wave energy which unfortunately hasn't been able to take off. We focused a lot on that, a lot of investigation effort in a technology that hasn't been able to prove itself and we don't know if it ever will. But we have been involved in other technologies as well and with quite interesting results.

But to be honest, I don't think there is a cluster in which we stand out.

While perhaps in Poland there is a strong coal cluster, what they call clean-coal.. it's a very dirty industry but with technology it can become less bad. So, there is a group of technologies that help that the gases emitted by the chemines are a little bit less bad and that the efficiency is higher, the burning is better. All of this is in fact a technology that is being used, makes sense and they are very strong at that.

As in for example France is strong in nuclear… Here in the Iberian Peninsula, having to choose one, I would have to say maybe renewables. But it is not an Olympic distinction.

I: Let's move on now to more specific questions regarding start-ups. How would you describe the typical journey of a clean-tech start-up from the moment the idea is born till it's introduced in the market and what are the main obstacles faced in this journey?

RB: The typical journey is to develop the technology, test on a client, obtain feedback, adjust the technology, test on another client, obtain feedback and if it's okay start expanding.

The main issue is that, in this industry in particular, the clients are very risk averse and they are extremely afraid of trying something that hasn't been very tested and not completely validated.

So the whole process of convincing them "let's try on an isolated case, as little as possible so the impact is small in case things go bad" and when that actually happens, lets identify the case… So the whole process takes a lot of time.

To convince a company to try a technological innovation even if the value proposition is quite solid, takes a lot of time. So the risk perception and the decision making process passes through I don't know how many people and all of them don't want to risk their neck for something that has no proven record, that's the reality.

So things end up happening but they take a lot of time. And the problem of start-ups is to have first stamina, which is the entrepreneur has to have the capacity to deal with all of this time of uncertainty and great personal frugality, also because it has resources for nothing, in the view of some day along the line eventually get something.
So this stamina from the person, the money the company has, the good will and money from the investors, all of this is going to be eroded throughout time, and it takes sometimes years till you can actually get a client to try the product.
And then the testing periods aren't two weeks, they try for 6 months or one year and in a very small place that is not giving any money.. And then invariably because these are new technologies adjustments must be made so sometimes things go okay but sometimes they go badly as well, and it's needed that the client continues to believe. " I believe this makes sense, and in fact that this blemish will be corrected and that next time it will be better"
So there is a group of good wills that have to align so that a project that started here becomes a sustainable and viable company 3 years ahead.
Also there is another problem, and this one is very regional. We are not very direct. I think we have difficulty in saying a very big no, and if the answer is yes to say "yes, let's go", and sometimes the start-ups stay rolled up in meetings with potential clients.
They pass from one person to the other and from the other to the other and no one decides. I am here working and the guy from the start up "so did you make a decision" and because I haven't I make another question "oh but what about the tension of the whatever, what is going to happen?" and then I send the question. The person is going to be one month or two weeks building an argument to reply to the question and then it replies. This was for the guy to buy some time… he didn't need to know that.
We try to avoid confrontation a lot, we don't want to say no, above all when… we have a 6 month relationship now, and how will I say no when I have demonstrated so much interest.
This is real, this is real and it's bad. And this is not only with clients, it happens with investors as well. There is a lot of people that complains about this.
And they ask information and information, order meetings and a lot of time is wasted. Now you are speaking with this one, now speak to that one, now more information, now review the business plan, now whatever,.. And in the end of 6 months without saying a word, "no".
If you knew it was a no six months ago then why didn't you say so before? Or if you had a not so sure feeling about it… And I have the idea, from my conversations with my

colleagues that there are other cultures in which people are more direct and say, “look this is interesting but for us not so much because of A, B or C”. Things are faster, we lose a lot of time…

I: Would you say convincing a client to buy is trickier than to get investment?

RB: Getting investment is more complicated than convincing a client to buy. Because with a client we can always use strategies like the pilot strategy or try and buy strategies. They try without spending anything and if certain goals are reached then they buy it, so it eliminates a bit the risk. I am only going to spend money if in fact this accomplishes what it promises to.

So there are a lot of strategies to put your foot on the client. It takes time for sure, but I think it terms of difficulty or probabilities, it’s harder to get investment.

I: Regarding obstacles that start-ups face, what do you think is the main difference between launching a “normal” technology and launching a clean-technology?

RB: I think that, typically, and not always obviously, the technology associated with energy and clean tech is more associated to hardware.

Of course there is also a lot with software we can do and that can be called clean-tech so there the same rules are applied than I the case of any other software start-up. So all of the journey in changing the project, all iterations are cheaper, faster and there is a higher growth potential because it’s a product that is not physical, easier to export, to grow and to sell more.

But the typical example of a clean tech company is associated to hardware and most of the times heavy hardware, and there is increased difficulty exactly because of that.

To be associated to heavy hardware in which each time I want to do an iteration, takes longer, costs more money. The prototype itself or the first units are more expensive, so I can’t, I mean it’s harder to offer the client a “try and buy” than in a software where I say “ try for a month. For me it doesn’t cost a thing because its already developed, if you like it you like it, if you don’t, you don’t”. To install a fancy transformer or a monitoring system, an aero generator.. it’s complex, hard systems to install and expensive. So it’s harder to use this client acquisition strategies, so it implies that my investors also have more availability to finance this kind of, quotation marks, “amusements”.

So I think that, and to answer to your question, it is a little bit harder than in other less heavy industries.

On the other hand, the regulatory aspect that applies to some cases here in clean-tech, is not as heavy has in other industries like for example bio-tech. So despite all, I think that there are industries that are even harder.

I: In your opinion what are the main reasons for the failure of a clean-tech start-up?

RB: The reality is that most start-ups that end up making it, are in the marketplace with something significantly different from their original idea. So we can infer from this that to reach the market place, the start-up will have in its journey to go around in circles a lot to find its way.

The ones that fail primary is due to inflexibility and lack of capacity to hear what the market is telling them, and wanting to push their idea to the market when the market doesn't need it.

It's a very thin balance. Firstly because the entrepreneur has to be someone with ideas of his own and strong ones, or else he is not bringing anything new. If I think like everybody else, I am not bringing anything new into the market. I am not able to create, to have an idea that will make a difference.

On the other hand I have to be able to listen to what I am being told and to be able to adjust. I can't listen to everything and adjust everything or else I won't be doing anything in specific but I do have to listen to something.

So this balance between listening to the right things and adjusting but at the same time to have the will and determination to take my own idea forward is very hard to get.

There is only a few people that can maintain this equilibrium and I think that is the main difference. It's about the people's profile, the ability they have to manage this equilibrium and the stamina and determination because things are going to take time.

There is a lot of people that gets tired in the way. Others are more determined, between parentheses, stubborn, and keep pushing something into the market that the market doesn't want. Others let themselves to be influenced by everybody so they can't have a strategy and can't have something that actually makes sense.

And then there are a few that manage to be in the middle of all of this and to hit this balance so I think this is the main subject. It's the people, the team, that obviously needs to have some specific technical or market knowledge, or something that makes them bring something new into the market that's evident. But to have that is not a guarantee that it will be okay and that they will be able to develop the company.

Then there is also the luck factor. To meet the right people at the right time, I mean there is a very big luck element. But we can't do anything about that.

I: When you analyze the projects, you also analyze the team, its competences.

RB: About 1/3 of our efforts go to analyzing the team and its 1/3 of the efforts but it doesn't mean it is 1/3 of the importance because usually it is much more than 1/3 of the importance.

An entrepreneur can come here to do a very interesting pitch- unless it is something extremely meteoric in which I say "screw it, even if we toss this guy aside and get another"- but unless it's something completely spectacular it is essential that the team convinces us. And the contrary as well.

We have invested in projects in which the idea didn't convince us much but we were totally conviced by the team and we think "let's invest in this guys, this is not quite "it" yet but they will get there".

I: What traits do you think are relevant in the team?

RB: Complementarity, coachability. The balance we were talking about before between being determined and having their own ideas but not stubborn.

To listen, incorporate in the thought process what people are saying, what matters. This capacity, I don't know what to call it, the capacity to listen and incorporate that into what it their own ideas, adjusting the ideas but not completely discarding them.

And stamina, a lot of stamina. There are a lot of ups and downs, more downs than ups. The downs are very down, I am working at McKinsey or my girlfriend is upsetting me or I have a baby on the way and I am here losing my time in this and the probability of succeeding is very low and it's a lot of work and there are much easier paths. So the capability of fighting this kind of thoughts and to maintain your vision and your way is essential, and fortunately in that we have been very lucky because we have people here that are completely exceptional and that give everything for the projects.

I: Regarding the growth of this type of companies, what metrics do you use to track the start-ups performance?

RB: Sales. We have a lot of metrics: patents, number of people, investment captured.. But the essential is sales, of course. And before starting sales, it's the investment.

I: Moving on to the topic of the network of contacts. What do you believe is its importance in this industry and what are the partnerships/ connections that are more important for this type of start-ups to have.

RB: The most important connection is with the client, or the potential client. It's important that they know better than the palm of their hand who is the person they are purposing to

create something. Something the person will value, and is willing to pay, how much the person is willing to pay so they don't ask too much or too little. So the main connection is with the client, without a doubt.

The best examples of success that I know of, here in our universe, are the projects that were developed intimately with a chosen client. A client that accepted to do this job for various reasons, with the offer of some benefits, but which solution, product, service whatever was developed in proximity to the client, and that's key.

And then having clients and sales everything else comes. If it is a market that is interesting the investors end up…well the person being in the business ends ups meeting investors. They eventually appear.

Everything goes around the market, of knowing the customer and of being an interesting market of course. To know how to choose, I mean sometimes to have the luck, I may even be working in an area and have the misfortune of being a domed area.

For example, wave energy, if it is something that appears here I say "sorry but no". But if someone from a super-hot area, for example with something that allows to extend the lifetime of an aero generator, its already a very hot and vibrant industry, pretty much installed, growing, that is looking forward to increase the lifetime of things that are already in the market… This will be absorbed with a level of interest that is completely different than the other that is going to be swimming against the immense current.

So there are already so many difficulties than choosing a hot and growing market makes a difference. Well, if you can chose. If I know a lot about wave energy, my life passion is wave energy… Well, too bad because you can't choose your passions.

I: Regarding competencies, hard skills inside of start-ups, which means marketing, legislation, finance. What do you believe are the most important?

RB: There is no key competence. That's why there are team, so that there are complementary competences.

So, the legal question, without wanting to undermine the role of lawyers which is something that unfortunately, quotation marks, essential, is something that can be subcontracted with some ease, so I wouldn't say it's a core competence.

The whole technological topic, to dominate completely the subject of what we are proposing to do is essential. Me, mechanical engineer, to go and start a pharmacy or biotech company is a bit strange, because I don't dominate even slightly the competences of that industry, I have no idea.. So it is essential to have a strong background in the area in which the company is positioned.

And then the whole commercial side, without a doubt, sales. To know the market, to know the client, to know how to sell. But marketing and sales are very connected. They are two sides of the same coin.

I: Since it is a global industry, is it relevant that the team is multicultural or that it has some sort of international experience?

RB: It is very relevant that they have at least that ease. If it is people from here, that never left here, that barely speak English… it's hard because it is important that going abroad is not a barrier.

There are already a lot of barriers besides having to leave our own boarders and having to communicate in a language that is not our mother language, so it is good that they are people with a global profile.

I don't think it is essential that the team is in fact multicultural. If it is good but it also brings other challenges. There is a growth phase when obviously this jump ends up happening, when the company starts operating abroad and starts hiring from other geographies. But initially it is not crucial. But it is essential that it's made of people with that ease.

I: Clean tech is an industry that needs a lot of capital to grow. There is, what is the relevance of existing financial capabilities inside the company?

RB: That has to do with the capability of being able to draw a plan of how much I am going to need and it is important without a doubt. I would say it is as important as the others I previsouly described, but it comes a little bit later.

First I need to know what I am doing, then I need to know how I am going to sell it and then how I will finance this plan.

But it is equally important. If I don't know how I am going to finance this, then I am not going to be able to finance it which means I won't be able to execute the plan. So even though it's something that comes a little bit later, it has the same importance level.

I: A lot of this start-ups make outsourcing of certain services, like for example communication.. Is it different or not to outsource certain competencies from having them inside the team?

RB: I can't have knowledge about everything in the team. There are things that are very evident and are screaming to be subcontracted, accounting, lawyers, sometimes management of certain communication actions,…

Even somethings things that are related to technological development but that can make sense. Product certifications obviously, development of some sort of board that does something very specific which is not my core, I can contract.

But not subcontract everything related to the product. Because, either I know nothing or I am putting everything out there and I stop having some sort of secret. If my secret source is all in some random supplier, nothing stops him from starting to do the same. But anytime it is more efficient, we have no problem against subcontracting.

I: Usually this type of teams are people with more specific backgrounds: engineers.

RB: Usually they are engineers but there are other backgrounds. It lacks sometimes, people with a better business knowledge, with an all-around rounder management education, it sometimes lacks in this type of teams yes.

Teresa Fernandes: Head of Marketing and Communications at BGI

I: Can you explain more or less how BGI was born and what you do?

TF: MIT wanted to bring what's best in Portugal to the United States, so I believe that to achieve technological innovation there are 3 pillars: the first one is education, to gain that entrepreneurship spirit in University. In Portugal we have a lot the spirit of creating employees and not entrepreneurs. If you look at students of MIT, 5 out of 7 leave university thinking they will create their own company. In Portugal 1 out of 100 maybe thinks it is going to do this so there is a huge gap here and this is also where MIT thinks it can go, through education.

The second pillar is the investigation scholarships. And the third acceleration. In Portugal MIT is also managed by a management school, in spite of being more directed to engineering. So here in Portugal all of this ideas had to be managed by a business school. The three most known business schools were Nova, Católica and ISCTE. It was very clear since the beginning, and this was some years ago, that ISCTE was much more advanced in terms of entrepreneurship than the rest. Now the difference is not so big but at the time, because it was involved in a lot of initiatives, brand storms and so on, so ISCTE got the part of acceleration.

Then NOVA took the part of education, because it was always the one that was better placed in rankings and some years ago the only one that was in rankings, so it was the obvious choice.

The part of investigation was lacking but investigation was the weakest point of Católica so we joined Nova and Católica to be together with the part of education and the Lisbon MBA was created, that is powered by MIT.

Here in ISCTE we created the company BGI, which is also powered by MIT, but focused on acceleration. So we would pick the good ideas that would come from Nova and Católica and would accelerate them. This was the idea but of course it is not what really happens, because we are lacking the investigation part which is what BGI trying to bring making a partnership with FCT, Técnico, FCUL because they are stronger in the area of investigation. And basically so far this is what we have been doing.

In terms of BGI, people enter here and they have three main things that are very important: number one, to have a clear and defined plan of what they have to do when they enter the market, and this plan has to be weekly, they have to do a report kind of like a homework, they have to do it and submit it for their mentor to see. The mentor of the start-ups is always an investor, because firstly it is the one that has more information about the market and knows what is riskier, what works or not because it's the one that invests his own money. And secondly because this investor may eventually invest in one of our teams. And if they are mentoring the start-ups this probability increases even more because they know the start-up, give their input and most times they are following their feedback so this also helps.

This is a very relevant point because the companies that have no management knowledge have already a business plan to follow and besides that they have a mentor that weekly gives his feedback. Every week they meet by skype, because we have companies from Brazil, Hong Kong and also of course some Portuguese companies.

Then we have also a very important point, which is connecting the people. Recently I went to the Smart Cities event, and I thought we have 2 or 3 companies that were really interesting for Siemens. And they didn't reach them because maybe they didn't go to the right person, or went to the general email or LinkedIn and people ignore. Now if you go to this events and present as part of BGI, people also start trusting our portfolio of start-ups and gain immediately more interest in knowing the start-ups. So we presented the start-ups as BGI, to the technology innovation manager at Siemens, so to the right person and we build this bridge.

So we can do this bridge because firstly we are in the events that have this objective of networking between companies… For example Seazyme they had to license, because entering in the cosmetic industry in Portugal or in Europe is very competitive…So if they

try to enter the market they are going to be completely crushed, but of course the start-up thinks it is going to be able to enter. Why? Because they don't know the resellers dynamic, which in Portugal for example we only have 3 groups (Douglas, Perfumes e Companhia, and Sephora), so you either sell in those ones or you don't make any business. And like it happens in Portugal it happens in the other countries as well so for them the idea was licensing. So it is very important for us to have the companies on our side, so that if there is the opportunity of doing licensing we can talk with them. Why? Because many times companies can gain royalties on their product's sales till the rest of your life. So this is interesting for some companies, but of course some companies see well maybe in Portugal I can't succeed in the cosmetic industry so I am going to Africa or South America. So you also have to study this possibilities.

But this mentors exist to tell you where you should go, if it's a good idea or not. And then our network of contacts exist so you can advance the business, in the point of view of having investment, having a client or in the point of view of buying the start-ups idea. So all of this three can happen when you have a start-up, either you sell or you want money to continue thinking a bit more or you want investment to sell more.

So we discussed here two points: mentorship with a marketing plan, and networking which is crucial for the start-ups because they have no idea who to talk to, and we put them in contact with the right people. And the third point is coaching, we have workshops. Usually in each program we have 3 workshops. One has the duration of one week and a half, its very intense, where start-ups have training regarding investment, business, product development… crowdfunding, venture capital, lean development, everything that is important for them to know to enter in the market. Another bootcamp where we present the teams to Caixa Capital who gives an award of 100 thousand euros that is also an important help for start-ups. Here we help in the part of the pitch, how to do a pitch, communication, what turns on an investor and we have investors coming here to talk and share their experience, people that have invested a lot of money and that have a lot of know-how and they come here to share their experience first because they know us from MIT and secondly because they can meet here interesting companies for future investment.

The last event, our third and last bootcamp when it comes to the coaching program is always in Boston, because MIT is in Boston, and basically we go there and provide one to one meetings with alumni of MIT as well as companies like IBM, Google Venture, Microsoft,… And we try to make this contacts so that in this bootcamp the companies

can have the biggest number of meetings all managed by BGI because we know the companies, the potential investors and we put this people together in the same room. This is what we do, we connect people, which is what they actually need. Because of course the idea is there, they may need to do a pivot, which is when you have an idea that can be applied to computers but maybe it's best to apply it to tablets, so you change it. It's the same software but they change the target. In the case of Movvo, we had a technology that could be applied to a lot of places (airports, transportation…) and they ended up targeting malls. But here it is very important to look at the market and understand in this case regulations, which is one of the points of the PESTLE. In this example, here in Portugal SONAE dominates everything from the supermarkets to the actual malls. For example, Colombo, Almada Forum, Dolce Vita, they all belong to SONAE. So you can sell to SONAE your technology for the shopping mall but you end up also being able to enter in the supermarkets so here it was smart to target SONAE. So this part of the study has to be done locally. And this is why BGI works with a law firm, and they manage this legal part, what you can do, what works best, the question of IRC, … And all our start-ups are supported by this firm.

I: How many clean-tech start-ups are you currently supporting?

TF: In this moment we were accelerating in our annual program 10. And in the other program, the Acceleration Climate-KIC Program, we were supporting 8 selected start-ups.

This program is European and BGI was chosen to select 8 start-ups to represent Portugal. Each start-up selected received immediately fifteen thousand euros and from then onwards they were inserted in the network, get payed trips to interesting bootcamps, trainings, as well as fairs which are very important to build the first contact. What we compare to the "first dates", that can evolve to a partnership or not. The start-ups selected had to be related to mitigation of CO2.

And then we have other start-ups that we support but are not yet ready to be accelerated by us.

Our business model here at BGI is that we only earn money if the start-up reaches 2 Million Euros, and we earn 3% of this money. And what happens is that we are giving free consulting services and if they fail completely they don't have to pay anything at all. So we have a big incentive to foster the growth of this companies.

We started in 2009 and we have accelerated now around 74 companies. And this companies are still alive today and many of them are already with 40M valuations so they are pretty mature.

This specific European program we did the things we normally do the mentorship, the networking, the coaching but in three months.

An important thing to notice is that we are an accelerator and not an incubator. So when start-ups don't come here with an idea and we help them mature it. No they come already with the idea that is matured and disruptive and we help them enter the market and grow. And this point is also a differentiator because we only select disruptive innovations. And we have a great pressure in the selection of the teams because if our portfolio is not good then our network will be weaker as well because people won't want to be associated with BGI. So this creates a lot of pressure in this selection and we also have people from MIT helping us select.

I: From this 18, what is the percentage of start-ups that are Portuguese?

TF: In the EIT program they are all Portuguese also because it was mandatory. The rest usually we have 60% Portuguese, and the rest foreign.

So what we are doing here is venture capital investment so we bet on business models that can work or not. And there are a lot of small variables that can determine whether you have or not success. If you are going to open a restaurant there are a lot of variables that determine your success: the time you get in Zoomato, the light at the entrance, … And we try to determine this variables upfront and only those that have good variables we decide to work with.

I: What are the main obstacles the start-ups face in the two stages of development: from the idea to validation and then growth in the market?

TF: Okay I can explain this with a simple example. You leave now college and you had excellent grades, you were enrolled in a lot of extracurricular activities and are now trying to enter in the job market. Although you have all of this you go to interviews and SONAE says no, Unilever says no, Nestle says no, and then you try Impresa and still no. They say sorry, you don't have what it takes and you never will.

This in a personal level hurts. Now imagine the case of a start-up, you are investing all your time, gave up on a lot of things are investing all your money there which is the case of almost all start-ups to create that prototype to be able to start the company. And then they receive a lot of no's. So from in an emotional level this is very hard and especially

since you are putting all your money there. If you fail what do you do, do you go back to live at your parents' house?

So this is the big problem. Point number one: have money. And things like Web Summit are ridiculous because you have to pay 3000 euros to be there and that's a lot of money. Point number two: the emotional side of receiving no's.

So this is important in the part of ideation that is idea creation, which is a part that we don't work on. So this part is hard because is where you decide to invest from your own pocket and this is not just a professional decision but a very personal one.

And then the no's on the acceleration part, the companies that don't want to work with you, people saying that your idea will never work.

I: Do you think there is a difference in terms of obstacles when launching a clean-tech instead of tech?

TF: I think in terms of incentives, with investigation scholarships and so on clean-tech is receiving a higher support especially after a Paris Agreement, so there is a lot of pressure for the government to look good in the picture.

And looking good in the picture results in giving money to start-ups, or to investigation.

In Europe, we have a lot of money being directed towards this low carbon initiatives, from the government. But still it is curious to see that there is more private investment in clean-tech than public investment. And I think this is good news. Because this means people are investing in being clean and this is great.

So I think that a tech in terms of positioning in the market has more opportunities. Because if you are only tech you can do a lot of things and you always have clear financial benefits, you are either doing things more quickly or more efficiently. But when it comes to clean-tech this is not so clear and if the clean-tech doesn't save you money then people won't buy it.

And I also think that if it something small, companies will have incentive to do so to look good in the picture and put in their annual report they invested in sustainability, in clean-tech and so on. I mean you always end up saving something, but the impact of the clean-tech may not be sufficient to incur in a big risky investment like this.

And also an interesting point is that it is very hard to say whether something is really "clean" or not. For example photovoltaic panels. This panels are made with silica which is highly pollutant not only in the production but also on recycling.

So this is a problem. What was done regarding this was investigation on solar panels to make them recyclable and now we have recyclable solar panels. Still these are much more

expensive so if I just want to look good in the picture I just put the cheap ones and that's it. And then the lifetime of the panels are about 25 years and then when you have to dispose them and end up provoking in the end a lot of emissions.

I: Which factors do you evaluate in start-ups?

TF: Innovation and Originality of the idea. Market Potential, if it is ready or not to receive this solution- if we are in a blue or red ocean. Then in the EIT Program, environmental impact. The Team's Experience, it is much better to bet on a so-so idea but with a very strong team motivated, ready to receive a no. Almost all companies fall apart because of the no.

If the team is not diversified then maybe it will not work out as good. Also it is not very trustful to have people just with an undergraduate degree. So, the team needs to be good. And our investors are always saying that the team is the most important thing in their decision. If the team is good, motivated and never gives up I'm betting on them.

And the truth is that the more stubborn people are the one that end up succeeding. Having the humility to understand that he is not the best person in the room but be able to hear feedback, incorporate it, and then try again and again till it's good and they can do it.

Start-ups are between 1 to 5 years also because we are talking about tech. So when talking about tech, the development processes are a lot of time, investigation, building the prototype, having money to do it and then to change what is needed and then only after that they enter in the market. So its many years and most people that we work with are college students of PHD, masters, with investigation scholarships that reached a result and then they try to make a business out of it.

Then it is very important the partnerships they have, if they have or not patents. Attention that if the process is very complex you don't even need a patent since you know that by reverse engineering people can't understand how you did it. So I wouldn't say in tech, and if it is complex, patents is not crucial.

I: What are the type of competencies needed to survive in the marketplace?

TF: We don't evaluate the competencies because that is what we offer the teams. But I think the key skill we offer them is the communication with the investor. Being able to do the right pitch so that they attract investors. Basically we help teams to choose the right dress. You can't show too much or too little. You have to say just enough to make them interested. So the most important thing is the sale. It is not having the best technology, the best development, the market study. No, it is the dress you wear that

night. In other words, their pitch. And this pitch includes knowing the personas, the competitors, why I am better than them. You have to have an incredible value proposition. So you start with the value proposition, then you evaluate your positioning and then you segment your market and finally target. If I am pitching to an investor I already know he is a part of my target so I adjust my pitch to that target.

So they have to have a great preparation before a meeting, know who they will talk to, what is your correct pricing. You can't just say a random number. If I am pricing my solution 3 times more than my competitors am I adding 3 times more value? I have to know this.

And usually the start-ups are directed to B2B which is much more complex than B2C because in B2C you go to the street and ask. So it is much harder in this sense. To know what the customer is willing to pay.

I: Do you feel added barriers when working with clean-tech? In regulatory terms?

TF: We don't feel there are exactly barriers but we feel that maybe there should be more help. For example this start-ups from Climate KIC Initiative, they receive fifteen thousand euros. But from this money there is a lot of bureaucracy, they will have to discriminate all the spending, why, show the invoices. So if an invoice fails, they won't pay. Reports to do to deliver filled with questions. So it is a lot of bureaucracy. So it is not exactly a barrier, because it's not because I have to fill papers that I won't participate, but this could be facilitated.

Another thing, if there was a tax on GHGs, then companies would be forced to look for solutions. So it is not a barrier but it could help in the development.

And also in what regards incentives for the final costumer. People like to help but in our day to day busy life, we don't have time or patience to think whether the lettuce you are buying is having an impact on emissions or not. You just get one and that's it. And to change this behavior is hard and maybe if people had a monetary incentive to choose the best lettuce they would. So if people and the government wants consumers to change their behavior they have to provide incentives to do so.

Even things like the transport system. If I only have public transportation available from 40 to 40 minutes, I have no incentive to not use my car because I don't have time to wait that long for public transportation. I would use it if it was efficient.

And this is important because as the consumer gets busier, it will make choices that are less time consuming and if I have incentives to act in a more sustainable way then I will.

And in Portugal, we are one of the countries in which gasoline is more expensive. And this is good because it gives me more incentive to buy electric cars but electric cars are super expensive. So either I am offered a good solution or I'm not going to change.

I: What do you think are the most important partnerships for a clean-tech to make?
TF: For a clean-tech I think to be connected with this state initiatives. If you have the support of the government it is much easier to enter the market.
For example, Wattis, which the business model is to enter in your electricity meter and measures your consumption. In this case of course you need EDP by your side. So if you have EDP you have your market done. This is good and bad. Here in Portugal EDP has a monopoly so if you can get EDP, then you can reach the whole market. But if you can't then there is no one else. But if you look at other countries like Germany, you need to talk to 10 companies to conquer the market. So it is an advantage and a disadvantage at the same time. If it goes well it goes very well and if it goes bad then it goes very bad. So for EDP, it is important to take an endorsement of the government, saying your technology is important and should be implemented.

Bruno Amaro: Innovation Center Coordinator at Tec Labs

I: What is your position in this incubator?
BA: Project Coordinator. Here we divide ourselves between areas. I am in charge of the strategic area, to define the strategy for the place. I am also in charge of the networking area and also project mentorship.
I: What type of start-ups do you support and in which stage?
BA: We have many years of activity and for a long time we weren't an incubator. Companies could stay here eventually forever. Currently that's not our vision, companies will stay between 2/3 years and if they are biotech a little bit longer.
Right now we have very mature companies with 10/12 years of life. Many of them are not discovering anything already, they are launched in the market and it's time to take the leap which is just a matter of time.
Regarding sectors, everything that is related to science and technology is of our interest. Depending also on the community investment boards, we try to focus on the sectors that are receiving a higher level of leverage, that have a directive from above to leverage

them. Right now we are focus on the sea, health, well-being, agro-forestall and urban smart mobility. Which doesn't mean that in the future we won't have others. To date, the companies we have fit a little bit on this domains, with some outliers.

I: What is the focus of the incubator and what does it offer to start-ups?

BA: We have an incubation program that includes the space (meeting room, auditorium, …) that is included in the price start-ups pay to be here. Our mentorship program is also included, to help thinking about the idea and also to help finding partners, or a very specialized human resource, that we can go to the university and get what they need. And also in many case the relationship with investors, they tell us the amount of money they need and we make the bridge with whom we think could be the right investor. There are also a number of complementary services that we don't do internally but provide to the companies like accounting, design, etc.. which are services we believe we should provide to them as well. But here we use our list of trusted partners.

I: How many start-ups do you support and how many of clean-tech?

BA: Start-ups per-se we don't have many. We have incubated 25 companies in very diverse maturation stages and 10 more in virtual incubation which means they have access to everything but the space. So they can come here to meet, talk with us, have physical address here and mail, but don't have an office, a physical space. So in total 30. In terms of clean-tech, we have 2 physically and 1 virtual, that was once before physical.

I: What is your definition of clean-tech?

BA: For us clean-tech, and I am not an expert, are companies that are offering projects or technologies associated with clean energies, so solar, wind, wave power, … Hardware and also services associated with this… one of the companies here is related with services, they resell clean-tech related hardware.

I: What do you think are the conditionings that the current Portuguese context presents to the introduction of technologies and clean-tech in specific?

BA: In the industry stand-view point, which is who is receiving this technologies I think that there is increasingly less barriers. This barriers can exist in industries that are more classical, or with a more family and traditional management with some risk aversion. So if my technology is new, there will be hardly evidence and there is a need to take some risks, and in the oldest companies in Portugal, there isn't this culture of taking risks. At

least in the companies with a more antique management. So there could be this barrier to enter. So to give first very concrete evidence it will work and only then start selling. If it is a technology to be sold to the masses, I would say the barrier can be eventually the price. And in this case the lack of governmental incentives so that the citizen can obtain this energies for his/her household.

But in general I wouldn't say there are a lot of barriers to enter, there are some maybe in the development of technology but in the part of placing it in the market, typically it's not that hard. And when it is, these are the main ones.

I: Looking at this obstacles, what do you consider to be the main difference between tech and clean-tech?

BA: I wouldn't say there is a big difference. Maybe one obstacle is being able to communicate my technology. If the clean-tech is solving a very direct problem, it's okay. But if I am helping improve the environment, something that doesn't benefit me directly, there could be a barrier due to the lack of global conscientization of people for the environment.

But I think it is much harder for a technology that is related to medicine for example than for a clean-tech. So from what I know, and maybe I am being to focused on the cases that I know, I don't believe there is a big difference between them and a very specific barrier related to clean-tech.

I: Regarding the growth of this type of start-ups, which metrics do you use to do this tracking and why?

BA: We don't have specific measures for clean-tech but for the companies we support, also not trying to be invasive because there are sometimes some questions of confidentiality, …

But the metrics we typically use is the number of jobs created, billing, investment raised or financing funds, fund applications that were approved. Also number of clients but that is related to billing as well, people impacted by the technology if we are able to measure that… The metrics are very macro.

I: Regarding partnerships and connections created, what is the importance of the network of contacts in this industry?

BA: Everything. Maximum Importance in this world in which we move, of entrepreneurship, of innovation. Whether it is the share of knowledge, the share of the journey "I've been that way, so you shouldn't do it or you should, or you need to go

more to the left or more to the right" and also later to do the deployment of the technology in the market.

I can't develop a clean-tech, me Bruno that no one never heard about and knock on EDP's door, and want to sell it. I mean maybe EDP is a bad example because they are very open to that but it is very important that there is here a network or a reference contact that takes you to knock on the right doors, to find investors and so on. Also because the investor is in principle more specialized, he isn't going to invest just because, he has to know more or less the market.

So it is very important and our role is also very relevant here, in the intermediation and promotion of this contacts not so much on the part of selling to the consumer but more on the part of partnerships, suppliers, investment.

I: From this partnerships/connections what do you think are the most relevant for success?

BA: The permanent connection to the R&D world, the connection to the centers of knowledge. It's there that top of edge technologies are being created, the people that are more up to date on the subject-matters are the ones connected to this centers of knowledge, who is studying the state of the art. So it is very important for companies to always have this bond, in tech in general and clean-tech in specific. Also so you're not obsolete, to understand what is happening and to allow me to reinvent and also create new products and have new ideas.

The connection with the investor is also very important but it is indeed a need, because it is necessary to start especially if we are talking about hardware.

Eventually also with big corporations, mature, of reference that are operating in the area. I can be in the idea/prototype phase and be already in touch with EDP and my final costumer have already something to say about my product or service. So this constant validation is extremely important so that we don't reach the finish line and have something that nobody wants or that isn't exactly that and having to go back and spend even more money.

I: When analyzing projects, you also analyze the team and its competences?

BA: Yes

I: Which traces do you think are relevant in the team?

BA: Persistence, Resilience which are nice terms for being stubborn. Capacity to implement, not only capacity to innovate. The way you implement and go to the street annoy people, that's what brings success to a so-so idea and a good idea can fail

because it didn't have the capacity to do this. So all of this, leadership skills as well, being able to work in a team definitely because it is what they are going to be doing.

I: Thinking about all the activities that the start-up needs to incur since the creation of the idea what do you think are the most relevant?

BA: It really depends on the maturation. In an initial stage your objective is to develop as fast as possible to reach the market as fast as possible. But before that, I insisted in the validation, and that is done with the clients.

So the first step is, not in a perspective of client raising but to talk with the clients/users to see if in fact this matters to them and if they are willing to pay for it.

When this is closed then I focus more on the development, on the investors. I need money, where do I go take this money, whether it's investors or anything else.

The sale appears in my optic much closer to reaching the market (half a year, one year). I can't go to the market and say "in 3 years I will have something that will interest you", I mean I can but it is not that beneficial because others will develop something much more interesting than I will.

So the focus on the client has to happen when I am much closer to the market, there is, I only need to do some touch ups and in half a year it is out there on the market.

So then I can annoy people, do pre-selling or whatever, at least in this type of technologies. Because I find it difficult that anyone would commit, I can see the prototype and like it, sign a declaration of interest. But committing with money and that I will buy when it is ready, I find it to be hard.

I: How do you evaluate the sales competencies (to clients) of the clean-tech start-ups?

BA: It depends on the promoters. Our vision is that if the team is exclusively scientists and tech people there is a very big difficulty in management and management can be anything, including sales.

A team should always be complementary and of course there is something an engineer that has a more natural ability for management. But the vision I have is that it is typically hard because the sale is focused in the value proposition and the scientist is focused on the technology, which the other side can't understand sometimes. The scientist says " oh but I have a molecule here" okay, but what I buy is not the molecule, it's the med. So I would say that in general they have a very weak sales competency.

I: In terms of management competences, in what areas do they present more difficulty?

BA: Fortunately the teams now are very complementary and you hardly find teams with just technologists for example. But in terms of specific competencies, the financial aspect maybe its easier for them because they are already used to doing it for other projects, to use excel and so on.
But the more relational part, more related to business and selling, negotiating prices with suppliers for example… More business stuff and then the general management itself, which ends up being a science also.
So the financial part is not as critical, accounting yes because it is more specific but I think the part related to selling, and sales channels must be the most problematic.

I: Do you think it's relevant that the team is multicultural?

BA: I think it's beneficial but not crucial. Of course there are no technologies to sell just in Portugal because we are tiny. But unless you are selling to a very specific market, for example China… But also I think that I can always make use of partners whether it is an AIECEP or government entities that can help me get there.
So I don't think it is determinant, especially in this specific industries more related to hardware and programing in which the language is universal.

I: What about legal competences?

BA: Extremely relevant because it can imply the death of my business, so they have to be there from the start. This knowledge has to exist, it doesn't need to be in the team itself but the person has to be very well documented about it, not an expert but it has to understand this context because it will influence directly the technology.

I: Which competencies do you consider the firm should outsource and the ones that make more sense to do in house?

BA: Accounting, legal partnership. For a very small firm it makes no sense to hire a lawyer, so it should be a partnership, a covenant with a law firm. The patent part has to be very well done, and for this to happen it should also be outsourced although there are very few people doing this well in Portugal. So it can be offices outside of Portugal and so on.
If you are talking about industrial design I don't think we should sub hire. More specific things, yes, but the core should be in house. Here the big decision factor is, how many times will I need this and if it is sufficiently secret or differentiation factor enough for me not to want to put it outside of my house. So the risk of leaking the information and also the regularity.

If it is industrial design it should be in-house. Programing also, but if I need something very specific I can go outside. So everything that is core inside, what isn't can be outsourced.

I: How do you see the role of Portugal as an innovation provider in Europe?

BA: We have a history of being very innovative, since Via Verde, etc. Portugal is very inventive but sadly it still stays a lot on the invention side. Nowadays this is changing, also with the entrepreneurship buzz. There is already a lot of market knowledge.

So right now not only we are good in creating the technology but also in putting it in the market. And also other factors , like companies establishing themselves here due to cheaper labor. So Portugal is becoming a tech hub. We could be even talking about foreign companies but that started here.

I: And what about the investors perception of Portugal?

BA: We are witnessing a boom in that matter, and websummit helped obviously. The problem is not the perception because they know we have good ideas here, cheap labor, an attractive cost of living, good weather… But there are some barriers, taxes, currency conversion (euro dolar) and there is also a big nucleus of investors in the UK so the libra-euro matter is also an issue (not mentioning now Brexit) and companies have incentives to establish themselves there fiscally.

So there is knowledge, will, and a great perception of the Portuguese as an inventor, a scientist and now a business men. But there isn't more investment also because mechanisms weren't created to foster it, whether it is tax decreases, government incentives.. I think it is very practical things and not the perception.

I: How do you see the evolution of the role of universities as innovation providers to the industry?

BA: Very positive but still have a long way to go. Who is doing this for longer now and well is America but I want to believe that it's a matter of time and because we started later on we will still reach it.

In America to take technologies and put them in the market is a very important revenue stream to universities. But here this is not an ambition, that the universities can survive from the technologies it creates but it is still extremelly relevant because investigation shouldn't be sustained solely on public funds because it's not sustainable. We can't put taxes to finance investigation because it could lead nowhere so there is no return on this investment. Investigation is very important but applied investigation needs to exist, it needs to reach people's houses, to companies so this needs to be fostered.

And I don't need to create a company for this, I can just license it. A scientist can be a scientist forever but technology needs to leave Universities. So there is extreme importance of Universities, in incentivizing, in encouraging and providing the tools so the investigator or scientist can discover its path.

I: How do you evaluate the patent situation in Portugal and the relevance it has for start-ups?

BA: Extremely important. We are very immature, all of us, in various levels because we lack critical mass and history. And many things happen, from the investigator ruining the possibility of having a patent because it already published an article, or to do a patent alone in a hurry and badly. The offices, if are only composed by lawyers can't effectively transfer the technology to the patent language. So if it isn't an office where you have lawyers and engineers a lot of information is lost and both sides get frustrated. And again it ends up badly written and its not enough.

And the investor knows that this is how he protects himself because we can't sell the knowledge, what is worth money is the patent which is an active. But he is also deceived sometimes because sometimes that specific patent is worthless and he can't really tell if that's a good investment opportunity or not. So I think there is a learning here that we all need to do and maybe we will only learn by failing many times.

So I think they are important but we also defend that teams should think a lot about whether that's the best path or if its best to go quickly to the market.

Many times we defend that it makes no sense to file for patent, it makes more sense to start selling fast and when the competitor is doing the same as I am I am already one step ahead.

Because to submit the patent I pay 3000 euros and then I have to protect it in each country. So whether I am already having revenue, or I have a very big investment because I won't have 10/20/50 thousand dollars for each country to defend my patent. For big companies yes, it's a business with return. But for a small company to invest hundreds and thousands of euros in a patent without being sure to have return and that maybe someone with more money than me comes and sues me with a 1 million euro law suit and I don't have that money to defend myself. I should have rather stayed quiet and selling. So sometimes a trade secret, a confidentiality agreement is enough to protect myself. But the essential is to be one step ahead always.

António Vidigal: CEO of EDP Innovation

I: What is EDP Innovation, when was it born and what is its main activity?

We were born about 7/8 years ago and with the mission of creating a competitive advantage for the Group EDP through innovation. It was designed to be the core center of promotion of various innovation activities for the whole group and for the various business areas of the group. The group is very big, with global presence so the purpose was to catalyze the potential of innovation of the whole group.

It is relatively small, with around 26 people and that develops its activity in five areas. The areas are: client focused solutions, cleaner energy, smarter grids, data leap which are disruptive innovations that IT is bringing to other areas and the fifth energy storage, which is something that is changing a lot. The functioning of the electric systems.

So we have 2/3 people in each of the areas that coordinate this areas of activity. The way they do this is through working groups that meet in a trimestral frequency with people from all entities of the business and presided by one of the presidents of the corresponding business area. Usually we do an innovation committee.

Then we have an incubator which is EDP Starter and then we have a Venture Capital Company inside EDP Innovation. And we cover the start-up since idea, then if it is a physical product they can do their prototype in our Fablab, then till the proof of concept inside of EDP and help launch the company also with investment.

I: What is your objective with this start-ups?

We search start-ups whose activity has interest for EDP and not only ones that constitute good financial investments.

The problem with start-ups is number one to focus their ideas because many teams are not from energy, they come from IT and other areas and don't quite understand the problem so we can help them focus the problem. And then we do something that is very important which is the proof of concept as well as be the start-up first client.

A Portuguese start-up is not going to sell their product to EDF which is a British energy company if it didn't sell to EDP. Because the first thing they will ask is "okay, great, but did EDP buy?" Of course they can sell it but it will be much harder.

I: You support only start-ups related to cleaner energy?

Yes but in a general sense. IT can also be an enabler of cleaner energy. Digitalization is an important part of the new model of the electrical company. And it enters in the area

of data leap, and we believe it will be a crucial part of the future of the energy sector. Big Data, Advanced Analytics, even Robotics. Now there is a new concept, in smarter grids, which is the creation of an Internet of Energy. Internet is something that we take for granted but in the energy case is not that much. Attributes like we have like plug and play and pear to pear, which means that if I buy a router I arrive home and it connects and so on. We don't have to ask nobody to connect it. And in electricity we also have this vision. This new things of distributed energy, being able to be plug and play. So I can be able to go to AKI or whatever, buy a photovoltaic panel and be able to plug it in my balcony. It should also be connected to a communication network in the concept of Internet of Energy and then it starts to be controlled by the system. And it produces more or less energy, or more or less tension according to the system's needs. A little bit like the concept of internet.

So the goal of having this start-ups is to redesign the way our business will work in the long-run.

I: What do you offer start-ups?

We have an incubator, they have a physical space as well as support like legal services to create the company. And also, we want to help them do the proof of concept, see if things work and if they do we offer to be the first client. For some we also have something called interring management, in which we have people here in the company with a lot of experience that do some operational work in the start-ups, free of charge. So for example someone that works here in finance at EDP can go to the start-up and help them organize the financial part. So if they don't have someone to do that job, we help in that aspect.

I: What is your definition of clean-tech?

Clean Energies, Green Economy in the Energy Point of view and all of the enablers of this like IT, IoT. And all of the support necessary needed to create this new model in which IT has a very relevant role.

I: How do you describe the evolution of clean-tech in Portugal?

Portugal has become a reference in what comes to clean-tech. Firstly because the country has a lot of renewable energy. And going back in time in 73/74, when I joined the company, all country worked on hydric energy, about 80%. Castelo Do Bode, Douro, .. So the whole country, Portugal was electrified through hydric energy. And today only around 60% is from renewables, we where greener back then. Meanwhile it

became cheaper thermic energy and we bet on that. A fuel central in Carregado, in Setubal and another of carvao in Sines. And then several more.
Around the 90s , and with surprise, Eolic energy appeared and it had a very rapid learning curve, around 20%. Every time the installed potency duplicates, the price goes down by 20%. And nowadays we have eolic energy competitive with the traditional energy sources.
Nowadays photovoltaic energy is emerging, and with great potential. The country has a great potential and it is very complementary with eolic energy.
So the country has great potential to function just on renewable energy, at least from the electric stand point of view. The electrification in what regards automobile, there is indication that mobility in the long run can be very dependent as well on renewable energy.
I usually say Portugal goal is to set itself in Europe as a living lab to test renewable energy technologies. Because there is a lot of know-how in Universities, a lot of reference industries like for example EFACEC that constructs all electric technology. We are even constructing intelligent meters that other countries just do in China. So we have here companies that produce all equipment needed.
So our vision is that Portugal could be the place to test the new concepts that appear and that will change a lot. And this would be a great opportunity for our startups to set themselves in the ecosystem.

I: What do you think are the conditionings that the current Portuguese context presents to the introduction of clean-technologies?

Portugal has a lot of renewable energy and is paying a price for being pioneer. Because when renewables appeared, they were much more expensive that nowadays.
I think Portugal per se, doesn't need a lot of renewable energy and I think they may appear connected with photovoltaic and with distributed energy storage. Photovoltaic will be so inexpensive in 4/5 years that someone that has a rooftop or a residence, it will be cheaper to use photovoltaic panels with a battery in the basement than energy from the grid. We have sun conditions so our resource is very good.
So in the long-run I think photovoltaic will appear in a spontaneous matter and without subsidies or supports and with few barriers as photovoltaic decreases in price. And the fact that it will get so competitive is going to force the rethinking of the grid a lot. Because the net of distribution and transport is not disposable and if we have 15 days of rain and no sun we can't subject ourselves to having no electricity. And no one will

have batteries to hold 1 month of energy. So no one will excuse themselves from having the grid.

But who will pay it? Because people that have more money are the ones that will put together the photovoltaic. So who will pay it are the ones that don't have money to pay for photovoltaic and to be more independent. So in this sense, it will force the rethinking of the regulation.

IR: So you see an opportunity of growth in Portugal?

AV: Yes, namely in the cross of energy with IT. IoT is a great opportunity and we have here many companies that work very well with programming so I believe the opportunity is here. Because other areas are very capital intensive. Even to prototype is a fortune and there is no money for that. In the part of software it is much easier to enter, since you have no entry barriers. Easier to test. So I think this should be the path that our start-ups should follow and here is the big opportunity. And they shouldn't think about business models for Portugal, they need to do things that can be applied all over Europe, all over the world.

You know that very known sentence, the largest hospitality company has no hotel which is Airbnb. And the biggest company of taxi/transportation has no car, which is Uber. So it could be in the long run that the biggest utility company will have no central. They may manage assets from others.

IR: What do you think are the main factors for a startup to succeed?

AV: Well, in general, not just ours. The idea has 20% of weight, the market 30% (don't do anything that can just be applied in your neighborhood or in Portugal), the team has 50%. To have determined people, complementary, know-how and obviously technical knowledge.

The entrepreneurs has to think it will change the world especially in this energy sector. I always think about Elon Musk, with the integration of Tesla with Solar City which is a company that is redesigning itself the electrical sector.

IR: In terms of management competencies and thinking about this start-ups, what do you think are the most important competencies?

First of all to have technical capability of developing an idea. Then, to be able to sell the first pilots. To do the so call elevator pitch. For example Feedzai did a pilot in SIBS, now here. Then after the success of the pilots, they sold the solutions and then went to sell to the United States.

But first do an MVP, because you don't know what the market wants, you know what you think the market wants. So to do this minimum viable product is important. So you're not 1/2 years developing something that isn't want the market wants. Then after this to enter in a cycle in which I implement the product, measure what is the result (number of sales, clicks, whatever) learn and do again. And the pivoting, if I see it is not growing according to my metrics I need to do a pivot. To orient to something different, using what I learned.

This industry is very capital intensive, ignorin a bit the software part. But for example a prototype we did, windfloat which is an offshore Aeolic fluctuation system. And this costed us 25M€, so a big deal. And we helped gathering other investors, Repsol,.. and nowadays the company is almost expanding.

So in this type of technologies, sales skills are very important and in this energy areas to support itself with Universities.

So we don't invest in anything that we don't believe satisfies the laws of physics. And there are a lot of ideas that come here that don't satisfy it. There is a lot of people that appear here with continuous technologies which means that things are moving without energy, forever. So a lot of startups come here saying they discovered a way to produce energy without any spending, and this doesn't satisfy the laws of thermodynamics.

And for us is fundamental that people come here already with a stamp of quality, associated with a reputable team university professors that have validated the concept and that show us it is viable in a physics and chemistry stand point of view.

And a lot of people always show here with very weak sales skills. And what I normally say is to introduce someone in the team with a sales profile even if it is not an engineer.

IR: What about legal competencies and Intellectual Property?

To finance itself it is important to have IP, but I confess I don't give much importance to it. A startup has to focus in walking faster than others that has to be the focus. And in some cases here we do the contrary, we publish the idea so that no one can stop us from doing it. To put the ideas in the public domain, and then their defense is that they are walking faster than competitors. In terms of network this connection with incubators and accelerators that know everyone is fundamental to open doors for the companies.

Marisa Loureiro: Project Manager at CohiTec

I: How was CohiTEC born, how does it deliver value and which startups are the focus?

ML: The CohiTEC program is a program more of acceleration but of education/training and this is very important. It works in a very early stage, it's not startups but people that participate with projects. And it is a program that started in 2004. In 2003 COTEC was created and it has 322 associates in this moment, which are companies that do business in Portugal and that joined together to create an organization that fosters innovation in Portugal through various initiatives and in various areas. Some areas more directly directed towards companies and to foster the constitution of sedimentation of innovation, establishment of a norm, building a tool called "innovation scoring" that allows companies to evaluate their state of innovation and their progress.

At the same time we also wanted to perform in this area which is of valorization of knowledge which is an area very mentioned by companies- the importance of the interaction between universities and the industry.

At that time there was a professor of Aveiro University, Pedro Vilarinho. He had been recently in a University in the US, which is the North Carolina State University. And that University had received recently a scholarship from the National Science Foundation to develop a method to facilitate the commercialization of university based technologies, what they called TEC- Technology Entrepreneurship Commercialization. And in this context, it was decided to do a pilot edition in Portugal. They brought the professors involved to Portugal, and in partnership with Porto Business School, they put together a group of technologies coming from Universities. They got university science offices involved as well as management students to understand how this could work and to give training to the participants.

The outcome was that this program could be valuable, at the time there was no accelerator concept, so at the time there were no big initiatives in this area in Portugal. So the idea was to connect the scientific and the industry sides and to do a training program focused towards scientists/investigators. The program CohiTEC was been developing since 2004. In 2005, it had already two editions (one in Lisbon and one in Oporto). Meanwhile it also had the possibility to connect with a fund of IAPME, allowing a small financing to develop the business plan. And later one, built partnerships for the financing of the proof of technological concept.

This because CohiTEC is a program that intervenes in a very initial phase, and we are focused in university based projects or investigation laboratories. So our areas are: biotech, lifesciences /health sciences and industrial sciences. Always with protectable IP, and that in the majority of cases can originate in patents in the long run.
Technologies with a very extensive degree of development, various years of investigation and very embryonary state. In TRL state they are usually in TRL 1,2,3,4.
So the objective with CohiTEC is to: introduce new competencies and new mentality in researchers/scientists; increase the proximity with the market/industry.
Our projects are very initial, so the way we position ourselves, our main objective is not to create start-ups. It is to train investigators and start creating a process of opening and connection between university research and the market.
So in some cases the investigators keep doing investigation but with more proximity to the companies and in other cases (more rare) they will try to take their technology to the market wheter it is by licensing or by startup creation.

I: What does this training consist in?
ML: CoHITEC has place once a year, between March and July and it is a hands-on training program. Applied to real technologies. It consists in an afternoon per week, in Porto Tuesdays in partnership with Porto Business School and in Lisbon at Thursday in partnership with Nova SBE.
We receive applications from investigator groups, we prefer that it is more than 1 although we have rare cases where there were just one. Most of our projects are from universities and investigation centers like University of Trás-os-Montes, University of Minho, University of Coimbra, Aveiro, évora, Lisboa. Investigation Centers such as ITQB, Instituto de Medicina Molecular, I3S, …. We have cases of companies as well, but it is quite rare. Usually the technologies are more disruptive, so I bit outside of the usual business models and that's why they come to the Cohitec program so that they can evaluate them.
What we do is that we receive applications of investigators that propose one or more technologies. And what they do is a description of the technology: what it is, the unique characteristics which is one of the main selection criterias because we want projects that can be protected by IP. This is very important, especially in technology areas because the patent is going to be the big asset that the investigators are going to have to negotiate with investors.

We select 16 teams per year: 8 in Oporto and 8 in Lisbon. And then we put this teams together with: management students (in Porto in the MBA and in Lisbon usually in their undergraduate or master); 2 mentors per team (more connected with the business area, that are working,… It is not preferred that they are of the same area of the project because they are not scientific mentors, they are business mentors. And when they are from the same area they end up discussing technology instead of business. So it's not advisable).

To validate the technology and make sure that that technology can originate in an interesting product that solves a market need, they have to be in touch with a lot of people. And we incentivize them to build contacts, the mentors are there to give guidance and some tips but this information of market validation they have to get it from many different sides.

So this is a training program. But practical. Our training methodology is similar to the TEC methodology coming from the US, but adapted. Every year we adapt a bit. This methodology is that in each of the weeks we have a different focus.

18 weeks: 1st week: unique characteristics of the technology, landscape of the technology, search patents and articles to see what exists because many times the investigators don't know what exists in the area that they are investigating; 2nd week: ideation, what are the applications. Since this are platform techs, there is in a very initial stage and that can have many applications, most times the technologies can have applications in completely different sectors. And what we do here is to explore the different applications to reach the one that makes more sense. And this is done used by many criteria: state of development, bigger fit, maybe there are some applications in which the technology is disruptive and others in which it is not. But it also has to do with the market: the size of the market, the necessity of solutions to solve some problem that isn't solved yet. All of that is evaluated. And so on.

So each week there is a different focus, we start more focused in the technology and then progress more into the market, when you actually are defining the product. Estimating the market, analyzing competition, plan the business model, think about the proof of technological concept.

This technologies are still very far from thinking about the marketing and sale. They are at least 3/4/5 years away of reaching the market, after finishing CohiTEC.

We have a lot of technologies on the areas of biotech/life sciences which are areas that are extremely regulated. For example in pharma, you need on average 10 years of trials

(after doing the discovery) to reach the market. Even outside of meds, we have a product here which is a fungicide that even though it is not a med it needs a series of trials in agriculture, the impact on animals. The areas are very regulated. Even in clean tech, there is regulation, even though not as strong. In terms of the security and certification of the products, that also takes some time.

I: So clean-tech for you is included in the industrial sciences vertical?
ML: Yes.

I: So the main objective is this training?
Investigators can become entrepreneurs, but they can also continue to be investigators. But the way they do investigation, conditions a lot what they are investigating and creating. And if they do investigation in collaboration with companies there is a higher chance that their investigation actually leads to something practical. If they investigate, closed in the lab, very focused in science and many times unaware of the market, the patents, and what exists. And if it exists already very similar things and they don't know, all of this is going to block the innovation system and the development.
So our primary goal is to change the mentality of investigators as well as the ones of the management students towards this area of technological commercialization. In the case of investigators it is what I just said. In the case of the management students, now it is changing but the management courses were very focused for students to go to the big consulting companies and to big corporations. They weren't as focused in the entrepreneurship area, and especially in the technology based entrepreneurship which is different than the general entrepreneurship.
Because if we talk about ICT and entrepreneurship based in business models which is not our focus, there are other accelerators that do this, the functioning is different. There is a lot of discussion in the importance of traction, do the MVP, to get a lot of users and sell fast. In our case, all of this takes longer, there is a lot more regulation. And the mentality of a CEO of this type of company has to be much different. It has to be able to talk with investigators, to pass from the science language to the investor's language, to be able to handle this regulatory barriers. So this is why we feel it is important for management students to have training in this area because we have this need. In the startups we have it is necessary someone with a management background. But we want

someone with a profile that knows what he is talking about. So having students that know how to manage and handle tech-based entrepreneurship is important.

I: What is your biggest value proposition?

ML: I think that it has to do with the fact that we have a lot of experience, because we are one of the oldest programs. And the fact that we are very focused in this type of tech- deep tech and that is an area that is not desirable for many accelerators because the returns are not as fast. So what we are doing is almost social responsibility. Of course now there is a boom of accelerators, so the companies associating with them is also a matter of visibility, the same as when they associate to other causes.

But in terms of output, all accelerators face the problem of the business model. How to be sustainable. Because even in the case of ICT based projects and that have startups that are developing much faster it is hard to get returns (considering an equity model). And in this case where we have most heavy technologies and in the case of clean-tech when there is a hardware component because it takes a lot of time, the amount of investment they need to attract is very high so there needs to be a structure that is not only based on the economic results that can justify its existence.

So it has to do with our experience, our big focus in this area and our network because since CohiTEC is a corporate association we have a very big number of associates that we can contact to support the projects and to validate them.

I: How does CohiTEC work in terms of sustainability?

ML: There are funds from COTEC that are attributed to the program of CohiTEC. So COTEC is a corporate association that takes quotas from its associates. And then from all the money it has, it distributes to the various initiatives.

Then we also have a sponsorship of Caixa Geral de Depósitos, and there are a group of accelerators that have this sponsorship- Building Global Innovators, Beta-I, various. And this sponsorship has been very important for us because it also helps to cover the costs of the CohiTEC Program.

Besides this, some of the projects post CohiTEC end up giving us, indirectly through services some income. For example in 2009, COTEC Associates decided to create a venture capital fund that invested in post CohiTEC projects. And this fund pays the CohiTEC program a management fee for the deal flow it arranges and for the support of the projects.

I: So you don't invest?

ML: No, CohiTEC is for free and we don't take equity.

I: So you have supported 35 startups so far?

For us the most important is the number of projects, because of our positioning. So we evaluate our impact not only with the number of start-ups created but also with the number of people that are trained and reached through the program. So what we usually say is that we have 65 projects that concluded with success the CohiTEC Program. And concluding with success is doing the 4 months and doing the final presentation in the end. Because there are some projects that join and throughout the program realize the technology doesn't have potential or that the team is dysfunctional. So the projects don't go to the final presentation, because projects only reach this point if they have potential. Because if we see that in fact there is no room in the market for that or that there is a niche market or that the team is dysfunctional usually the people end up realizing this and give up in the course of the program.

Investigators, Management Students and Mentors +800 participants

In terms of startups it is the number you said (35) even though sometimes we lose some contact with certain projects. But that is the number we can track, the 35. Which are the case of companies that originated directly from the CohiTEC Program. There are some cases in which people created companies, but changed the project in what regards what was established in the program. So the startups created are important for us of course, but since we are focused in such an early stage we tend to worry about other things. For example more and more investigators have to apply to financing. And this is an issue that is much discussed. Portugal has to be competitive, and the financing from "Fundação para a Ciência e Tecnologia" are not enough and we have to apply to European Financings for Science to be able to finance and improve our science. And more and more this contests require knowledge of the market and the interest of that particular science. And we feel the CohiTEC program is very important for the investigators, even returning to investigation, to be able to manage better and be more competitive in the access to external financing. And we have many cases of investigators that participated in the program but that continue in investigation but that with the knowledge they gained are now in positions of technology transfer of science management. We have cases of people that are vice-principal and many people that are

now in the area of tech transfer because they have this profile that allows them to make the connection between this two worlds.
Another important point is the scientifical employment. When startups are created, which are very few cases, these are startups that are very intensive in knowledge. Just so you know, we had a startup that was Biomove and there is this rankings of the companies that submit more patents in Portugal and they are a startup, not even in the market. And about 3 years ago they were already the second or third company that had more patents submitted in that year in Portugal. And in terms of employment of doctorates, taken into account the structure of this companies, because they are very intensive in knowledge they end up taking in many more doctorates than the usual. And this is very important. We are having an upward tendency in doctorates but they tend to stay more in the universities but it is very important that this doctorates go also to the companies. And it is very hard as well to get scientifical jobs and this new startups are creating also very specialized scientific employment. And this is not common for a doctorate to find.

I: What is your connection with governmental institutions?
ML: We are a private organization. So CohiTEC is totally secured by COTEC. So there is no direct connection. But we do have a connection with ANI, we collaborate with them even though not directly in CohiTEC. We also collaborate for quite some time now in the IAPME and they did this small fund to help the most promising companies of the CohiTEC program to develop their business plan.
And we also applied once to Norte 2020, but we don't have any direct connection with public entities. Unrelated with CohiTEC, COTEC is now going to supervision an initiative by the Government called, Industry 4.0.
In terms of the Universities, we have a partnership with Porto Business School and Nova. And have a good relationship with many other universities as well as research centers where we get the projects, but no formal partnership.

I: What in terms of international connections?
3 Universities: North Carolina State University, Brown University and Red Cur University
And we have connections with 3 particular professors from each University that are heading programs similar to CohiTEC in their Universities.

(Do you take on projects from abroad?) No only national projects. Because our reasoning is to give value to the science that is done in Portugal. So our collaboration with the US is that these professors come here and give mentorship and training. And also in terms of networking, because one of the big problems, when talking about projects starting in Portugal, is to get this networking. To get access to companies that validate the market problems and that are even interested in the products and in running initial tests. So we have this connections that are more formal. And then we have the network that has been built by CohiTEC throughout the years and that have already opened doors to us, in some institutions that we have more proximity abroad. Even though each project is from a different area usually we have to look at the project to see in that specific area what are the companies that are more relevant and that we need to reach. And in the program we also have this component, of access to contacts so that people can reach the contacts that are more interesting for them abroad. We even did a game , 2 years ago in the closing session, with the projects in which we would track the number of calls and contacts built, and if they did international contacts better because they could validate that problem in different geographies and ecosystems.

And another differentiating point is: We were in a debate with Fábrica de Startups and they are very interested in the entrepreneurship of people, there is, self-employment through building a start-up. And it is very important this type of entrepreneurship because it's the one in which someone who is unemployed creates its own job. But the logic in CohiTEC is a bit different. We want to impact first investigators in their mentality and connection with the companies, and then in the startups that are created we are interested in their impact not only in the self-employment of people but in the economy. That being few they can grow due to their unique and disruptive characteristics, that come in the basis of the technology, and that can always be global companies and never just Portuguese. Portugal doesn't count for us. We always want the companies to be international.

And usually they start here, and ideally if they can have the investigation part here great. And the startups that we have are based here, even though they have international connection. We have a startup that is based in Cantanhede, and that produces a fungicide for agriculture. They have a very big part of investigation, they have production that right now it's only functioning half of the year. But then, they export this fungicide to the United States. And they have a company that does the commercialization in the United States. So the product is selling in the US and also

Canada even though the production is in Portugal. So it depends on the case, but our idea is to give value to what is done in Portugal.
And this is a fungicide, in practice it could be used in Portugal. But the reason it isn't is because in Portugal and in Europe in general the regulation is very complicated, more than the US and not completed yet. But regardless of that, Portugal would always be a small market.
But still, we have technologies and products that are so specific that in Portugal you don't have exactly clients for them. In terms of pharma, sometimes we have certain products that there needs to be big companies abroad that could be interested. Another peculiar characteristic is that these projects not always will reach the market in our hands.
Because this are projects that have financing for proof of concept of usually 100K, 300k; then a round of 1,2,3M of investment. And then later they will maybe need another round of more 10M.
And also this type of money is not easy to get just in Portugal. And they take a lot of time to reach the market.
So some that may need less money and time, may reach the market in their own hands. Others will develop the company till a certain point and then sell to others that will keep developing it. In the pharmaceutical case this is what is more frequent.
Dial was able to develop a product and take it to market on its own, but it was the first and only in Portugal.
The usual is to do a development stage, in Portugal it is very frequent to do here clinical trials for example. But then the whole process is very hard to do on just one side.
And we don't have an abundance of clean-tech start-ups. We end up having more biotech startups than clean tech but from our cases that are in the market and are more active we have 2 that are clean tech.
One is Advance CycloSystem, which is a company that started in the University of Oporto with a professor's investigation and with the optimization of cyclones that serve to filter air particles. This is a device that is useful to prevent pollution in biomass centrals and what he discovered here at CohiTEC is that it is also very useful for the chemical food industry and pharmaceutical industry. Because there are valuable particles emitted to the atmosphere and to recover this particles is worth a lot of money. The company was this professor and a management student that created the startup, had around 1.5M of investment and right now have around 6 people working.

And this type of devices exist for a long time but didn't filter small particles, and the devices that did where very expensive. So they invented this, that is the price of a cyclone but with a plus, so very accessible and very effective.
Their model is that they outsource the parts to external suppliers, do the engineering and montage. They design the cyclones customized to the client's measure. And just so you know cyclones are very expensive, 500K. And then they have commercial partners in various countries and sell cyclones more or less throughout the whole world. They already have 5M in billing. And they have a small structure.

I: Thinking about the cases that you know of clean-techs, what do you think are the main challenges faced by the startups in the creation and deployment of the tech in the market?
ML: In general and in the specific case of CohiTEC we have some difficulties that are: early stage technologies, the investigators evaluation is based on the number of publications they have. This means they tend to publish things that they can't protect later on. And we try to catch them in that phase that they didn't publish yet, because or else all is lost. You can't patent it and people can copy it.
But the fact that they are early stage means that a market test and validation is still needed to prove that it works and above all to optimize. And this is a phase where there is technological risk and it's not very easy to get financing. What the researchers call valley of death.
Which is a time that science doesn't finance, because it is no longer a scientifical project it is already applied. But companies don't like to finance as well because there is still a lot of risk. Its risk capital but its risk capital specialized in this type of projects and in an early stage. So, there is a technological risk and this is a problem.
And even though there is a lot of financing now in Portugal, a lot is going to ICT what makes it harder to get financing in this early stages and in industrial technologies. Because there is a smaller number of investors that invest in this technologies. Not only because it is riskier but because it is something more technological they are a bit more afraid. It is harder to understand the project and because they don't understand they prefer not to invest. Even though there are some foreign investors, because this is something very based on people and in localization, it makes it harder to get financing more than in ICT also because the ecosystem is different. It is less dynamic.

There are regulatory issues and of scale that are important to take into account, that may not exist in other areas. And sometimes it is not black and white, there are no book that says according to each product the tests you need to do to comply with certain regulations or not. No. Sometimes you need to speak with the regulatory institutions to discover which tests are necessary to do and to do them customized. And to negotiate with them which complexifies this.

And then in this type of projects there are also some difficulties in terms of team. Because in science based projects we have to involve the scientists, because you always need to understand the technology, validate it and develop it.

So, scientists are used to being a lot of years in universities, don't have a very entrepreneurial mindset and that are sometimes in a very comfortable professional position. But it is important that the scientist stays connected with the company, especially in the initial stage. Or that the junior scientist goes to the company and the senior stays in University. Or that the senior staying in the university gives some hours to help the company. This is important.

And then you have the management side. You need to have management people that know how to deal with this type of companies. That are not companies that will be directed towards sales in a first stage. First they need the investment, the proof of concept. To try to open contacts outside of the country, which is not very easy. So this components are also very important.

I: What are then the main reasons for failure of a clean-tech?

Our feeling is that the advantage of ICT is that it can be applied to any area and the knowledge is very standard. You can program different things and think about different applications to make the processes more intelligent.

If you are talking about a clean-tech that is heavier, you need to have this technology first. And our general feeling is that investigation in Portugal is very focused in life sciences. And I think this has to do with employability. People that took biochemistry and biology had no jobs. And they ended up doing investigation, and top students included. People more connected with engineering had more ease in finding jobs. So they turned less towards investigation. So our feeling even though you have the robotics institute and the civil engineering lab.. but if you look at the life sciences labs, they are more. So there is already this problem in the input which is that the science that comes from the areas of clean tech vs science that comes from the areas of life sciences. With

the disadvantage that in life sciences, then it reaches Portugal there are no companies and economic tissue that helps growing this areas. It is more complicated.
And in the clean tech, is not that you have a lot of companies, but they are much more because you have a EDP, a REN, an EOL… And this is an advantage of the clean techs.
And attention because the clean-tech concept is quite vague. In times, Caixa Capital told me "we are not saying clean-tech, we say materials. Because investors got a scare with clean tech and don't like the term anymore".
For example we have a batteries project, is this clean tech? Sometimes there are some frontiers in which is not very easy to define.
Now, I think the challenges are a bit of the general ones: passing from a technology to a product. And we believe in CohiTEC there is no use in giving them money to build a product without understanding if that is the right product to do. Because we'll be spending money in a product nobody wants to buy.
So the first thing is look at the technology and understand which products we can create and if they make sense and what is the best route. Then, yes, spend money building a prototype.
So a difficulty is to pass from investigation to a prototype. And this implies not only the technological part but also the part of looking at the market.
Then it terms of financing, we usually say there is money, you just have to look for it. But of course it is always a difficult matter. Because you need to reunite consortiums of investigators usually. And a startup is small, with few resources, and at some point it is torn between the investigation part and the financing part. And sometimes they are focused on the financing and leave investigation behind so the equilibrium is not very easy. Then the team question is also very important. This are very specific companies, that need people that are very involved but at the same time need investigators and this means that there needs to be a balance.
Then another thing is that the discoveries are a small part of a product. To pass from a method that you can sell but the value is residual, to a product. So there is a lot to do besides the science part.

I: What is usually the initial financing of this type of investigation?

ML: Most of the investigation is financed by the "Fundação para a Ciência e Tecnologia" which pays labs and doctorate and post doctorate scholarships and some investigation scholarships. The investigators have investigator areas that they work in,

they win projects join some doctorate students they like and do investigation in that area.

There are investigation centers that apply more to European funds, of the European research council. And then there are rare cases of contract research.

But most of our projects are of basic/applied research that was done in the normal course of the doctorate and that they found something new and think that it could have commercial potential.

Then, usually the next step is that … Or you have some proof of concept financing but this is very rare. For example i3s applied to Norte 2020 and has a small grant. Universidade do Minho as well. Around 20K, not much.

Now there is SME Instrument that has financing that is also for proof of concept but it is quite competitive and hard to get. And these are a lot of money.

But the most common cases are to search for venture capital. But it needs to be special financing because these projects are special. Portugal Ventures sometimes invests, but sometimes says is too soon. Caixa Capital also invests. Change Partners as well, but there aren't many that invest in this initial stages.

I: What do they do then? Do they search financing abroad?

ML: Either they get some investigation money to advance a bit. Or they get venture capital. Or they walk to slow and end up not advancing.

I: Do you think there is room to develop an accelerator only focused in clean tech? Yes, no and why?

ML: The ecosystem has grown a lot. Me and some colleagues have the opinion that we are in a bubble. A lot of accelerators, entrepreneurship is trendy, and Lisbon is also taking advantage of this to mix entrepreneurship and startups and so on. But this will not last forever. And some accelerators are changing their business model because of this. A case is Beta-I, who is now including equity. Because the sponsors and so on, this won't last forever. Because there is a big proliferation. So there is room until the system is cleaned and there are some left that can survive.

Now there is already some accelerators or some initiatives more focused in the energy area. Building Global Innovators, InnoEnergy, Climate KIC… So there are some stuff already. So I don't know. It is good specialization, because there is not the same support you give to a donut company and a clean tech. This is obvious. Now, I don't know in terms of the ecosystem exactly what will happen. And also contests with a part of training. But let see how the ecosystem evolves.

Appendix III: Interview Coding

Challenge	KIC InnoEnergy	TecLabs	COHITEC	BGI	EDP
Passing from Technology to Product	-	”(...) in general I wouldn’t say there are a lot of barriers to enter, there are some maybe in the development of technology ”	”so a difficulty is to pass from investigation to a prototype.(...) and the discoveries are a small part of a product. ”	-	-
Target Market	“(…) fail primary is due to inflexibility (…) to hear what the market is telling them, and wanting to push their idea to the market when the market doesn’t need it.”	-	"Since these are platform techs, (...) that can have many applications, most times the technologies can have applications in completely different sectors. "	”Because of course the idea is there, they may need to do a pivot, which is when you have an idea that can be applied to computers but maybe it’s best to apply it to tablets, so you change it.”	-
Proof of Concept	"Issues with time it takes to get a client to try and then getting them to keep believing in you since there are long testing period"	”this constant validation is extremely important so that we don’t reach the finish line and have something that nobody wants or that isn’t exactly that and having to go back and spend even more money.”	"To validate the technology and make sure that that technology can originate in an interesting product that solves a market need"	“This is good and bad. Here in Portugal EDP has a monopoly so if you can get EDP, then you can reach the whole market. But if you can’t then there is no one else.”	-
Funding	”(...) it implies that my investors also have more availability to finance this kind of, quotation marks, “amusements”. ”	-	"And even though there is a lot of financing now in Portugal, a lot is going to ICT what makes it harder to get financing in this early stages and in industrial technologies. "	"I think in terms of incentives, with investigation scholarships and so on clean-tech is receiving a higher support especially after a Paris Agreement, so there is a lot of pressure for the government to look good in the picture. "	” IoT is a great opportunity (...) other areas are very capital intensive. Even to prototype is a fortune and there is no money for that.”
Business Background	"Usually they are engineers but there are other backgrounds. It lacks sometimes, people with a better business knowledge, with an all-around rounder management education, it sometimes lacks in this type of teams yes."	"It depends on the promoters. Our vision is that if the team is exclusively scientists and tech people there is a very big difficulty in management and management can be anything, including sales. "	"And the mentality of a CEO of this type of company has to be much different. It has to be able to talk with investigators,to pass from the science language to the investors language, to be able to handle this regulatory barriers. "	"This is a very relevant point because the companies that have no management knowledge have already a business plan to follow and besides that they have a mentor that weekly gives his feedback"	And a lot of people always show here with very weak sales skills. And what I normally say is to introduce someone in the team with a sales profile even if it is not an engineer.
Regulatory Aspect	On the other hand, the regulatory aspect that applies to some cases here in clean-tech, is not as heavy has in other industries like for example bio-tech. So despite all, I think that there are industries that are even harder.	"Regulatory Barriers not so strong in cleantech, worse in biotech "	"There is a lot of discussion in the importance of traction, do the MVP, to get a lot of users and sell fast. In our case, all of this takes longer, there is a lot more regulation. "	"We don’t feel there are exactly barriers but we feel that maybe there should be more help. (...) So it is a lot of bureaucracy.”	-
Global Outlook	"The standard is to look immediately to the global market. In fact, we don’t even consider investing in a start-up that has a very local focus. "	-	"Portugal doesn’t count for us. We always want the companies to be international. And usually they start here, and ideally if they can have the investigation part here great. And the startups that we have are based here, even though they have international connection”	-	-
Local Adaptation	"Despite of, in fact, in reality it is easier to start with regional pilots. Start with clients close by that give us feedback so we can do alterations in the product. It’s much comfortable, and cheaper. "	-	"Even though there are some foreign investors, because this is something very based on people and in localization, it makes it harder to get financing more than in ICT also because the ecosystem is different. It is less dynamic.´"	-	-

Appendix IV: Accelerators Analysis

Description of Portuguese Accelerators Analyzed

Building Global Innovators (BGI)

Born in 2010, Building Global Innovators is a deep-tech startup accelerator based jointly in Lisbon (Portugal), with operations in Cambridge, MA (USA). BGI is an integrant part of the MIT Portugal Program and has been actively working with several MIT entities, which include Deshpande Center for Technological Innovation, Sloan and The Martin Trust center for entrepreneurship.

It is directed at startups working on 4 market verticals: Medical Devices & Health IT; Smart Cities & Industrial Technologies; Enterprise IT & Smart Data; Water Economy

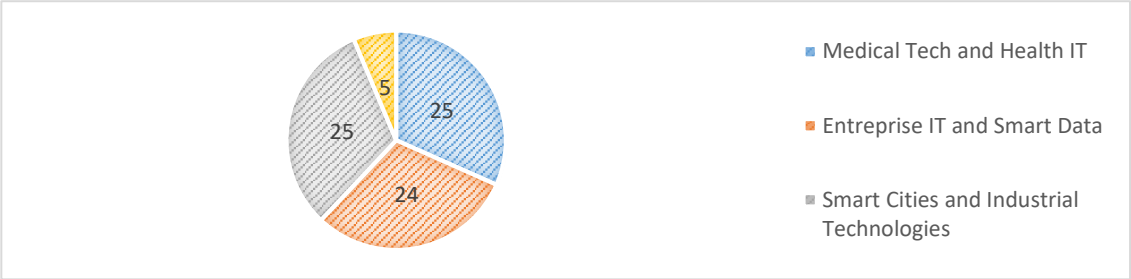
BGI is Portuguese representative in the EIT (European Institute of Innovation and Technology) as well as Climate KIC Networks. BGI launched conjointly with Climate KIC, the Climate KIC Portugal Accelerator and ran its first edition in 2016.

BGI acceleration program runs once every year and takes on in each batch of acceleration up to 20 ventures. The program consists in 2 presence mandatory bootcamps in Lisbon and 1 in Boston, USA. Weekly Meetings with Mentors (who are always investors) to work on the Go-to-market strategy (1 hour meeting per week). It includes a Demo Day in Lisbon (webcasted worldwide) where teams can pitch for investment. BGI also continues to support start-ups in what they call venture phase (up to 5 years after finishing acceleration).

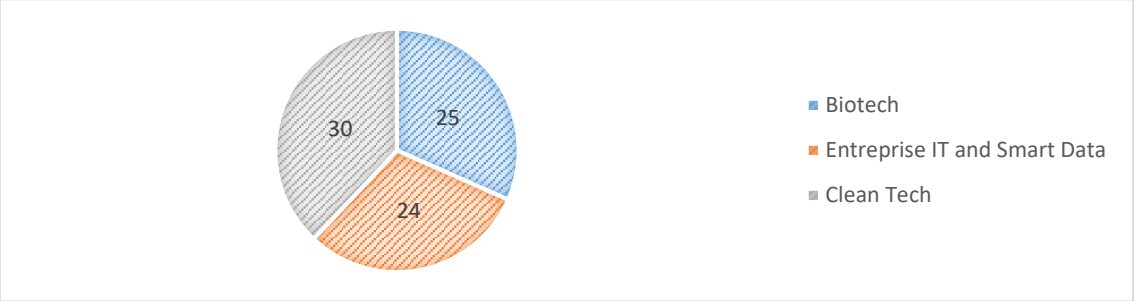
Unique Value Proposition: Industry Unique Focus, US Network- connection with MIT, Global Outlook, Track Record of Proven Results, Quality of Alumni, Partnership with European Institutions.

KPI	Result
Years	7
Applications	918 Applications; 2489 Entrepreneurs
Countries	54 (who applied)
Ventures Accelerated	117
Investment Captured	107€M
Jobs Creation	727 High Qualified Jobs
Active Ventures	85
Survival Rate	73%
Location	Lisbon, Portugal

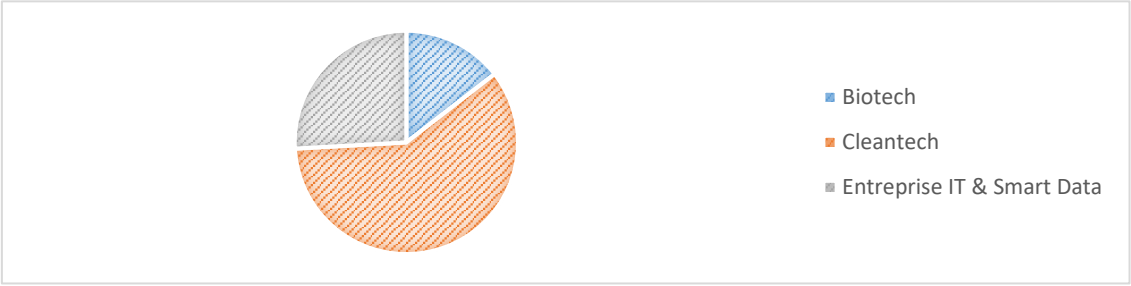
Taking into account **only** the 79 ventures that graduated successfully from the BGI Acceleration Program (listed in BGI's official May 2017 Report), the distribution between the verticals defined by BGI is the following:



When dividing the ventures accelerated by: Enterprise IT & Smart Data, Biotech (Medical Tech and Health IT) and Clean Tech (combining Water Economy and Smart Cities and Industrial Tech):



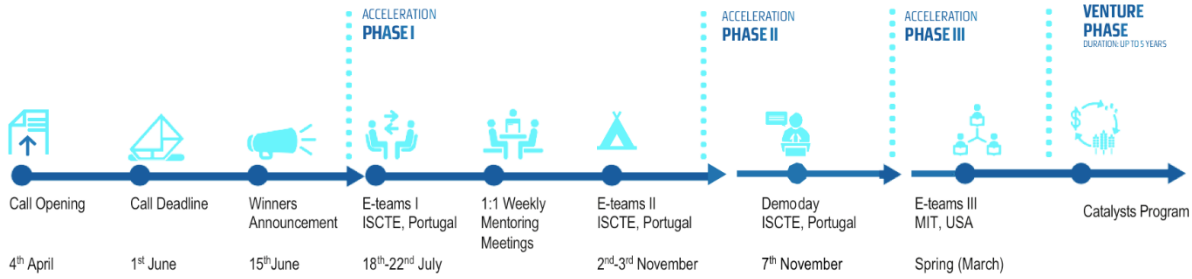
Given this and dividing investment captured by the named 79 ventures, the distribution between sectors is the following:



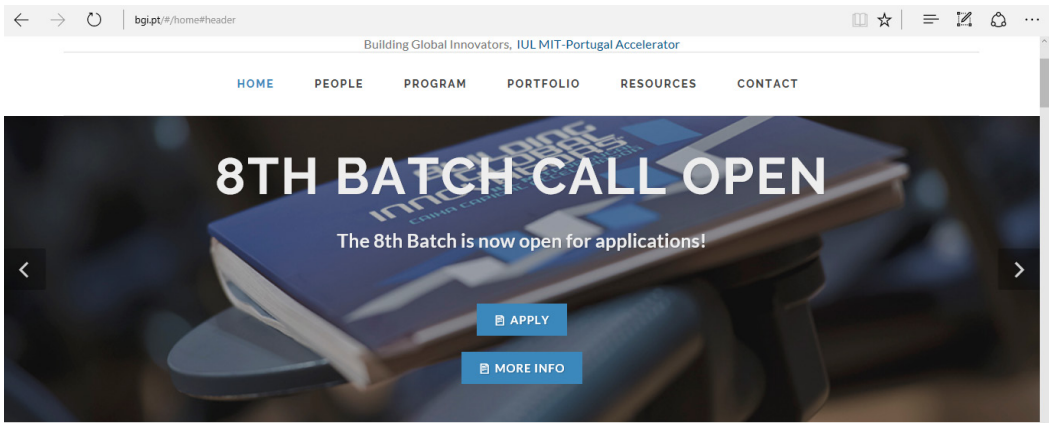
VERTICAL	Investment Captured	Investment per Venture (30 CleanTechs)
Clean-Tech	€50.5 M	€1.7M

BGI Logo:

BGI Acceleration Timeline:



BGI Website Overview:



CohiTEC

The CohiTEC Acceleration Program was born in 2010, founded by COTEC Portugal (Associação Empresarial para a Inovação- Entreprise Association for Innovation).

The program is targeted at university-based technologies, with deep technological component and in a very early stage of development (TRL 1/2/3). It focuses on three main tehcnological areas: biotechnology, life sciences and industrial tecnologies.

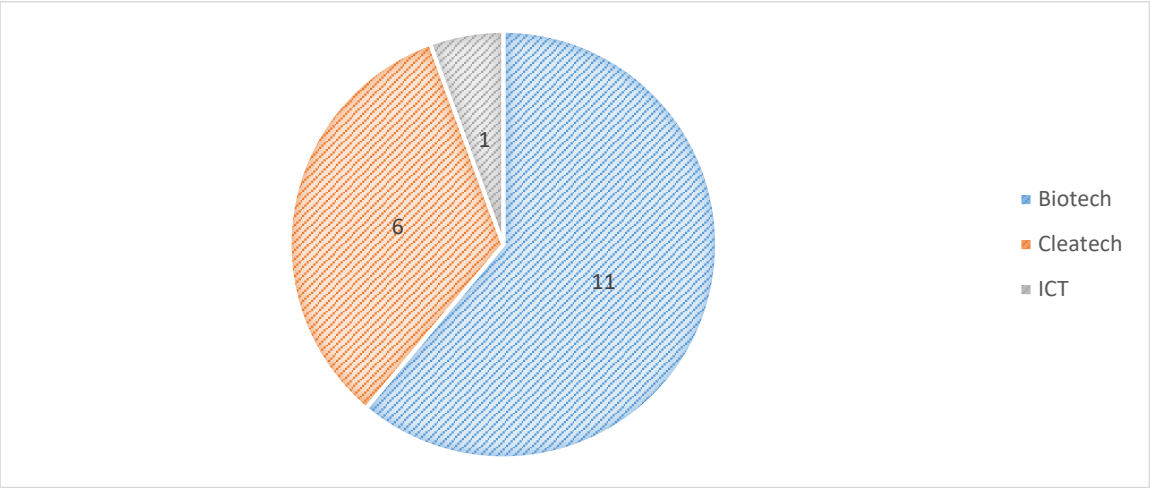
In partnership with Porto Business School and Nova School of Business and Economics, CohiTEC organizes a hands-on training program of 4/5 months between March and July each year. It takes on 6 teams (groups of investigators) per year and provides a training program focused on defining the industry application for the particular technologies. Each of the teams is paired with 2 business non-scientifical mentors and management students and once a week have bootcamps focused at defining their unique value proposition, do Ideation as well as proof of concept with the final objective of defining where and how the technology fits in the market.

The main objective of the CohiTEC program is to fill the gap between university research/investigation and the market, in order to change the way of thinking of investigators so that they can create market-driven innovation. Given this startup creation is not its sole success metric, given that it has a much broader mission as well as harder to measure in terms of performance.

Unique Value Proposition: Early Stage Focus, Experience, Deep-Tech Focus, Network and Connection with Corporations (given that it is an organization composed of corporates)

KPI	Result
Years	7
Applications	-
Countries	1 (Focus in Portugal)
Projects Involved	165
StartUps	35
Location	Porto, Portugal (HQ); Operations in Lisbon, Portugal (Nova SBE)

Distribution of active startups (18) that graduated from CohiTEC in terms of industry vertical:

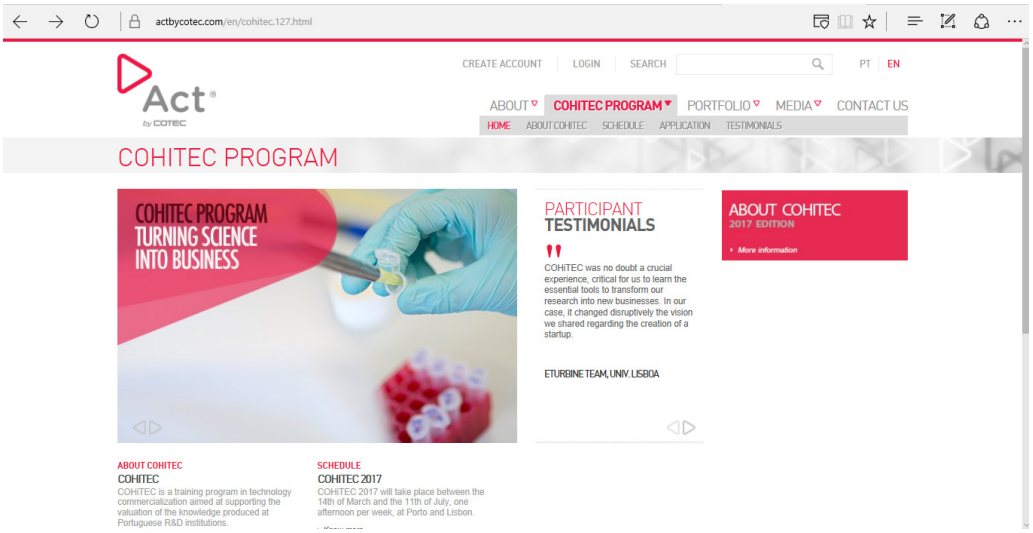


The full list of accelerated ventures together with their respective vertical can be consulted in the table bellow:

StartUp	Vertical
LifeTag	Bio Tech
Charge2Change	Clean Tech
Exogeneous Therapeutics	Bio Tech
InnovCat	Clean Tech
VitaControl	Bio Tech
Biomimetx	Bio Tech
Sea4Us	Bio Tech
Extremochem	Bio Tech
Magnomics	Bio Tech
5ensesinfood	Bio Tech
IstrionBox	ICT
Pharma 73	Bio Tech
Abyssal	Clean Tech
Omniflow	Clean Tech
Thelial Technologies	Bio Tech
Biomode	Bio Tech
Advanced CycloSystems	Clean Tech
CEV- Consumo em Verde	Clean Tech

CohiTEC Logo:

Website Overview:



KIC InnoEnergy

KIC InnoEnergy is a Knowledge and Innovation Community, born in 2012, whose mission is to promote innovation through 6 European co-locations, in the areas of sustainable energy, with the operationalization of the innovation triangle (education, technology and business creation).Given this, the community focuses in 3 main activities: innovation projects, education programs and business creation services.

The main objectives of the program are to: reduce energy costs, reduce environmental impact, increase operational security and increase energy storage capacity.The business creation services part of KIC Innoenergy is what we can commonly refer to as startup acceleration activities.

The organization is headquartered in Holland and started in Portugal with business creation activities in 2014. Portugal is part of KIC Innoenergy Iberia together with Spain.

The program is directed at clean energy startups that can be in a pre-revenue phase, with minimum required TRL of 6 and estimated time to reach the market inferior to two years. The current technology areas tackled in Portugal are: renewable energy, energy storage, smart electric grid, smart and efficient buildings and cities.

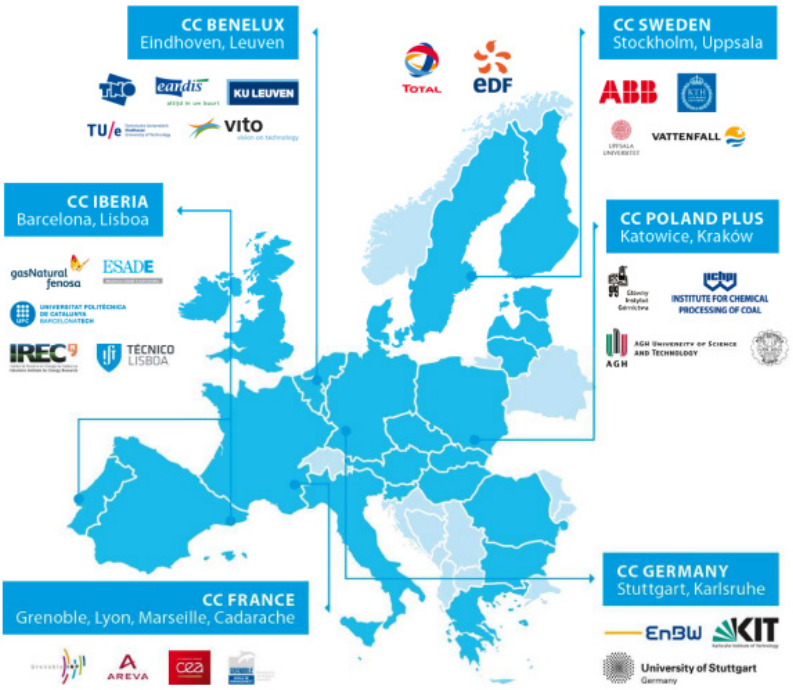
The value provided is through training, networking opportunities, seed capital investment (in exchange of equity) as well as soft landing services in target markets by the startups. The European Network allows a start-up to launch in the co-locations with local support of the incoming KIC, from connecting them with the right people in the ecosystem to providing them office space to work and establish themselves. Another differentiating point is that there is no pre-determined acceleration program, all start-ups needs are access individually and KIC provides a set of tools tailored made for the start-up.

Unique Value Proposition: Access to the whole InnoEnergy European Network, Tailored Services for each start-up (no pre-determined acceleration program), Seed Capital Investment

KPI	Result
Years	3
Applications	-
Countries	1 (Portugal)
Ventures Accelerated	8 (3 Graduated, 5 Ongoing)
Investment Captured	-
Jobs Creation	-
Active Ventures	8
Survival Rate	100%
Location	Lisbon, Portugal (plus 13 other locations in Europe)

KIC Innoenergy Logo:

The 6 KIC Innoenergy European co-locations:



List of Accelerated Venture:
Graduated(3): IsGreen, Pro-Drone, RVE.sol
Ongoing(5): BeOn Energy, C2C New Cap, Eneida, Heaboo Energy, IONSEED

Climate KIC RIS Portugal Accelerator

Climate KIC is is the EU's largest public private partnership addressing climate change through innovation to build a zero carbon economy. As well as KIC Innoenergy it is suppported by the European Institute of Technology and Innovation (EIT).

Climate-KIC RIS Accelerator is an acceleration program that fosters the development of new businesses in the field of the low carbon economy. It does this through the provision of a **service package and grants** for selected participants from the RIS countries. It is run in **collaboration with regional partners**. In Portugal the Climate-KIC accelerator has as leading regional partners, Building Global Innovators (start-up accelerator), Startup Lisboa (startup incubator) and FCT-UNL (University).

The target applicants are cleantech startups (up to 3 years) or breakthrough ideas working in one of the 4 verticles: urban transitions, sustainable production systems, decision metrics & finance, sustainable land use.

The program is usually run in 3 stages, offering specific support packages.

- Stage 1: Fundamentals / Business Model Definition, which provides support for up to 10 business ideas and ends with the definition of the business model and main project characteristics.
- **Stage 2: Business Model Validation - which provides support for up to 8 business projects per main RIS country and ends with the verification of the technical / economic / financial business plan.**
- Stage 3: Delivery / Investor Readiness - which provides support to 2 already established startups and ends with the organization of meetings with investors and / or potential customers.

In Portugal, the Climate KIC Accelerator ran its first edition between October and December of 2016 and implemented only the stage 2 package.
Support and services provided: coaching and mentoring for the development of the project; bootcamps and workshops on issues related to marketing and sales; grant support amounting up to a maximum of €15,000 per start-up / project. In Portugal the acceleration was provided by BGI and consisted in 3 bootcamps, 2 in Lisbon and one in Remini, Italy in the course of 3 months.

Unique value proposition: access to Europe's largest clean tech accelerator network, international network of climate-KIC corporate partners, free mentoring by world experts, grant of up to 15000 euros for business model validation and acquisition of first customers.

KPI	Result
Years	1
Applications	-
Countries	Portugal Focus
Ventures Accelerated	8
Location	Lisbon, Portugal & Remini, Italy

Climate KIC Logo:

Climate KIC Portugal Communication Material:

List of participating ventures in Climate KIC 2016 Accelerator Portugal:

- Birdtrack
- Fibersail
- Issho
- Sensefinity
- Watgrid
- WattIS
- CEM
- PRSMA

EIT Overview

Both KIC InnoEnergy and Climate-KIC, the main clean-tech focused accelerators in Portugal are initiatives by the European Institute of Innovation and Technology (EIT). The EIT is an independent body of the European Union whose main mission is to ”enhance Europe’s ability to innovate by nurturing entrepreneurial talent and supporting new ideas”.
The EIT brings together the ‘knowledge triangle’ of business, education and research to form dynamic cross-border partnerships: Knowledge and Innovation Communities (KICs). The KICs: Develop innovative products and services; Start new companies; and Train a new generation of entrepreneurs.

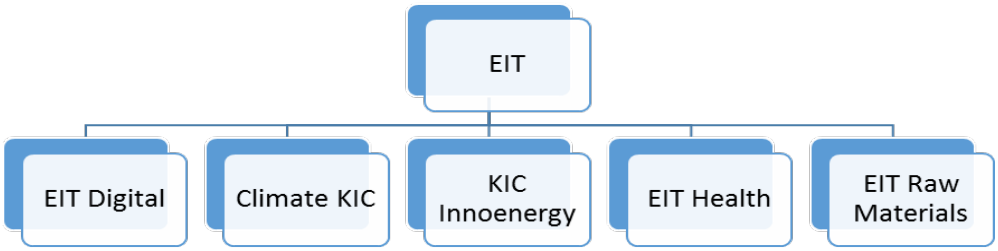
There are currently 6 EIT KICS.

- Climate KIC (adressing climate change challenges)
- EIT Digital (generating world class ICT)
- KIC Innoenergy (tackling sustainable energy)
- EIT Health (improving quality of life for European citizens and sustainability of health and social care systems)
- EIT Raw Materials (ensuring the accessibility, availability and sustainable use of raw materials for the economy and citizens.)
- EIT Food (ensuring a climate-resilient and sustainable global food value chain.)

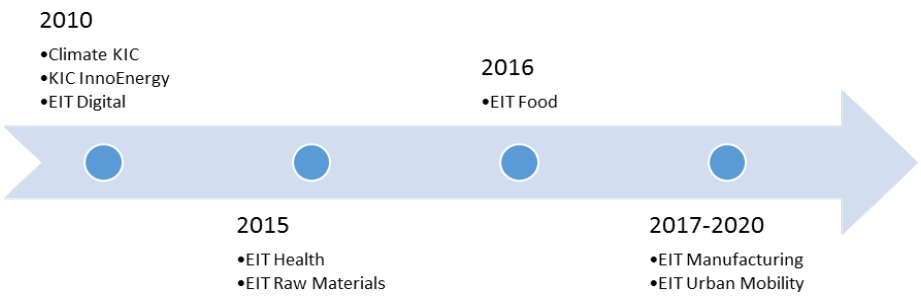
It is envisioned already the birth of two new KICs in the upcoming future.

- EIT Manufacturing (strengthening and increasing the competitiveness of Europe’s manufacturing industry.)
- EIT Urban Mobility (providing sustainable solutions for urban mobility)

EIT Organigram:



EIT Birth of Initiatives Timeline:



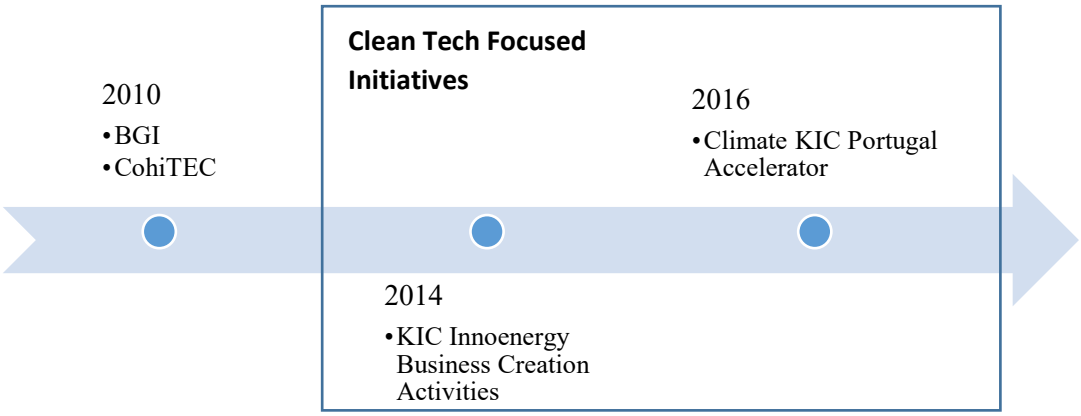


Figure 1- Birth of Clean-Tech Acceleration Initiatives in Portugal

Stage	Concept	Commercialization	Scaling
Description of Stage	Technology Development & Target Markets Identification	Business Model Definition & Market Entrance	Growth & Expansion of the already identified Business Model
Acceleration Focus	Accelerators focus on defining target markets and unique value proposition	Accelerator focus on go-to-market strategy and networking opportunities. Identification of repeatable & scalable business model	Networking Opportunities
Examples	CohiTEC	Building Global Innovators	EIT Digital Scale-Up Accelerator

Figure 2 - Stages of StartUps and Acceleration Focus

Structure Evaluation

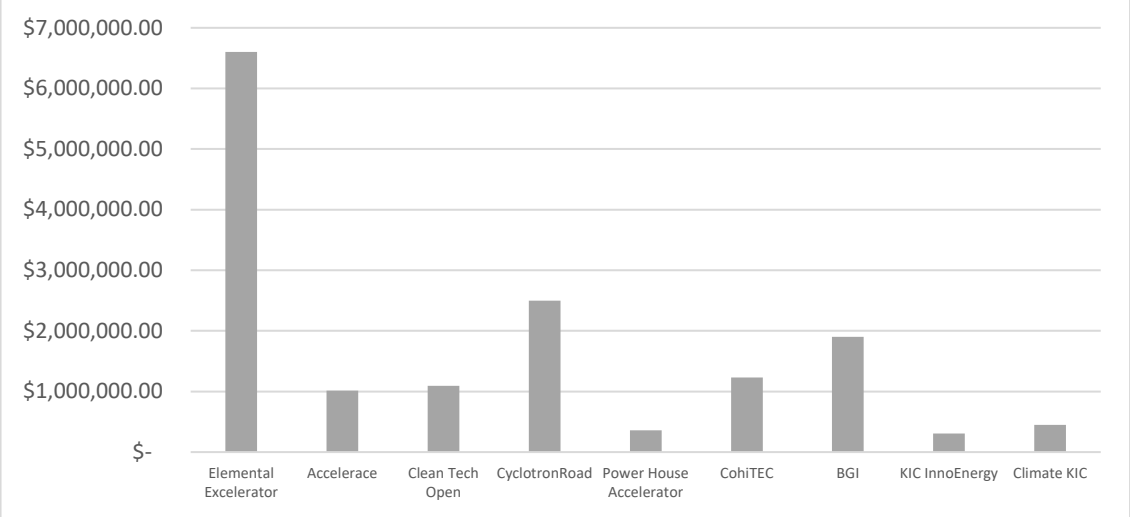
Portuguese Accelerators:

Name	BGI	KIC InnoEnergy	Climate KIC	CohiTEC
Stage	Concept & Commercialization	Concept & Commercialization	Commercialization	**Concept**
Time (months)	9	-	3	**6**
Avg Equity	3%	5%	0%	**0%**
Investment	-	50K€ (Grant)	€15K (Grant)	**-**
Fee	-	-	-	**-**
Batch Size	15- 20	-	8	
Vertical	Smart Cities & Industrial Tech , Water Economy	Energy Related Technologies	Urban Areas, Land Use, Production Systems, Climate Metrics & finance	**Deep-Tech including Clean-Tech**
Cohorts	Yes	No	Yes	**Yes**
Governance	NP Public Org.	NP Public Org.	NP Public Org.	**NP Private**
Revenue	Public Funding	Public Funding	Public Funding	**Associates Model, Fund**
Selection	Competitive	Competitive	Competitive	**Competitiv**

Name	Power House Accelerator	CyclotronRoad	Clean Tech Open	Accelerace Clean Tech Accelerator	Elemental Excelerator
Stage	Concept & Commercialization	Concept	Concept & Commercialization	Commercialization	**Commercializatio n and Scaling**
Duration (months)	6	24	5-6	6	**12-18**
Avg Equity	5%	0%	0%	0%	**4%**
Investment	$ 10K	$500K	$	$	**Up to $1M**
Fee	0	0	$1,200.00	0	**$3000-5000**
Batch Size	3.25	6	100-150	-	**12-15**
Vertical	Solar Software (storage, integration and uptake)	Advanced materials or manufacturing related energy technology	Energy ,Chemicals, Advanced Materials, ICT, Green Building and Materials Transportation Agriculture, Water, and Waste	All Clean-Tech	**Energy, Water, Agriculture, Transportation and Cybersecurity**
Cohorts	Yes	Yes	Yes	Yes	**Yes**
Governanc	FP Private	NP PPP	NP Private	FP Private	**PPP (NP & FP)**
Revenue	Grants, Corporate sponsors & Rental Fees	Public Funding	Sponsors & Fee	Fund (65M)	**Fund**
Selection	Competitive	Competitive	Competitive	Competitive	**Competitive**

Key Performance Indicators Evaluation[12]

Accelerator	Accelerated Ventures	Inv. Captured	Inv. Captured per Venture	Inv. Per Venture (in $)
Elemental Excelerator	53	$350M	$6,6M	$6.6M
Accelerace	265	€240M	€906K	$1013K
Clean Tech Open	1036	$1,135B	$1,1M	$1,1M
CyclotronRoad	6	$15M	$2,5M	$2,5M
Power House Accelerator	13	$4,7M	$362K	$362K
CohiTEC	35	€39M	€1,1M	$1.23M
BGI	30	€50,5M	€1,7M	$1.9M
KIC InnoEnergy	171	€47M	€275K	$307K
Climate KIC	500	€200M	€400K	$447K



12

Both CohiTEC and Accelerace are being evaluated using the numbers of all start-ups accelerated by the programs (not just refering to clean-tech ventures) due to lack of available information. These are therefore used as a proxy of the evaluation of level of quality in adressing the funding challenge. CyclotronRoad Numbers refer only to their Cohort One (composed of 6 Projects). Building Global Innovators numbers take into account only **acceleration graduates clean-tech ventures.** For more information see BGI Description Page in this Appendix.

Analysis of Fit: Challenges & Value Proposition

Accelerators:

Challenges	Accelerace Cleantech	CleanTech Open	PowerHouse	Climate KIC
From Tech to Prototype	**N/A**	**N/A**	Access to Power House Incubator **HIGH**	**N/A**
Target Market	1:1 Mentorship **HIGH**	1:1 Mentorship **HIGH**	1:1 Mentorship **HIGH**	1:1 Mentorship **HIGH**
Proof of Concept	Testing w/Corporate Partners **HIGH**	Networking **LOW**	Networking **LOW**	Networking **LOW**
Funding	Investment opportunities from partners or Accelerace Invest; Internal Fund; Demo Day **HIGH**	Opportunities through Networking & Visibility; Demo Day **MEDIUM**	Cash; Introduction to angel & VC network; Demo Day **MEDIUM**	Cash (Grant) **MEDIUM**
Business Background	Personal business training, mentoring, learning labs and workshops **HIGH**	Hands-On Training **HIGH**	Advisory Services & Bi-Monthly Workshops **HIGH**	Bootcamps and Workshops on Marketing & Sales **HIGH**
Regulation	Connection with Public Organizations **MEDIUM**	Connection with Public Organizations **MEDIUM**	Pro-bono legal and advisory services **HIGH**	Legal Partners **MEDIUM**
Local Adaptation	Denmark Offices; Connection with EU Institutions **MEDIUM**	Runs Programs across all US 50 states- local adaptation in US Market **HIGH**	California Focused **LOW**	European Network **MEDIUM**

Long Accelerators:

Challenges	Cyclotron Road	Elemental Excelerator	Building Global Innovators
From Tech to Prototype	Access to research facilities & expertise in 2 year fellowship **HIGH**	 **N/A**	 **N/A**
Target Market	1:1 Mentorship **HIGH**	Mentorship Track on Validation/Business Model Vetting **HIGH**	1:1 Mentorship **HIGH**
Proof of Concept	Networking **LOW**	DemonstrationProjects in Hawaii **HIGH**	Networking **LOW**
Funding	Connection with Public Organizations; Cash; Demo Day; Network **MEDIUM**	Connection with Public Organizations; Cash; Demo Day; Network; Fund **HIGH**	US Network; Connection with European Institutions; Demo Day **MEDIUM**
Business Background	Mentorship **HIGH**	Mentorship **HIGH**	Bootcamps focused on Business Training, Marketing, Sales and Pitching **HIGH**
Regulation	Connection with Public Organizations **MEDIUM**	Connection with Public Organizations **MEDIUM**	Legal Partners **MEDIUM**
Local Adaptation	US Focus **LOW**	Focus on Hawaii and Asia Pacific **MEDIUM**	US & European Networks **MEDIUM**

Outliers:

Challenges	CohiTEC	KIC InnoEnergy
From Tech to Prototype	Access to Expertise **MEDIUM**	 **N/A**
Target Market	1:1 Mentorship **HIGH**	1:1 Mentorship **HIGH**
Proof of Concept	Networking **LOW**	Networking **LOW**
Funding	Networking Opportunities; Fund **MEDIUM**	Networking Cash (Grant) **MEDIUM**
Business Background	Training **HIGH**	Training & Advisory Services **HIGH**
Regulation	Connection with Public Organizations **MEDIUM**	Access to Legal Services **HIGH**
Local Adaptation	US University Connection **LOW**	European Network; Soft Landing Services **MEDIUM**

Appendix V: Figures and Graphs

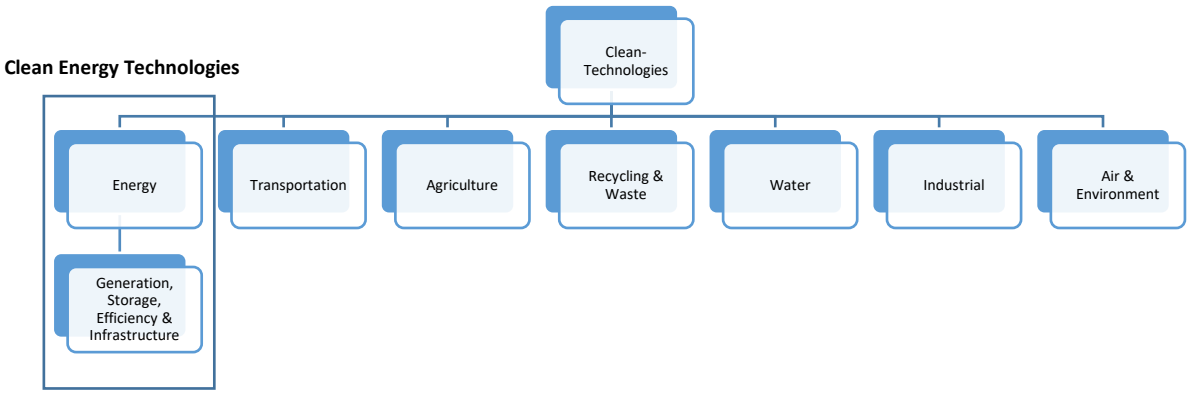


Figure 1- Clean Technologies Scope Definition by the Clean-Tech Group

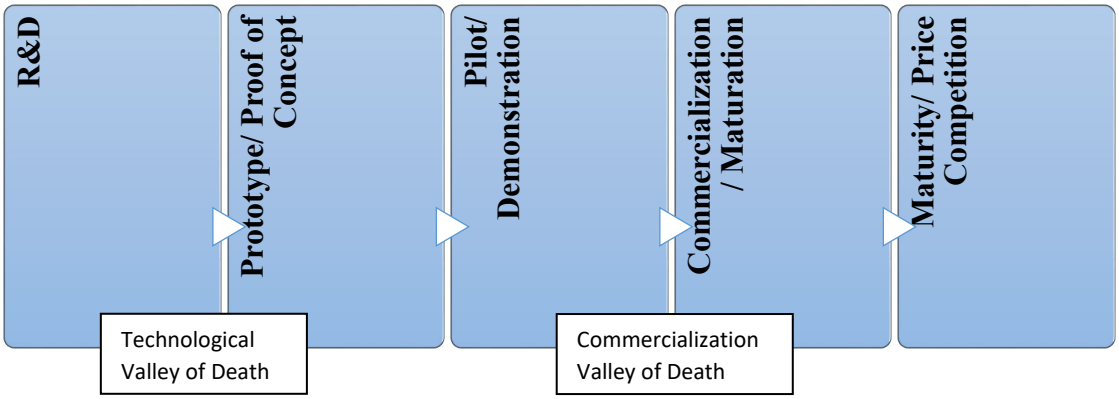


Figure 2- The Energy Innovation Cycle and Clean Tech Valleys of Death

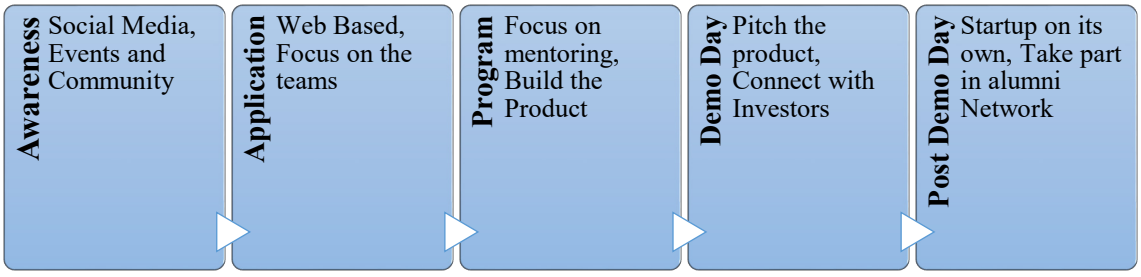


Figure 3- The Acceleration Cycle by Barrehag et.al (2012)

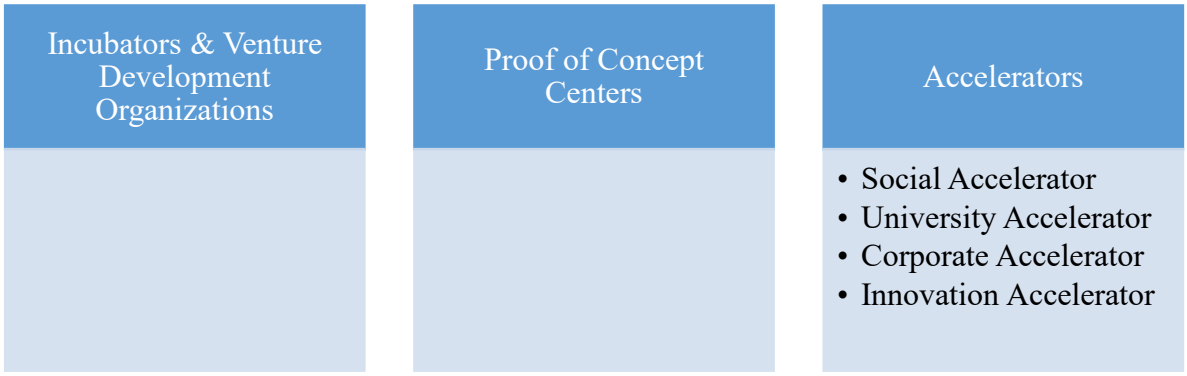


Figure 4- A taxonomy for startup assistance organizations by Dempwolf, Auer & D'Ippolito (2014)

Types of CECA Capabilities	Dimensions
R&D Focused	Strategy: public–private partnership Governance: policy model, technical services model Business model: Incubation model, technical services model Operation: Incubation focused, licensing focused Financing: Large public (government) grant, public–private fund, VC fund
Technology Enabled	Strategy: public–private partnership, specialization Governance: policy-representative model Business model: technical Service model, market linkage model, partnership model Operation: customer focused Finance: public–private fund, Technical services fees
Market Enabled	Strategy: specialization Governance: policy-representative model Business model: market linkage model, partnership model Operation: customer focused Finance: government grant, Services or membership fees
Network Enabled	Strategy: public–private partnership, specialization Governance: representative or hybrid model Business model: partnership model, Market linkage model Operation: customer focused Finance: government grant, membership fee

Figure 5- Types of CECA Capabilities by Malek, Maine & McCarthy (2013)

Variables	Description
Venture Stage	Stage of Accepted Ventures (Concept, Commercialization or Scaling)
Time of Program (months)	Duration of Acceleration Program (measured in months)
Average Equity	Average amount of equity requested by Program
Average Capital Investment	Average Capital Invested by the Accelerator
Program Fee	Fee requested by Program Participation
Average Batch Size	Average Number of Ventures per Batch
Vertical	Accelerator Industry/Challenge Focus
Cohorts	Dummy Variable: Yes or No, in case the program accepts ventures in cohorts (groups) or not
Governance	Nature of Organization comprising Public, Private, Profit or Non-Profit
Revenue Model	How the accelerator sustains. Comprises variables: Program Fee, Corporate Sponsors, Grants, Rental Fees and Internal Fund
Selection	Competitive or Not
Demo Day	Yes or No

Figure 6- List of Studied Variables

General Clean-Tech Challenges	Portuguese Ecosystem Characterization
From Technology to Prototype	Cultural Features: Market Risk Aversion, Slow Decision Processes
Choosing Target Market	Lack of Specialized Capital
Getting Clients for Proof of Concept	Need to Focus on External Market but the Technologies need Local Adaptation
Funding- Technological Valley of Death	Governmental Support mainly due to EU Funding Initiatives
Lack of Business Oriented Backgrounds in Teams	Lack of research directed towards development of clean-techs
Regulatory Aspect	

Figure 7- Results of Semi-Structured Interviews Analysis

Venture Stage	Funding Stage	Description
Concept	Idea/ Pre-Seed Stage	Idea Stage. Helps start-ups go from concept to viable first product.
Commercialization	Seed Stage	Most common focus. Helps start up enter market and validate business model.
Scaling	Series A and Above	Help start-ups scale up to different markets and increase revenue on their already validated and established business model

Figure 8- Stages of Support Description

Key Performance Indicator	Description
Survival Rate	Percentage of Total Ventures Accelerated that are still active post-acceleration
# Companies Accelerated	Total Number of Companies That Have "Graduated" from the Acceleration Program
# Jobs Created	Total Number of Jobs Created by the Ventures post-acceleration
# Jobs Created per Company	$\frac{Number\ of\ Jobs\ Created}{Number\ of\ Companies\ Accelerated}$
Investment Captured	Total Investment Captured by the Ventures Post-Acceleration
Investment Captured per Company	$\frac{Total\ Investment\ Captured}{Number\ of\ Companies\ Accelerated}$
# Exits	Number of Exits

Figure 9- List of Key Performance Indicators Analyzed