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UNIVERSIDADE D
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**HEADING TOWARDS 4TH GENERATION
INCUBATORS
A MODULAR APPROACH FOR STARTUP SUPPORT**

Dissertação no âmbito do Mestrado em Engenharia e Gestão Industrial orientada pela Professora Doutora Cláudia Margarida Ramos de Sousa e Silva e pelo Professor Doutor Luís Miguel Domingues Fernandes Ferreira e apresentada à Faculdade de Ciências e Tecnologia da Universidade de Coimbra no Departamento de Engenharia Mecânica.

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Heading Towards 4th Generation Incubators: A Modular Approach for Startup Support

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Engineering

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*"Shoot for the moon. Even if you miss, you'll land among the stars."
Norman Vincent Peale*

*"No matter how far it is to the top, it's still within my grasp!"
Wukong*

Plvs Vltra.

Acknowledgments

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Resumo

O trabalho desenvolvido nesta dissertação segue um estágio curricular no Centro de Incubação de Empresas (BIC) da Agência Espacial Europeia (ESA) em Portugal, inserido no Mestrado em Engenharia e Gestão Industrial da Universidade de Coimbra. Actualmente, num mundo aparentemente insaciável de informação e acessibilidade, o universo da incubação deve procurar acrescentar mais serviços para acompanhar a evolução da sociedade e dos negócios. É impossível prever o futuro das necessidades exatas das empresas à medida que crescem e mudam a uma taxa muito rápida, o melhor que se pode fazer é tentar avaliar, entender e suportar as suas necessidades.

O principal problema a ser estudado vem da vasta gama de empresas que se podem inscrever no programa de incubação da ESA BIC Portugal. Essas empresas podem estar em diferentes níveis de desenvolvimento e especializar-se em diferentes áreas, o que dificulta o processo de incubação, devido às suas diferentes necessidades que requerem suporte específico em determinadas áreas.

O objetivo do trabalho apresentado nesta dissertação é a conceptualização de um novo processo de incubação para a ESA BIC Portugal. O trabalho desenvolvido foi baseado numa metodologia de Design Thinking para aproveitar a sua filosofia de resolver problemas complexos com base na abordagem pessoal, na definição de ideias e a capacidade de testar facilmente protótipos de incubação. O trabalho final apresenta um novo processo, baseado no fornecimento de um serviço personalizado para cada startup, que vai de encontro com as suas necessidades - uma abordagem modular. Um sistema de dez módulos, que definem as áreas fundamentais de um negócio, foi desenvolvido para ajudar os gestores de projetos a identificar as principais áreas em que as startups estão a ter dificuldades, a fim de desenvolver uma estratégia mais eficiente de modo a ajudar na superação dessas falhas.

No final, é apresentada uma visão geral das atividades da ESA BIC, e os seus resultados são estudados e abordados como um passo em direção às Incubadoras de 4ª Geração.

Palavras Chave: Inovação, Startups, Incubação de Empresas, Avaliação de Startups, Incubadoras de 4ª Geração

Abstract

The work developed in this dissertation follows a curricular internship at the European Space Agency (ESA) Business Incubation Center (BIC) in Portugal, inserted in the Masters in Industrial and Management Engineering of the University of Coimbra. Nowadays, in a seemingly insatiable world of information and accessibility, the incubation universe should look forward to adding more services to keep up with the evolution of society and business. It is impossible to predict the exact needs of future companies as they grow and differ at an untraceable rate, the best one can do is try to assess, understand and support them.

The main problem to be addressed comes from the wide range of companies that can apply for the incubation program of ESA BIC Portugal. These companies can be in different development levels and specialize in different fields, which hinders their incubation process as they have different needs and require exclusive support in certain areas.

The goal of the work presented in this dissertation is the conceptualization of a new incubation process for ESA BIC Portugal. The work developed was based on a Design Thinking methodology to take advantage of its aim to solve complex problems based on a user approach, define ideas and easily test incubation prototypes. The final work presents a new process, based on providing a customized service for each startup, one that fits their needs - a modular approach. A ten-module system, which encompasses the fundamental areas of business, was developed to help project managers identify the key areas where the startups are having difficulties, in order to develop a more efficient strategy to help them overcome such setbacks.

In the end, an overview of ESA BIC's ventures and activities is presented, their results are studied and approached as a step towards 4th Generation Incubation.

Keywords: Innovation, Startups, Business Incubation, Startup Assessment, 4th Generation Incubators

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List of Acronyms

ANACOM Autoridade Nacional de Comunicações

BIC Business Incubation Center

BMC Business Model Canvas

CCDR-C Comissão de Coordenação e Desenvolvimento Regional do Centro

CD Customer Development

ESA European Space Agency

FCT Fundação para a Ciência e a Tecnologia

FNC Finance

HR Human Resources

INV Investment Programs

IPN Instituto Pedro Nunes

IP Intellectual Property and Legal

MKT Marketing

NW Networking

OECD The Organisation for Economic Co-operation and Development

PIT Pitch

R&D Research and Development

TEB Tender Evaluation Board

TOB Tender Opening Board

TTPO Technology Transfer and Promotion Office

UPTEC Parque de Ciência e Tecnologia da Universidade do Porto

VCI Department of Valuation of Knowledge and Innovation

VP Value Proposition

1 Introduction

1.1. Context

Organizations are embedded in a complex context filled with challenges. Faced with this scenario, it is expected that organizations look for differentiating elements in order to provide services and products with a higher standard of quality and competitiveness. To do this, they require human resources with competences in the fields of entrepreneurship and innovation, capable of developing and implementing successful and effective solutions. Several empirical studies indicate that entrepreneurship can be taught, or at least an entrepreneurial education can be encouraged. Universities have a relevant role in training and educating their students with the knowledge and skills appropriate to their current needs (Yeoryios & Barlas, 2014). But which teaching processes are capable of promoting this level of learning? The development of University Incubators has been increasingly adopted as a way for universities to reinforce their mission to respond to the new trends imposed by the current environment with an entrepreneurial attitude and to reinforce their role with the community. To help achieve this mission, an incubation center has the primary mission of transforming its startups and tenants into independent business players by your flexible combination of business development processes, infrastructure and people designed to nurture new and small businesses by supporting them through the early stages of development and change. However, the role of incubators, including the University-based incubators has been evolving. No longer infrastructure or value-adding services and training were enough to satisfy the new trend of companies that appeared in that time, because of that, business incubators focused on providing enhanced access to external players and developing a more proactive network of contacts (Breznitz *et al.* , 2018).

1.2. Motivation and objectives

One has to wonder: *What are the requirements of future companies, knowing that different stakeholders have different needs and objectives? What services should an incubator provide? Is there a 4th generation of incubators in the making?*

To answer these questions, the following work presents a case study of an incubation program, the Business Incubation Center of the European Space Agency in Portugal (ESA BIC Portugal), hosted by Instituto Pedro Nunes (IPN) in Coimbra. As the program prepares for a contract extension and in order to improve the service provided to companies that enter the program, the IPN team responsible for ESA BIC Portugal decided to change its incubation strategy, providing the right and most qualified service for the company in the incubation period.

The main problem comes from the wide range of companies that can apply for the incubation program - not only in terms of different scientific fields but also of age since a newly born company has different needs than an older one. Therefore, a unidirectional scenario would not work - nowadays, companies are too much different from each other and require tailor-made solutions for their problems.

So, for the sake of the internship which lasted from the 4th of February to July 5th, it was proposed to study a new approach, based on providing a customized service for each startup, one that fits their needs - a modular approach.

Initially, the model presents nine startup support “pills” (later renamed modules):

- Value Proposition;
- Business Model Canvas;
- Customer Development;
- Marketing for Startups;
- Finance for Startups;
- Investment Programs;
- Pitch for Investors;
- Intellectual Property;

- Networking for your company.

These nine items were chosen based on the experience of the ESA BIC Portugal Team and modeled by subjects of Innovation and Entrepreneurship courses taught at the University of Coimbra.

The main objective of this work is to validate these support modules, verify if more should be added, and start to conceptualizing the new incubation model - by providing a system that helps the project managers of ESA BIC Portugal identify the key areas that the startups are having difficulties. As such, by being aware of the difficulties faced by its tenants, the staff from ESA BIC can, more rapidly and efficiently, develop a strategy to help them overcome them.

As part of the internship, additional work was developed for ESA BIC Portugal. Mainly in areas in which technologic difficulties were felt, as the team lacked someone with an engineering and scientific background that, in the brokerage and technology transfer fields, could develop and document the space-sector technologies.

The work focused on 3 areas of technology transfer and entrepreneurship support:

- Mapping of Portuguese entities working in the space sector that use space assets in terrestrial or tech-intensive applications, as well as the survey of their related technologies.
- Analysis and technical/scientific support for the commercialization of space technologies in terrestrial context and support in the development of new business models in the "New Space" context.
- Support in the planning, organization, and promotion of events promoted by IPN in the area of innovation and entrepreneurship.

1.3. Framework of ESA, IPN and ESA BIC Portugal

1.3.1. European Space Agency

The ESA is Europe's gateway to space. It was created in 1975 as an intergovernmental organization in order to assure the needs of European countries in space. Its job is to draw the European space program and make sure it is carried through.

Currently, it manages the intellectual and financial assets of its 22 member-states which allows the best resources to be used coherently to achieve the agency's goals. With various facilities around the continent, over 2200 employees and a 5,75 billion Euro annual budget, some of ESA's activities are human spaceflight missions, launching probes and satellites for space exploration, Earth observation, navigation, telecommunications, and astronomy. It also manages and develops launchers, spacecraft, and facilities for space operations.

1.3.2. BIC Network

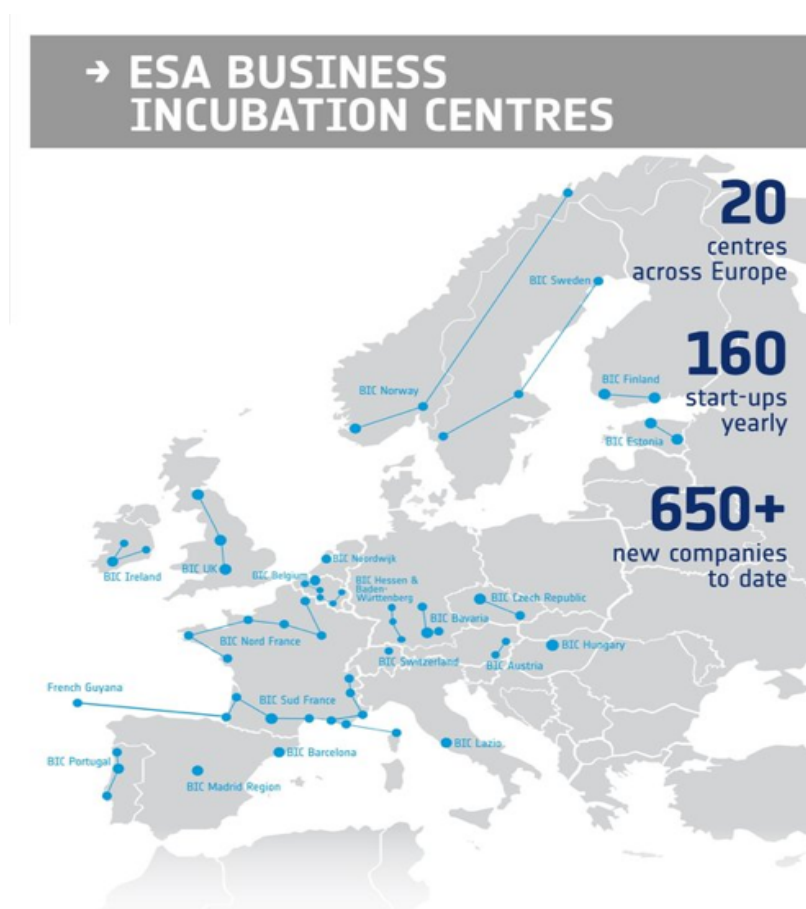


Figure 1.1: ESA BIC Network throughout Europe. Retrieved from: <http://www.esa.int/>

In order to bring space business “down to Earth” and show people that space technology is not light-years away, the Agency's Technology Transfer and Promotion Office (TTPO) created the ESA BIC network in the year 2000. The goal of this network is to help and inspire entrepreneurs to use space technologies in terrestrial businesses,

applications, and markets.

They act on various sectors such as company incubation, patent development, brokerage, and technology transfer among the several players in the network.

Since 2003, more than 20 incubation centers have been created in over 60 cities in 17 countries. More than 700 Startups have been incubated by this program and the numbers keep on growing.

1.3.3. Instituto Pedro Nunes and ESA BIC Portugal

Instituto Pedro Nunes is a private non-profit organization created by the University of Coimbra in 1992 whose main goal is to promote innovation, knowledge flow and technology transfer by making a bridge between the scientific, technologic and academic stakeholders.

IPN's Mission is to contribute to the development of the companies and organizations it embraces by providing a culture of innovation, quality and entrepreneurship among them, based on a strong university/company relation.

This work is done in four primary sectors:

- Research and Development (R&D) - 6 Laboratories used for technology development;
- Training - Provides continuous specialized training in several fields;
- Incubator and Accelerator - IPN has its own award-winning incubator and accelerator for the development of innovative technology-based companies;
- Knowledge and Innovation- This department provides advisory services on innovation.

Department of Valuation of Knowledge and Innovation (VCI) supports numerous activities in IPN, promoting several partnerships with national and international stakeholders thus strengthening the innovation ecosystem. It provides some external services like Intellectual Property advisory, innovation management and hosts ESA's Incubation Center in Portugal since 2014.

The work of ESA BIC Portugal in IPN is divided into 3 action areas:

- Space Brokers;

- Ambassador Platform;
- Business Incubation Center;

Technology Transfer Network - Brokers

ESA TTPO is a network of technological brokers around Europe. Their purpose is to analyze the markets in order to find technological space solutions developed by companies and academia, enhancing new commercial ventures, licensing agreements and expanding their market outreach.

Each broker assesses its market needs and tries to identify technology that has been part of the ESA Space program because the main objective of the TTPO is to facilitate the use of space technology. There is an online platform with all the available technology descriptions and intellectual property that can be accessed by any broker when they find a technological need. After the technologic match is found, a negotiation will occur between the holder and the requestor

Ambassador Platform for Portugal - SMALL ARTES

It is an initiative from IPN and ESA with the support of Fundação para a Ciência e a Tecnologia (FCT) and Autoridade Nacional de Comunicações (ANACOM) that stimulates the submission of realistic and innovative ideas using Satellite technologies like Satellite Navigation, Communications, and Earth Observation. The selected applications will receive a grant up to 25.000 Euro in a co-funding basis up to 50 % of the total project cost.

ESA BIC Portugal

ESA BIC Portugal is a program managed by IPN in collaboration with ESA, FCT, Parque de Ciência e Tecnologia da Universidade do Porto (UPTEC) and DNA Cascais. It was launched in late 2014 and its 5-year goals are to support 30 Startups by 2020, create 240 high tech jobs and raise at least 6.5 million Euro. It represents a total investment in Portugal of 1.950.00 Euros in 5 years. Regarding incentives for startups,

the budget is 1.500.000 Euros, and for startups in the Portuguese Centro region, it can be roughly assumed that the support will total about one third of this budget.

The work developed by this dissertation will focus on this specific program.

1.4. Structure of the Dissertation

This dissertation is organized in 5 Chapters. The first one being the present introductory and contextual remarks. The second chapter is focused on the Literature Review of topics such as Innovation, Startups and Business Incubation, which have the utmost importance in order to understand the work developed by this dissertation. The third chapter consists on the approach to the case study, the methodology used and the description of the steps that were taken in its development. The fourth chapter introduces the outcomes of the work, presenting and explaining the mechanism of assessment of the startups' needs. The fifth and final chapter contains the conclusions, recommendations, and limitations of the work developed, in addition to the future work that can be carried out as well as any additional comments to be made about this dissertation.

2 Literature Review

Every practical work needs a good theoretical basis to justify the assumptions made. This chapter aims to explore the concepts used for the development of the work. It provides an overview of the concepts of Innovation, Startups and Business Incubators. The detailed analysis of these concepts allow for a better understanding of the whole scenario, allowing to critically analyze any statement made throughout the upcoming chapters.

2.1. Innovation

Innovation is a concept with many definitions in the business and technological world. Damanpour (1996) says that a general definition of innovation can be “the development of activities in a different way from that used in an organization and to take initiatives to improve products, processes or procedures, increasing their value and performance.”

The Organisation for Economic Co-operation and Development (OECD) (OECD & Eurostat, 2018) says that “*an innovation is a new or improved product or process (or a combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).*” The term “unit” is used to refer the actors responsible for the innovation. It can be used to describe institution units in any sector, from households to large multinational technological firms.

There is still an important concept of two interpretations that exist on the innovation process that is worth mentioning in order to prepare the ground for future work. These are based on Chesbrough (2003) concept of innovation management model and are called Open Innovation and Closed Innovation.

Chesbrough (2003) presents six principles so that a comparison between both is possible.

Table 2.1: Principles of Closed and Open Innovation. Adapted from Chesbrough (2003).

Closed Innovation	Open Innovation
All the smart people work in our organization.	Not all smart people work in our organization.
To profit from R&D we have to discover, develop and supply everything ourselves.	External R&D can create value for our organization.
Only if we discover it will we manage to get it to market first.	Internal R&D is needed to grasp that value.
If our organization is the first to commercialize an innovation, we will beat our rivals.	We have to be involved in basic research to benefit from it, but the discovery does not have to be ours.
We have to be involved in basic research to benefit from it, but the discovery does not have to be ours.	If we make better use of external and internal ideas and unify the knowledge created, we will win.
If we have full control over the innovation process our rivals will not be able to profit from our innovative ideas.	We should optimize the results of our organization, combining the sale or licensing of our innovation with the purchase of external innovation processes whenever they are more efficient and economic.

In sum, the author sustains that organizations that Open Innovation consists in the alignment of an organization’s internal and external strengths to produce a successful result that creates added value for the institution. On the other hand, Closed Innovation is based that, in order to succeed, a company needs to create the value all by itself and to adopt a self-centered and independent position.

According to the Oslo Manual, OECD & Eurostat (2018) also has two interesting definitions to further develop the scope of innovation. These are:

Innovation activities - which includes all of the developmental, financial and commercial activities that are undertaken by a firm that are intended to result in innovation for its own.

Business Innovation - consists in a new or improved product or business process that is considerably different from the firm's past products or processes and that has been brought into use by the firm.

These terms will allow the understanding of innovation activities.

2.1.1. Innovation Activities

In midsts of the 20th Century, the Austrian economist Joseph Schumpeter, widely known for introducing the concept of "Creative Destruction" in Economics, considered entrepreneurship with a specific emphasis on innovation. (Schumpeter & Opie, 1934)

In his view, innovation deals with:

- new products;
- new production methods;
- new markets;
- new forms of organization.

Matching Schumpeter's view with more recent developments provided by the OECD & Eurostat (2018) which point out eight types of activities firms can initiate in order to reach innovation. These are:

1. Research and experimental Development (RD) activities;
2. Engineering, design and other creative work activities;
3. Marketing and brand equity activities;
4. Intellectual Property (IP) related activities;
5. Employee training activities;
6. Software development and database activities;
7. Activities related to the acquisition or lease of tangible assets;

8. Innovation management activities.

Following the line of thought, it is only logical that after studying the innovation activities we'll look forward to the different types of innovation and what can be retrieved from their concepts.

2.1.2. Types of innovation

As it is such a comprehensive idea, (Lundvall, 1992) believes that the concept of innovation in technological companies as "*... on-going processes of learning, searching and exploring, which result in new products, new techniques, new forms of organization and new markets*". Of which he considers:

Product Innovation - It consists in a new idea, product or service that can be developed by the company. Most of the time occurs when the company suffers structural changes or wants to invest in new markets or unexplored areas of technology.

Process Innovation - It can be the adaptation of the company's production plans, the implementation of new infrastructure or the adoption of new technologies in the creation process of a product.

Organizational Innovation - It is about new strategies in the management part of the company, based on its structure, communication, job allocation and other formal interactions between people in an organization.

Market Innovation - Involves the exploration of new markets, investors and customers as well as the implementation of new strategies to improve retail segments.

The author states that all of these domains are connected with each other as it can be seen in Figure 2.1, and that innovation is a broad concept that interlinks different sectors in an organization, deeming their dependency with each other essential for a successful business.

Keeley (2013) created a framework, as shown in Figure 2.2, that divides ten types of innovation into three categories: Configuration, Offering and Experience. The author believes this framework is useful for companies to structure and diagnose the innovation they are working on and to analyze existing competition. The system presented is not a process timeline, so there is no sequence or hierarchy amongst the types of innovation, which allows to focus on any type present on the framework.

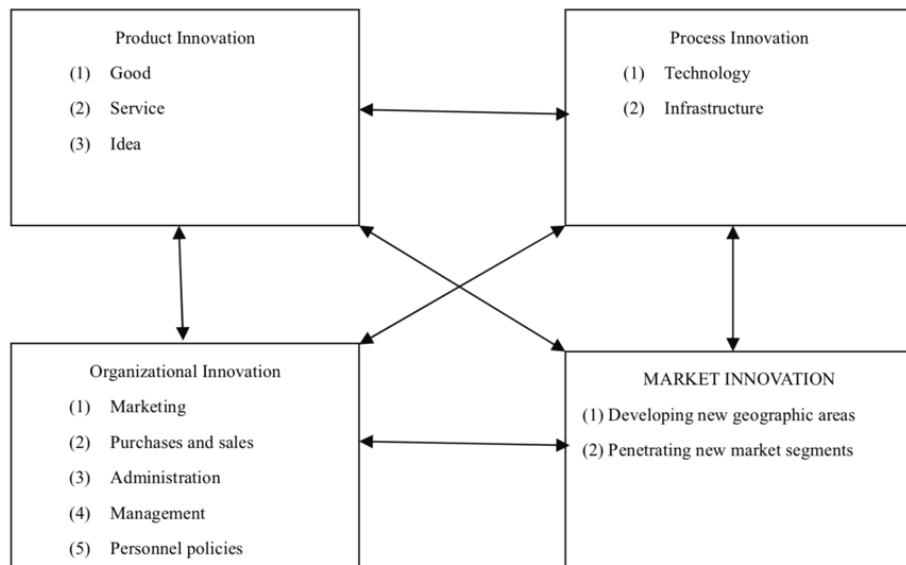


Figure 2.1: Domains of the concept of Innovation. Adapted from Lundvall (1992)

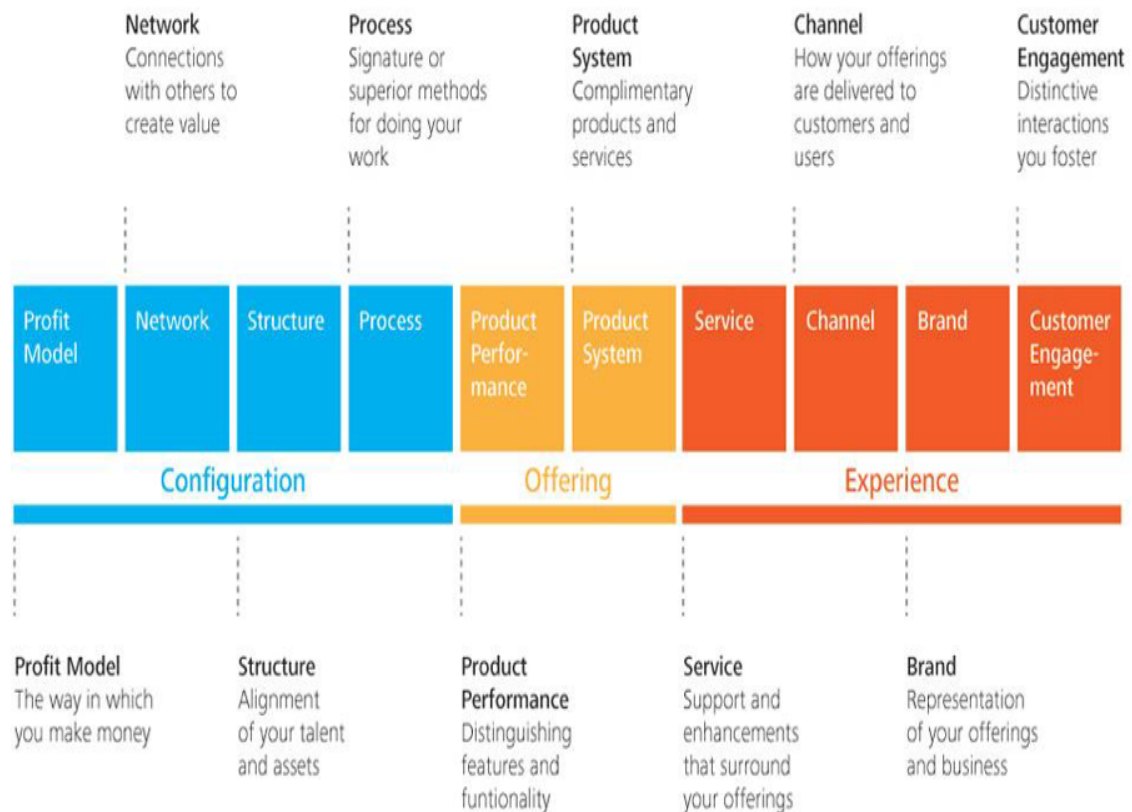


Figure 2.2: 10 Types of Innovation. Retrieved from Keeley (2013).

The author asks some rhetorical questions while describing and providing details of the ten types as:

- **Profit Model** - it is how you make money. Innovative profit models - in order to succeed - must align with the firm's strategy. *"Does the company make money in ways that are different from competitors or industry norms?"*
- **Network** - it is how you connect with others to create value. Network innovations are a great way to thrive by taking advantage of other companies biggest strengths. *"Has the company formed any unusual partnerships - for example, with firms that seem unrelated to its current business, or with competitors?"*
- **Structure** - it's how you organize and align your talents and assets. Structure innovations are focused on bringing the best possible ways for a firm to organize its internal resources - hard, human or intangible - so that it can bring value to the firm. *"Does the company have a unique or unusual organizational structure?"*
- **Process** - it's how to use signature or superior methods to do your work. Innovative processes are new activities, processes, techniques or practices which allows a company to make its products in a different way. *"What is the company uniquely skilled at doing or delivering across products, services and platforms?"*
- **Product Performance** – it's how distinguished features and functionalities are developed. Innovation in this area allows companies to address the value, features and qualities of their offerings so they can develop new products or improve/update existing ones. *"Do the company's products possess unique features and functionality that captivate customers?"*
- **Product System** - it's how you can create complementary products and services. It includes extensions to existing products and service combinations that allows to build innovative ecosystems and attract customers. *"Does the company make multiple products that connect with one another in unique ways?"*
- **Service** - it's how you support and amplify the value of your offerings. Its goal is to make a firm's product easier to use by providing assistance and support throughout the customer journey. *"Has the company implemented website, help*

lines, or other methods that highlight additional product features or applications or that make it easier to use its services?”

- **Channel** - how to deliver your offerings to customers and users. Although it may vary from industry to industry, channel innovations are extremely important to connect to the end users of the product. *“Does the company use different channels in a complementary way?”*
- **Brand** - it's how you represent your offerings and business. Brand innovations are crucial to establish a well established, strong and recognizable trademark. It's not just a marketing campaign or public relations strategy, but a way for the firm to express their image and connect to their customers. *“Do the company's customers and users see themselves as part of a distinct community or movement centered around the brand?”*
- **Customer Engagement** - it's how to foster compelling interactions. It's all about the connection a firm has with the customer. Great customer engagement is the one that incites and awakens deep feelings among the users of the product. *“Do customers talk about how a product or service has become part of their lives?”*

Keeley (2013) concludes, after analyzing the framework and the description of the types of innovation, that the left side of the framework is more internally focused and far from the end users - when you move to the right - the types grow into a more customer-centered approach.

Authors like (Keeley, 2013; Chesbrough, 2003; Lundvall, 1992) and even entities like OECD & Eurostat (2018) all label the concept of innovation as very broad and ambiguous. They also agree that it is of utmost importance for a company or institution, to have the different types of innovation - to be applied in the organizational, services or product level - because it will promote its growth and improve their chances of success.

At a first glimpse, it is possible to match some of these topics with the proposed modules to be studied and developed ahead, which further deepens the connection between successful business developing and incubation.

2.2. Startups

According to Blank & Dorf (2012), *“a startup is a temporary organization in search of a scalable, repeatable, profitable business model”*, in other words, it’s basically a premature company that is still trying to figure out how to succeed in the business world.

Ries (2011) defines the startup concept as *“a human institution designed to create a new product or service under conditions of extreme uncertainty”*, he also admits that the goal of a startup is knowing the right thing to build - has to be the thing customers want and will pay for - as quickly as possible.

Osterwalder *et al.* (2014) consider that the main challenges faced by a new venture are the management of investors, the proof of added value in a limited budget and the risk of running out of money. This differs from the challenges of already established organizations like the risk aversion, to overcome rigid and slow processes along with the structure of the chain of command and the tough access to existing resources.

2.2.1. Types of Startups

Blank & Dorf (2012) state that a startup cannot be considered a smaller version of a big company, in fact, they are different in every possible way - from goals to measurements, number of employees and organizational culture. Their employees and executives need to be *“comfortable with uncertainty, chaos and change”*, actively searching for repeatable and scalable business models, eager to learn and venture into unexplored territory and be comfortable with failure, when it leads to knowledge.

The authors propose two different types of startups:

- **Scalable Startups** - are the result of the work of traditional entrepreneurs who have strong “change the world” Vision and believe their company will be very successful. They are characterized as being highly scalable and may reach high revenue streams when In their inception, most of them will look for their Business Model and are seeking rapid expansion. This is the most common type found in innovation clusters and incubation centers.
- **“Buyable” Startups** - as a result of the low cost in the development of mobile and web services, these new type of startups can fund themselves and develop

their products all alone. They are “happy to be acquired” by larger companies, who not only are interested in the startup’s business and services but as well in the people and the talent that are behind them.

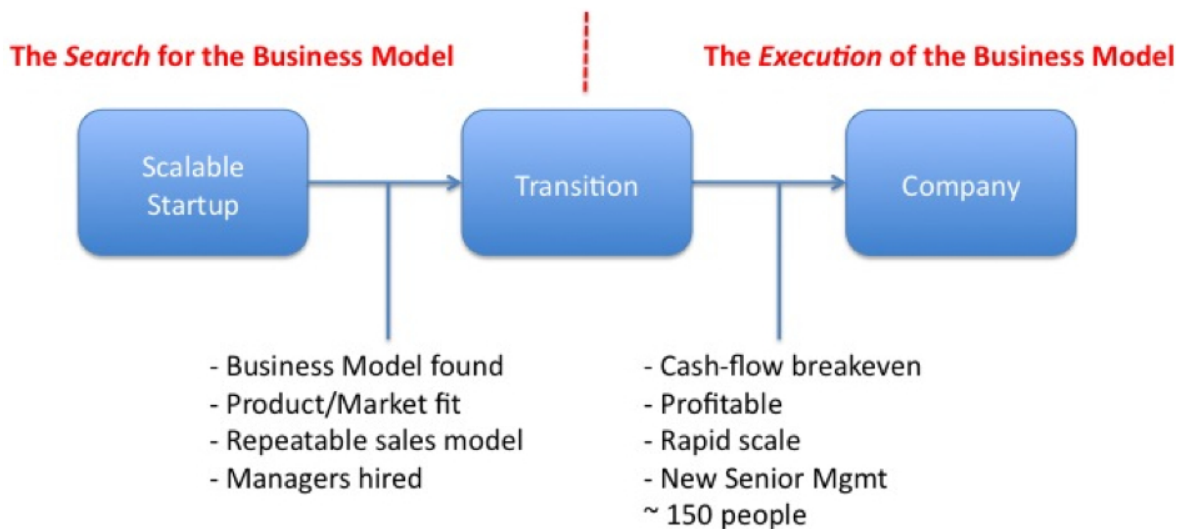


Figure 2.3: Scalable Startup. Adapted from Blank & Dorf (2012)

The Innovazione (2017) report also divides the startups in terms of age, from youngest to older, as **Standups, Startups and Scaleups**, each of them with different needs and services requirements.

2.2.2. Startup Needs and Difficulties

Before studying the incubation services it is important to understand what are, in fact, the needs of startups.

The Board of Innovation’s Investment Guide Lewis L. T. (2018), provides a good overview of the differences of the weaknesses and strengths of a startup as it can be seen in Table 2.2. These are aligned with Blank & Dorf (2012) ideas and philosophy that startups must use their unique strengths, such as a quick adaptation to the external environment, the ability to take risks and the chance to create new ideas, which may lead to a rapid business growth.

A really interesting study was made by CBInsights (2018). In order to study the *post-mortem* causes of startups, this Institution analyzed the situation of 101 failed startups and, though there is rarely one reason for a single startup’s failure, they identified a pattern on their stories and present the following Top 20 ones.

Table 2.2: Weaknesses vs Strengths of startups. Adapted from Investment Guide Lewis L. T. (2018)

Startup weaknesses	Startup Strengths
Difficulties in accessing new markets.	Organisational agility.
New to market.	Creativity & new ideas.
Limited workforce.	Challenge the status quo.
Lack of resources and partners.	Versatile environment.
Need of extra resources to scale.	Highly motivated teams.
Lack of money.	Potentially rapid growth.
Lack of visibility.	Willingness to take risks.

1. No market need;
2. Ran out of cash;
3. Not the right team;
4. Get outcompeted;
5. Pricing/Cost Issues;
6. User un-friendly product;
7. Product without a business model;
8. Poor Marketing;
9. Ignore Customers;
10. Product mistimed;
11. Lose focus;
12. Disharmony among the team;
13. Pivot gone bad;
14. Lack of passion;

15. Failed geographical expansion;
16. No investor interest;
17. Legal Challenges;
18. Didn't use network;
19. Burn out;
20. Failure to pivot.

The outcomes of this study are of extremely importance not only because they provide exact topics that lead to the startups' failure, but because it is also identifiable a clear distinction of areas/fields within the 20 reasons that may allow to further develop the modular work.

Now that a clear idea on the startups' needs is available, let's move on to the work done by the Business Incubation Centers and what is their role in supporting the tenants, by making sure these difficulties are overcome.

2.3. Business Incubation Centers

Business incubation started in the '50s when the world's first incubator - inside an old factory - opened doors in New York. However, it was only by the '80s and '90s that authors like Allen & McCluskey (1991) started writing early definitions as "*an incubator is a facility that provides affordable space, shared office services and business development assistance in an environment conducive to new venture creation, survival and early-stage growth*".

More recently the United Kingdom Business Incubation (UKBI, 2009) highlights the help business incubators give to startups as "*Business incubation is a unique and highly flexible combination of business development processes, infrastructure and people designed to nurture new and small businesses by supporting them through the early stages of development and change*". In another view, Dichter *et al.* (2010) states that incubation is "*is a process which tends to be activated whenever there is a need to support entrepreneurs in developing their own business. This process, or parts of it, is*

put in action when there is an entrepreneurial need to develop their business idea and transform it into a viable and sustainable activity".

Nonetheless, there is still no globally accepted definition of business incubator nor of its services, efficiency measures or key success factors. Theodorakopoulos *et al.* (2014) conclude that different stakeholders have different needs and objectives, that is why it is so hard to determine a specific set of indicators to measure the work of incubators.

2.3.1. Services provided by incubators

An incubation center has the primary mission of transforming its startups and tenants into independent business players (Prasetyawan *et al.* , 2017). For this process to succeed it is important to state and do a literature review of the general factors and services provided by the incubator to its tenants.

Abduh *et al.* (2007) after an extensive academic review, stated that more than 65% of the incubators studied provide:

1. Logistical facilities with office space and internet connection;
2. Networking;
3. Business planning;
4. Funding support;
5. Marketing advice;
6. Financial advice;
7. Secretary services;
8. Pre-incubation programs.

Scaramuzzi (2002) in her report for the infoDev Program asserted that an incubator should provide the following services:

1. **Facilities** *"The offer of modular and inexpensive space and facilities. Optimize the use of common space to foster informal networking among companies."*

2. **Professional services.** *“An offer of professional advice, counseling and mentoring at no or very reasonable cost. Some incubators, especially in the U.S., offer qualified resources to join the client’s board of directors, until a ‘formal’ one is created by the company after graduation.”*
3. **Networking opportunities.** *“Organization of seminars, forums, and events facilitating contacts and networking among companies located both inside and outside the incubator.”*
4. **Access to capital.** *“This is often perceived as one of the most valuable services provided by incubators. Equity capital generally comes from venture capitalists, business ‘angels’, corporate investors, or public funding programs.”*
5. **Networking.** *“Creation of support mechanisms and partnerships to encourage cooperation of incubator clients with universities, corporations and the government.”*

In the end, in order to understand the whole incubation ecosystem, it is necessary to comprehend all of the knowledge, processes, relationships and services provided. These services, shall be further developed in this work, as they match the IPN’s capabilities to support startups.

2.3.2. Stages of incubation

As a process like any other, the incubation process is divided into stages. Most of the institutions that were studied (UKBI, 2009; Dichter *et al.* , 2010; Davies, 2009) all agree on the existence of 3 main separate stages.

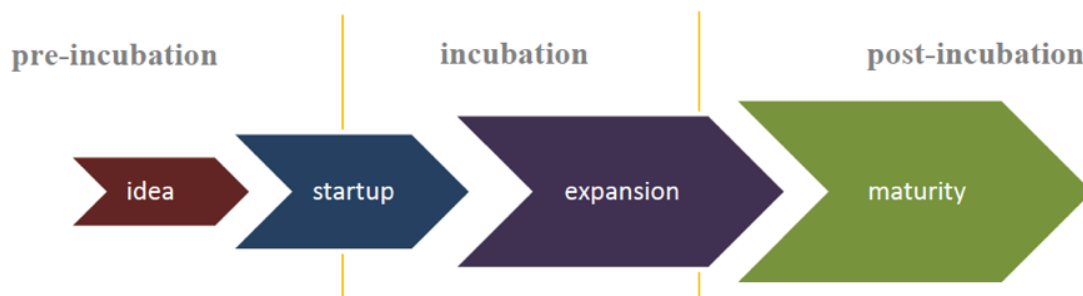


Figure 2.4: Incubation stages following the startup lifecycle. Retrieved from Davies (2009)

Pre-incubation is the stage where all the activities needed to support potential upcoming entrepreneurs and business ideas to apply for an incubation program are implemented. It may start with the assessment of the business idea and the innovation within it, and can provide guidance for defining the Value Proposition and Business Model of the applicant.

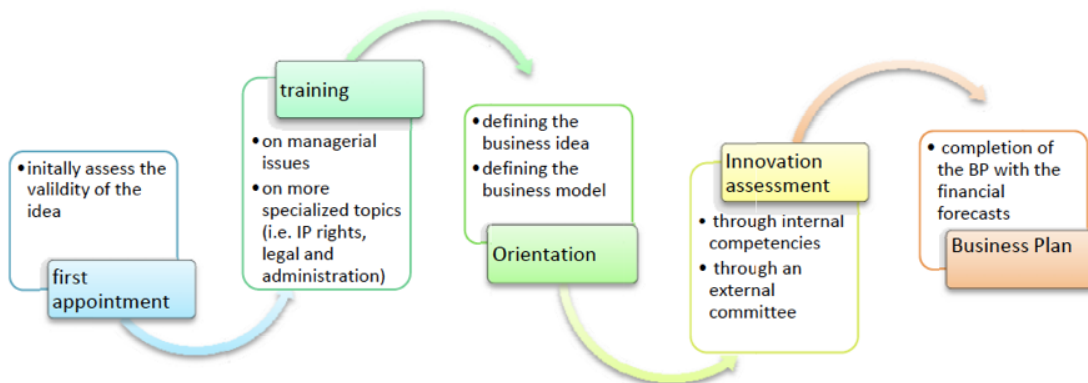


Figure 2.5: Pre-incubation services. Retrieved from Dichter *et al.* (2010)

Incubation goes from the start-up creation to the expansion phase. It gathers all the activities necessary in order to develop the startup into maturation and becoming a successful, self-sustainable company. During this time, the incubator should offer access to finance, training and coaching for entrepreneurs, as well as to networks of potential business and technology partners, office space and, in some cases, access to fully equipped laboratories, workshops, and prototyping facilities.

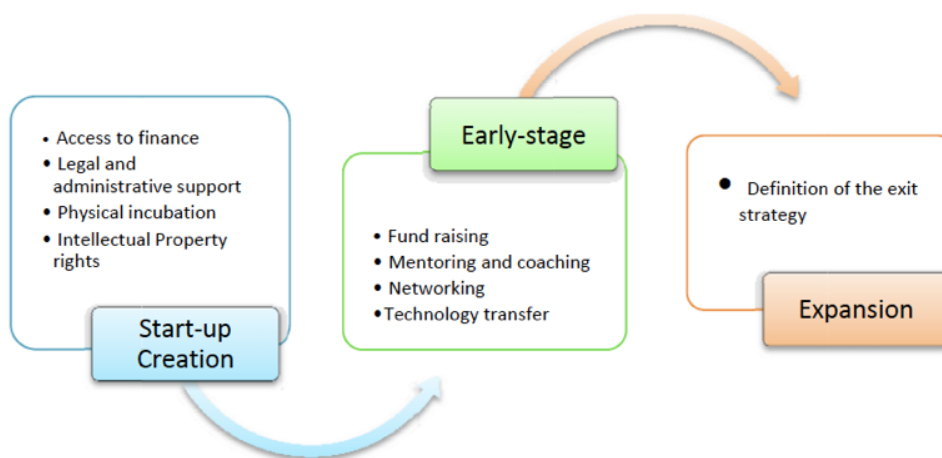


Figure 2.6: Incubation services. Retrieved from Dichter *et al.* (2010)

Post-incubation. This stage covers all activities made after the startup achieved a

certain maturation stage that allows continuing its operations without external support. In this stage, it is really important to measure the success indicators and to guide it towards the future. Some indicators provided by Dichter *et al.* (2010) are business development, innovation diagnostics, technology commercialization, and international support.

Innovazione (2017) provides an interesting overview of the innovation services provided by an incubator, matching 3 types of support by the incubator - as **Soft support**, **Physical infrastructure** and **Funding** - to the different growth stages of a startup.

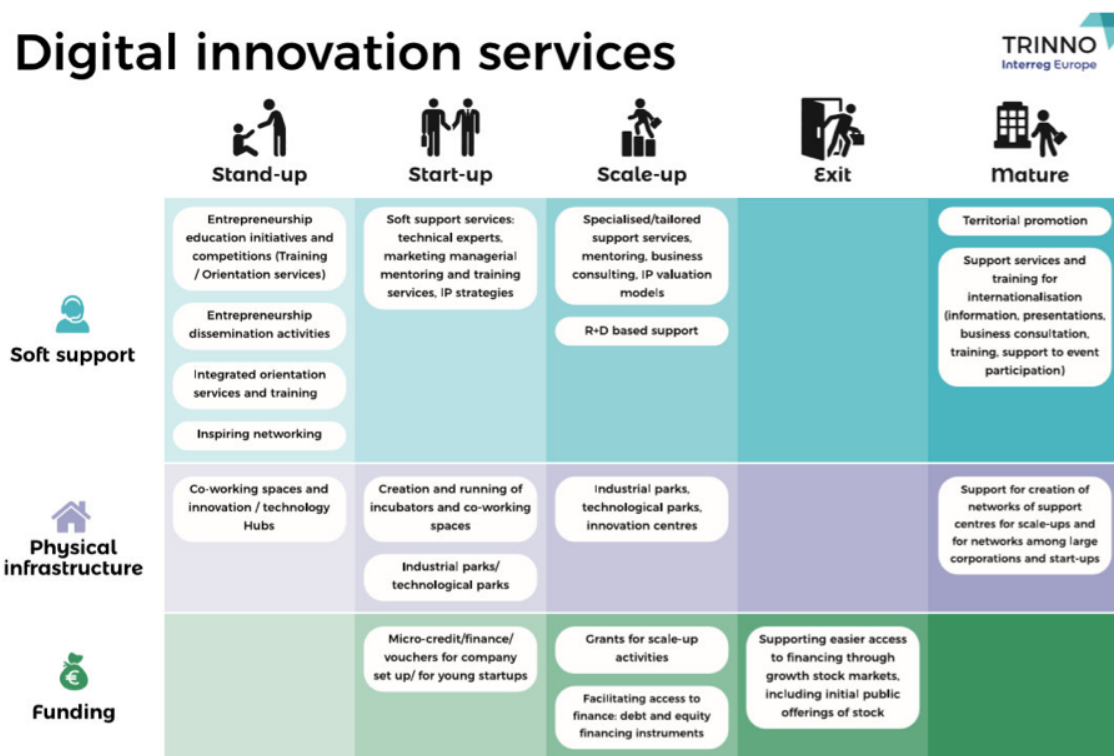


Figure 2.7: Small business support ecosystems and services provided. Retrieved from Innovazione (2017)

This overview of the different stages of incubation, as well as some examples of services provided, helps to frame the work of an incubator and how it acts according to the different needs and age of the startups, which is one of the main topics addressed in this work.

2.3.3. Key factors in Business Incubation

Measuring indicators is essential to ensure that the objectives of the incubator are being achieved, services provided are being done properly, to determine what works or not and why, and also to continually improve the performance of the incubator

In order to maintain its activities, to ensure a high-quality service and sustainable work, an incubator requires indicators that measure its success. Following Smilor & Gill (1986) study on American incubators more than 30 years ago, most of the literature follows their results. They identified 10 critical success factors in business incubation, of them, being:

- on-site business expertise;
- access to finance and capitalization;
- in-kind financial support;
- community support;
- entrepreneurial networks;
- entrepreneurial education;
- perception of success;
- selection process for tenants;
- ties with a university;
- concise incubation program with clear policies, procedures and milestones.

Theodorakopoulos *et al.* (2014), more recently, did an extensive literature review on key success factors of business incubation. Although he concludes that as the literature grew, the list became more and more inconclusive and that there is still a lack of a comprehensive framework for assessing the effectiveness of business incubation, 6 factors can be highlighted:

- Incubatee selection policy;
- Exit/graduation policy;

- Shared offices and resources;
- Incubator manager competencies and relationship with incubatees;
- Support services like advice on regulations, R&D support, networking and access to funding;
- Monitoring performance.

This framework of topics is interesting because it brings three new important concepts that haven't been developed by the previous review of the literature on the incubation services. Having a selection and graduation policy, as well as constant monitoring the startup, appear as key success factors in incubation. They are ought to be taken into account when the work is further developed in the following Chapters.

2.4. History of Incubators

Looking back to 1959 in Batavia, New York when the “Batavia Industrial Center”, the widely considered first business incubator center was created, one can notice that though the industry is pretty recent, big changes have occurred that shaped business incubation as we know it by now. It was only by the late '70s and early '80s that business incubators started appearing more often and the concept spread around the world. Back then they would mostly provide logistical and infrastructure services to companies like office rental and shared offices. In the '90s, business incubators became more service oriented and started providing advisory services and business support. In the '00s with the spread of the internet, we entered in the *.com* era, where the Business Incubation industry rapidly expanded mainly because of the rise of IT and Tech companies.

A need for external resources was identified. No longer infrastructure or value-adding services and training were enough to satisfy the new trend of companies that appeared in that time, because of that, business incubators focused on providing enhanced access to external players and developing a more proactive network of contacts. In more recent years, a new concept called “Virtual Incubation” has emerged and consists of the services previously talked about with the exception of the infrastructure support. That means a company can access all of the help provided by the incubator

without being physically in it. (Theodorakopoulos *et al.* , 2014; Dichter *et al.* , 2010; Torun *et al.* , 2018)

Through an extensive literature review, Theodorakopoulos *et al.* (2014) compiled information regarding the evolution of the general services of business incubators through time as it can be seen in Figure 2.8.

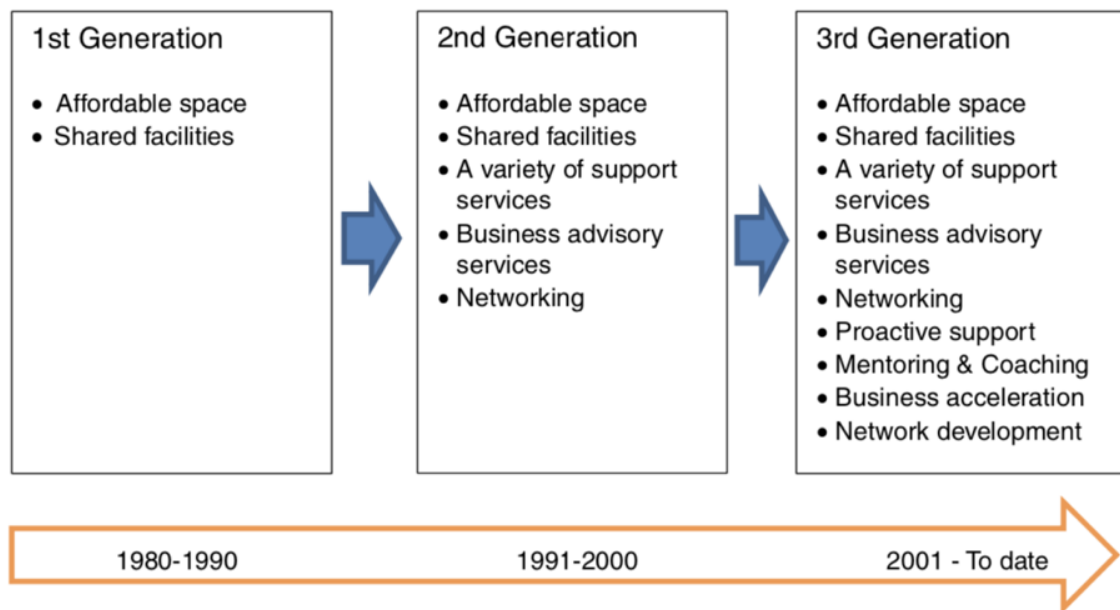


Figure 2.8: The evolution of business incubators from first to the third generation. Retrieved from Theodorakopoulos *et al.* (2014).

It is possible to match the services provided by the 3rd Generation incubator with the ones presented and reviewed in this Chapter. Ultimately, after almost two decades, the lack of update of the incubation services may lead to a stagnation of business development by small ventures like startups. The absence of studies about a new generation of incubators and taking account the progression of services studies by Theodorakopoulos *et al.* (2014) has made the community wonder: *What are services a new Generation of Incubators should provide?*

The further Chapters of this work will allow for a comprehensive knowledge on this matter - connecting the topics that were studied and presented on this Literature Review - like the innovation activities to achieve success in startups, their different needs and what actions an incubator may apply to help them achieve success.

3 Case Study Development

In order to build the assessment tool, the author had to get to know the whole ecosystem and the stakeholders that were part of the ESA BIC Portugal incubation program. It was a step by step development that took into account the feedback and inputs given by the people involved in the process. The stages are developed in this Chapter.

3.1. Methodology

As the objectives and goals of this work were relatively wide and involved a great deal of knowledge in different areas, it was suggested to look for a work methodology to develop it, not only to serve as the foundation of the work, but also to be easier to define the following steps, benchmark and evaluate results. The methodology used for this work was Design Thinking. (Brown, 2009)

3.1.1. What is Design Thinking?

The concept of Design Thinking is defined by Brown as a “methodology that imbues the full spectrum of innovation activities with a human-centered design ethos”. As it is a methodology based on people whose ultimate goal is to foster innovation, the Design Thinking technique aims to solve complex problems based on a user approach, it tries to identify user needs in order to provide the best solution possible. (Brown, 2008; Müller & Thoring, 2012)

Brown divided the Design Thinking Process into 5 steps, as it can be seen in Figure 3.1. These are:

- **Empathizing** - it consists of direct interaction and connection with the user in order to understand their challenges and needs.
- **Define** - in order to define the problem you will try to solve, you have to consider

everything you learned from the first step and weigh in all the options as you pinpoint the user's challenges that need to be solved.

- **Ideation** - after defining the problem it is time to ideate, brainstorm and try to find a solution.
- **Prototyping** - following the finding of several solutions it is time to develop them through various iterations.
- **Test** - final implementation of the solution with the users.

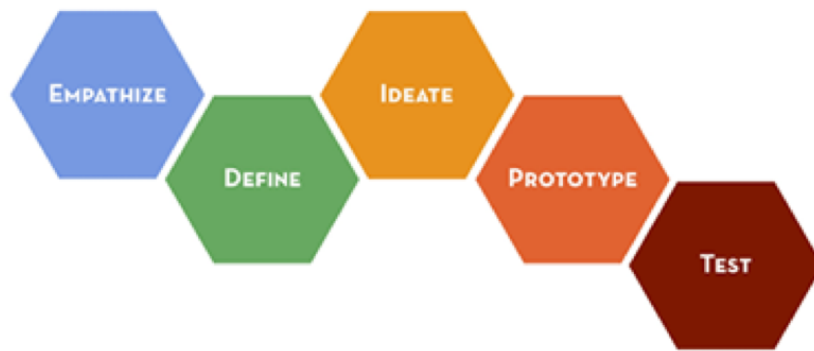


Figure 3.1: The Design Thinking process. Adapted from Brown (2009) and retrieved from <http://www.longevity3.stanford.edu/designchallenge/design-thinking-process/>

It is important to notice that this process is highly interactive and flexible. The authors state that Design Thinking makes use of thorough user research, feedback loops and iteration cycles. (Brown, 2008, 2009; Müller & Thoring, 2012)

3.1.2. Why Design Thinking?

Knowing that the problem was inserted in a big innovation hub like ESA BIC and the IPN network, and as the main objective of this work was developing a new incubation process based on modules which have to be in constant evolution, customized and adapted to a wide variety of startups, it was only logical that an innovation management tool like Design Thinking would be used. As the main objective was developing a new incubation process for ESA BIC Portugal, by utilizing this framework, the author

had the possibility to meet the stakeholders and intervene in the process, propose and ideate ideas, make observations and test solutions as well as the freedom to change approaches and be able to repeat again and again.

As it is noticeable in the following topics and as the work is described, this method was used on several occasions and the 5 steps were the infrastructure that supported the work developed. This strategy allowed the author to formulate scenarios, propose solutions and pivot from setbacks.

3.2. Beginning of the research

To get more familiarized with the work currently done by ESA BIC Portugal, particularly in IPN, and by making use of the Empathizing phase of Design Thinking, it was decided to start by interviewing the internal stakeholders in order to get to know their opinions on the current process of incubation and to understand about how it works and how it is done.

A plan was drafted that consisted of the interview and approach of 3 key groups:

- **ESA BIC Portugal** – in order to get to know precisely their incubation process.
- **Incubator Managers** – in order to know how other incubation processes are developed elsewhere.
- **ESA BIC Startups** that were in different stages of development – so that one may understand their difficulties, context and feedback about the program.

It was expected, when this stage was concluded, to be aware of the whole incubation process in Coimbra and to have defined a clear idea on the development of the modules of incubation.

3.2.1. ESA BIC Process

On the 27th of March, an interview with Alexandra Almeida, Innovation Manager of ESA BIC Portugal, was held in order to understand precisely the incubation process of their tenants. Alexandra was chosen for this interview as being one of the ESA BIC Portugal team's oldest members and by having experience with applications for the program since 2016.

The program is based on the application of teams or startups up to 5 years old, that have an innovative solution based on a space system or technology to be used whether in a:

- **non-space environment** – being able to use space technology and apply it in a non-space market.
- **space market** – being able to find a solution for the optimization of an existing process, component, system or manufacturing in the space sector.

There are three open calls yearly for the ESA BIC Portugal program. In 2019, the deadlines for submission of the proposals were: March 7th, June 5th and November 4th. After all the proposals have been submitted, they are evaluated by a Tender Opening Board (TOB) composed by members of IPN and ESA. Afterwards, if the application is considered eligible, it is forwarded to the Tender Evaluation Board (TEB) who comprises representatives from ESA, FCT, Comissão de Coordenação e Desenvolvimento Regional do Centro (CCDR-C), IPN, UPTEC, DNA Cascais and other technical and business experts. The applicants must present their business idea to the TEB for 15 minutes, followed by 30 minutes of questions.

When the final applications are chosen, the applicants are invited to sign the official contract agreement with the ESA BIC team. The applicants may choose the place that best fits their needs: IPN in Coimbra, DNA Cascais in Lisbon or UPTEC in Porto since all 3 incubation centers are part of the ESA BIC Portugal project. The main advantages of this program are the financial support given up to 50 000 Euros, physical incubation, 80 hours of technical and incubation support, as well as Intellectual Property management and protection. As for the terms and money installments:

- **Minimum incubation period: 1 year** – installments every 3 months.
- **Minimum incubation period: 2 years** – installments every 6 months.

The money granted may only be used for the startup's product development such as company material, equipment, and services like Intellectual Property protection for the prototype or product developed by the Startup. It cannot be used to hire personnel, incubation rent or general company costs. Currently, the team is aware of

the projects that wish to apply to the program and provides counseling and feedback to their applications.

In terms of monitoring, there are three important moments in the incubation process: First Meeting, Mid Term Review and Final Evaluation. In the First Meeting after being accepted, the entrepreneurs are invited to sign the contract and are introduced to all the details of the program. In the Mid Term Review, the startups must document in detail the status of its technical and commercial progress and at the end of the contract, the tenants must deliver a Final Report that sums up all of the activities developed, lessons learned, financial details and details of the support given from IPN and ESA BIC Portugal. Presently, there is no post-incubation strategy, but the alumni are invited to stay connected in the network and invited to the yearly ESA BIC anniversary.

From this first assessment it is possible to verify that the services that should be provided by an incubator that were studied in Chapter 2 , based on the guides of Dichter *et al.* (2010); Innovazione (2017); Scaramuzzi (2002), are being met. As for the performance of the incubation program, some data is private but for the sake of this work, it is allowed to say that all the benchmarks are being achieved and the results are promising.

With the exception of a post-incubation strategy, the current ESA BIC program meets every key success factor presented by Smilor & Gill (1986); Theodorakopoulos *et al.* (2014), which brings a sense of confidence about the practices made by the program.

3.2.2. SWOT Analysis

After learning about the specific details of the project it was decided to do a SWOT Analysis (Gürel, 2017) of the current ESA BIC Portugal activities.

The SWOT Analysis is a powerful tool used for strategic planning and management in organizations. The acronym SWOT stands for '*strengths*', '*weaknesses*', '*opportunities*' and '*threats*'. The Strengths and Opportunities are considered positive and helpful topics, because when developed, can bring added value to the institution. The Weaknesses and Threats can be considered harmful topics as they expose the frailties

of the institution. It is a process that involves 2 different dimensions as the Strengths and Weaknesses are attributes of the organization and considered Internal Factors, and Opportunities and Threats are considered External Factors as they are characteristics of the outside environment. (Gürel, 2017). They are usually presented in a matrix for better understanding and visualization.

The SWOT Analysis was considered because the author was familiar with it and is an easy-to-use tool that allows for a whole strategic overview of the program. A big paper flipchart with an empty SWOT Matrix was taped to the ESA BIC’s office wall for three weeks, the team members were encouraged to glue Post-its when they remembered something that would fit the topics. In the last week of May, a general meeting occurred to discuss the materials and the main topics where filtered. Figure 3.2 shows the completed matrix.

	HELPFUL	HARMFUL
INTERNAL ORIGIN	Amount of money (50k) ESA Brand Visibility Networking access Organizational culture Strengths	Small team Lack of project management tools Requirement of incubation in specific locations Lack of flexibility for the granted money Weaknesses
EXTERNAL ORIGIN	Space 4.0 New funds 2020-2023 Portuguese Space Agency Opportunities of H2020 European network events Opportunities	Political Instability in Europe Other players Unknown and scarce use of space technology Threats

Figure 3.2: SWOT Analysis of ESA BIC Portugal.

The team stated that the 50.000 Euro granted to the startups, the European Space

Agency brand and image associated with the incubation process - which is internationally prestigious and recognized. The international networking access and the organization culture within ESA BIC Portugal and the IPN ecosystem were considered to be the main strengths that are more advantageous when compared to competitors and add significant value to the program.

As for the opportunities and external factors that can be developed, the team opted for the great interest that is being shown on the new topic of Space 4.0 and its future developments. The possibility of a new ESA contract until 2023, the opportunities for applications to the H2020 investment program, the founding of the Portuguese Space Agency and the availability to go international networking events, are all great topics that can be further explored.

The threats pointed out that may jeopardize the current state of the ESA BIC Portugal program were the political instability of Europe, that can lead to unpredicted consequences in the space sector, the existence of other players such as incubators and incubation programs that may affect ESA BIC's own applications, and the still unknown and scarce use of space technology, that may drive away possible applications to the program.

The topics that the team believes are a weakness are the fact that the team is small in order to manage all the startups in the program, the lack of project management tools, the requirement of incubation in specific locations as it may discourage applicants to make the travel to Coimbra, Porto or Lisbon and the lack of flexibility of the money granted, as it can only be used for the product development.

In regular talks with the team, it was also mentioned that most of the people that applied to the ESA BIC program didn't have the entrepreneurial understanding about the pursuit of what their customers are looking for of Blank & Dorf (2012)'s teachings. Instead, most of them have a deep technical mentality and focus on the perfection of their product. They have a lot of difficulties in trying to change that mentality and to promote an innovative approach to their entrepreneurs' minds. The wide range of space technologies accepted in the ESA BIC program allied to the difference of ages (between newborns and 5 year-old companies) are a big challenge and provide a lot of difficulties to the managers as they have to deal with the disparate needs and necessities of the companies.

The results provided by the SWOT analysis accentuated the need of a tool to help the managers assess the companies difficulties. The lack of project management tools allied with a small team and the possibility of a new ESA contract extension that proposes to increase the number of startups in the program, makes the future of ESA BIC uncertain. For the program to maintain its status and high quality standards, actions need to be taken.

3.2.3. Other incubation processes

Inquiring incubator experts was crucial to be done prior to the meetings with the ESA incubatees in order to get to know the different processes of incubation, how they were applied and differ from each other.

On the 6th of May, the author met with Joaquim Sousa, the director of HIESE, a structuring project of entrepreneurship and rural innovation promoted by the IPN Incubator in partnership with the Municipality of Penela. On the 13th of May, Jorge Pimenta, senior project manager from IPN was also interviewed. From these interviews, a solid idea of how the incubation universe works was made by getting to know different incubation strategies and processes.

The main ideas/topics that were retrieved:

- The different steps of the incubation process in their respective institutions.
- A private and personal assessment of the startup by the manager is important for the development of an incubation strategy.
- A monitoring strategy is essential for a successful incubation process.
- Sometimes it is difficult to deal with the entrepreneurs because of their personal attachment to the idea and unwillingness to change.

When asked about their opinion on the work developed in this dissertation, the idea was praised but a warning was issued - *an initial assessment won't give all the answers, and as it is an incredibly volatile environment, the tool must be flexible and easily updated.*

In the end, now with a fresh view on incubation processes and based on the topics covered by the two interviews, a guide/script for the upcoming ESA BIC startups' interviews was developed, see Annex I, in order to facilitate the conversation.

3.2.4. ESA BIC Incubatees

For the incubatees, three Startups were interviewed, each one in a different stage of growth – *THEIA* with less than 1 year of business activity, *MATEREO*, an alumni that ended incubation recently and *SpaceLayer*, an older alumni that was part of the first batches of companies that entered the program more than 3 years ago.

The purpose of these dialogues was to understand each company individually, what were their difficulties in the past, their feedback on the incubation process and their opinions on this work and modules.

Only three startups were suggested for making interviews because a broader spectrum of companies was believed wouldn't bring much valuable information to the work and would delay the gathering of information.

The following Figure 3.3 shows the most important information that was retrieved from the interviews as they are grouped by the date and duration when they were performed, the initial difficulties felt when entered the ESA BIC program, the positive aspects of the program and the main lessons learned from it.

It is noticeable that most of the difficulties felt by the startups are areas covered by the proposed modules. It is also important to notice that the money provided allowed for the verification of the product, and in some cases, the companies concluded that it was the factor that made the difference and allowed to pivot from the original idea in order fit in the market and customer needs. Regarding the topic of the development of customers and market screening, most of the feedback retrieved was that this matter was mostly developed towards the end of the incubation process and further matured after the incubation period. When presented to the work developed in this dissertation, the three startups thought it was relevant and brought added value to the ESA BIC's strategy.

One can conclude that, at least for the three companies interviewed, the ESA BIC program was essentially used for the development of the products and subsequently

	THEIA	SPACELAYER	MATEREO
Date	17 May	21 May	21 May
Duration	27 minutes	53 minutes	47 minutes
Initial Difficulties	Financial Management Pitch Marketing Sales	Customer Development Recruiting and Skilled Labour Force	Customer Development Marketing Business Modelling Pitch
Positive aspects	Workshops and Mentoring provided Money provided	ESA Branding Money provided	ESA Branding Money Provided Technology Transfer
Lessons Learned	The 50.000 Euro allowed to test the initial idea and to pivot the initial strategy; Physical Incubation was useful for networking.	The support given in monetary and networking terms allowed for the consolidation of the product.	Mentoring and Networking activities should have been better utilize; The 50.000 Euro allowed to test the initial idea and to pivot the initial strategy; Allowed for a new strategy when approaching the market needs.

Figure 3.3: Matrix of interviews of ESA BIC’s incubatees.

the value proposition of the startups.

The proposed modules were almost validated, as the needs of the startups matched the problems which the modules were to tackle. These conclusions were also used to connect the services that the incubators can provide (Abduh *et al.* , 2007) to the startups needs, as well as to verify that the needs and problems that CBInsights (2018) and Lewis L. T. (2018) stated in their guides, are applicable and match real-life issues of Portuguese startups.

3.3. Overview of the knowledge and steps towards the final objective

At this point, after being familiarized with the incubation process and getting to know some of the participants, a strategy was formulated – part of the Ideation and

Prototyping phase of Design Thinking - in order to reach the final goal of the work: a tool used for the assessment of the startups' needs that facilitated the work of project managers involved in ESA BIC, in understanding the troubles of their tenants. This new strategy was based on two steps, also using interviews as a method to assemble information:

- Firstly, the author was challenged to contact foreign project managers from international ESA Business Incubation Centers in order to understand their practices and process of incubation.
- Secondly, start developing the tool by contacting experts of every module's area from IPN and do a literature review and research of each innovation area covered by the modules.

The people that were suggested to approach for each module were:

1. **Value Proposition (VP)** - Carlos Cerqueira, Jorge Pimenta and Paulo Santos;
2. **Business Model Canvas (BMC)** - Carlos Cerqueira and Jorge Pimenta;
3. **Customer Development (CD)** - Carlos Cerqueira and Jorge Pimenta;
4. **Marketing (MKT)** - Luís Andrade and Nelma Figueiredo;
5. **Finance (FNC)** - Alexandra Almeida;
6. **Investment Programs (INV)** - Paulo Santos;
7. **Pitch (PIT)** - Jorge Pimenta;
8. **Intellectual Proprety and Legal (IP)** - José Ricardo Aguilar;
9. **Networking (NW)** - Carla Duarte, Clara Luxo and Francisca Eiriz.

At this stage, some of the modules' titles suffered minor changes for aesthetic reasons.

3.3.1. International ESA BIC's

In order to extend the range of information obtained from other incubation processes and to get to know how “sister” institutions developed their strategies, invitations to eight ESA BIC were sent, of which four replied and agreed to do online meetings via Skype. This was done at this late time due to the need of more information about incubation strategies.

These were from Prague in the Czech Republic, Noordwijk from the Netherlands, Hessen & Baden-Württemberg from Germany and Barcelona from Spain. They were represented by Marek Aldorf, *Head of ESA BIC Prague*, Martijn Leinweber, *Community Manager at ESA BIC Noordwijk*, Sascha Heising, *Head of EU-Projects at ESA BIC Hessen & Baden-Württemberg* and Martí Foz, *Head of ESA BIC Barcelona*.

A script was drafted for the upcoming international ESA BIC's managers interviews, see Annex II, in order to facilitate the conversation. The interviews lasted for around 30 minutes though only the main topics will be presented and discussed.

The following Figure 3.4 shows the most important information that was retrieved from the meetings as its grouped by the date when they were performed, the main services provided by each incubator, pre incubation process, monitoring strategy (besides the three meetings mandatory in the ESA contract) and biggest difficulties felt by their incubatees. If the table section is clear, then it lacks any answer or it wasn't provided.

After analyzing the answers provided by the managers, a lot of similarities can be found between the Portuguese and foreign ESA BIC programs. Most of the services provided, excluding the Human Resources management and CEO mentoring, are identical to the ones provided in Coimbra and the areas that fit into the proposed modules. In terms of pre-incubation, the idea of a training course pre-application of ESA BIC can be developed although the applicants are helped currently in Portugal. In terms of monitoring, the Dutch plan of scheduled meetings throughout the incubation period is interesting and can be implemented in IPN as, excluding the three main ones, there is no monitoring strategy.

The most intriguing answers, however, were the main problems that the managers identified in their tenants. All of the experts, similarly to Portuguese ones, described the same exact problems based on the lack of entrepreneurial and business knowledge of their residents.

	Prague	Noordwijk	Hessen & Baden-Württemberg	Barcelona
Date	4th of June	5th of June	5th of June	29th of June
Services	Value Proposition; Prototyping and Technical Expertise; Legal; Internal Management.	Same as the ones presented plus Technical and Soft Skills mentoring.	Business Model Canvas mentoring to each startup; Funding application; Marketing and Public Relations; Project Management tools; HR Management Tools;	Intellectual Property; Finance; Legal; Networking Activities; Mentoring with CEO's of important companies.
Pre-incubation	Knowledge of the applicants 2 months earlier and help in their application process	Unprepared companies are sent to a 10-week training course.	-	-
Monitoring	Face to face meetings every 3 months; Phone contact every month.	Face to face meetings every 2 months.	-	Informal meetings and phone calls when there is a request.
Problems	Good technicians but lack of entrepreneurial knowledge; Lack of pivoting strategy.	Assessment of startups' needs; Small community and networking problems because of their location.	Lack of understanding of incubation and entrepreneurial knowledge	Figure out a clear and proper business model; Obtain funding; Gather a good and efficient team; Good technicians but lack of commercial view.

Figure 3.4: Matrix of interviews of International ESA BIC's.

The main points were identified and helped to further develop the assessment strategy. Based on CBI Insights (2018) report of the main reasons startups fail, the answers by the managers and adding to Spacelayer's mention of difficulties in the recruitment pro-

cess, a new module called **Human Resources (HR)** was proposed. It was expected to cover these difficulties and will be developed further ahead.

3.3.2. Consultation with managers about the modules

Considering the suggestions of the team, and to provide an initial overview and key topics about each module, meetings with technicians from IPN were arranged. The main objective was to understand which subjects were essential for each module and, if possible, raise questions for the assessment based on their experience, as all the surveyed were specialists in the different modular areas. Some people were contacted for more than one module due to their background in different areas.

Figure 3.5 displays the people that were consulted, their professional experience, the modules their involvement was needed, dates of the interviews and their duration. They weren't recorded nor timed though the duration of the interviews was controlled.

	Carlos Cerqueira	Jorge Pimenta	Paulo Santos	Alexandra Almeida	Luís and Nelma	José Ricardo Aguilar	Carla, Clara and Francisca
Modules	VP; BMC; CD	VP; BMC; CD; PIT	VP; INV	FNC	MKT	IP	NW
Experience	Head of ESA BIC Portugal and IPN's Innovation Director	IPN's Incubator Project Manager	Director of IPN's Incubator and Accelerator	Innovation Manager of IPN and ESA BIC Portugal	Coordinator of Marketing services of IPN; Marketing Manager	Lawyer and Intellectual Property Manager of IPN	Innovation Managers of IPN and ESA BIC Portugal
Date	3 June	6 June	19 June	3 June	14 June	12 June	24 May
Duration	~30 minutes	~90 minutes	~60 minutes	~20 minutes	~40 minutes	~30 minutes	~20 minutes

Figure 3.5: Matrix of interviews of professionals from IPN.

The outcomes and information retrieved are presented in the fourth chapter, as all the development of the modules is explained in that section of this work.

3.4. Other work developed and ESA BIC activities

During the five months of internship in ESA BIC Portugal the author provided assistance and contributed to numerous projects and activities developed by them. The most important tasks will be briefly described:

- Mapping, assessment, theoretical framework and business identification of 34 space technologies owned by Portuguese companies. Later, the design of “*Tech Cards*” was also developed in order to promote and facilitate technology transfer of those innovations, an example can be seen in Figure 3.6 with the summarized information that was retrieved. They were presented to the team throughout the internship and are currently being used as part of the Brokerage strategy of ESA BIC.
- Mapping, screening and identification of companies and activities that fit in the space sector of Portugal and Finland.
- Database, statistics and reporting development of many ESA BIC activities like their annual anniversary which gathers more than 120 participants, their academic and scholar records and benchmarking and the records of the last 4 years of their event, Space Summer School.
- Support, planning and promotion of talks and workshops given to students. Most of them were in Coimbra but some were in Lisbon, Porto, Viseu and Vila Nova de Poiares.
- Support and help was provided in numerous IPN events related to innovation and entrepreneurship.

Along the internship, the author was getting to know more about the reality of ESA BIC Portugal’s activities outside the incubation process and the work that is done “behind the scenes”. This work is done in the form of talks, activities and workshops related not only to space, but to ideation and business creation too. As the author followed and supported these activities, he was astonished by their audience: students from high school with less than 15 years of age, Economics, Journalism and

Template cards



Figure 3.6: Example of a Tech Card.

Communication students and Science and Engineering students as well, were all participating and involved in the talks and case studies. People were being introduced to the innovation universe without even realizing it.

“From Space down to Earth in about 120 minutes. Are you ready? Hands on Workshop” is the title of most of the workshops given by ESA BIC managers. In less than 2 hours, students are divided into teams and given a space technology to develop, find its value proposition, imagine a problem it could solve and go through all the business development steps. In the end, they have to pitch and “sell” their product to the audience as the winner is awarded based on most popular vote. Just like a small version of an ideation competition done regularly in IPN.

Going to High Schools, Universities, Polytechniques, participating in Job Fairs and providing the topic for case-studies and competitions is becoming a routine as ESA BIC Portugal is continuously doing these activities around the country. In 2019, they have done over 20 events, which 350 students attended, 77% of them being from Science and Engineering background and 23% of Social Sciences.

Although one may think that the requirement of a space connection is a handicap as

it reduces the universe of possible applications, the specific case of ESA BIC Portugal is different because they are introducing a new incubation philosophy – a new perspective in which its foundation is not based on receiving applications from companies, but that wants to boost and spread the universe of innovation and entrepreneurship with the general public.

This is possible with several internal and external events that the team promotes such as the mentioned Workshops, Talks, JobFairs, Technical Mentoring. These activities contribute to the promotion of the incubation program and generate leads about possible new applicants or technology ideas that may lead to technology transfer and brokerage from space sector to non-space markets. They are a more interactive way to deepen knowledge about the space sector and present space business applications potential and examples as well as funding opportunities on private and public levels.

These actions will contribute for a conclusion on what is, in fact, the work of an incubator in the present day and what it can become henceforth.

4 A Modular Approach for Startups' Needs Assessment

In order to improve the service provided to companies entering the program, the IPN team responsible for ESA BIC Portugal decided to change its incubation strategy, seeking to provide the right and most qualified service for the company in the incubation period by knowing exactly on which area the startup is having difficulties and lacking essential knowledge and understanding of its activities. 10 modules, whose subjects and substance cover a big spectrum of the startups' universe towards success, were proposed. Each of the modules will be assessed individually to determine precisely where the proficiency is lacking.

This chapter consists of several prototyping phases of the assessment tool. It presents how the 10 modules were addressed, the essential topics that were evaluated and how the research was made.

4.1. Module Development

As the main objective wasn't an extensive literature review on each topic but to find the key points that can be developed and are essential for the successful growth of a startup, the chosen sources for this were, of course, the interviews with the experienced personnel from IPN, the book "Ten Types of Innovation" by Keeley (2013), and three online platforms called Board of Innovation, Pimento Map and Startup360 which are professional innovation and business platforms that, among many other activities, perform their respective assessment. They were matched to the Literature Review made in Chapter 2 about the needs and weaknesses startups face and the reasons why they fail in order to filter the best results. (CBInsights, 2018; Innovazione, 2017; Lewis L. T., 2018)

After the interviews and having a clear idea of what to promote in each module, in order to make it easier for the development of each topic, the 10 modules were divided

into Innovation skill-based and Technical skill-based as it can be seen in Table 4.1. They were divided this way because of their underlying areas, as some are more based on technical and practical knowledge and the others have a strong connection to the Innovation theme - based on Keeley (2013)'s book, Schumpeter & Opie (1934) and OECD & Eurostat (2018) views of innovation activities developed on Chapter. 2

This was done to help further research on each module and for the project managers to act accordingly their different needs.

Table 4.1: Division of the modules into Innovation-based and Technical-based activities

Innovation-based	Technical-based
Value Proposition	Finance
Business Model Canvas	Investment Programs
Customer Development	Pitch
Marketing	Intellectual Property and Legal
Networking	
Human Resources	

For practical terms, the innovation-based modules were further developed by the innovation sources while the Technical-based ones were mostly based on the IPN's project managers' feedback.

A small introduction was made to each module, a few examples of questions that were retrieved from all sources were presented in order to explain what was trying to obtain and the key activities/tips suggested to be done by the companies that are assessed. These activities/tips contain the essential topics that were filtered from the research and can help the project managers in their strategy definition.

4.1.1. Value Proposition

The Value Proposition of the company consists of finding the right solution for the problem one is trying to solve. It is the source of the innovation that distinguishes the product of the company when compared its competition. Osterwalder *et al.* (2014)

The 2 main subjects decided to focus on this topic were Problem Exploration and

Solution Development. The key activities/tips for them are:

Problem Exploration

- Define unmet needs;
- Have a clear user group;
- Check market opportunity;
- Understand what competitors are doing.

Some retrieved questions were: *“Who is your customer? What are their problems? How are they currently solving those problems? Is the problem we identified worth solving?”*

Solution Development

- Ideate around the challenges faced;
- Develop multiple concepts;
- Prototype several solutions;
- Validate learnings.

Questions that came up are for example: *“Did I consider all solution options? Which features of my solution offer the most value? Does my end-user value the solution that I have designed? Is the company undeniably differentiated from the competitors?”*

To conclude this module, the target users must have a validated problem worth solving, and identified an innovation thesis in which to do so, they should have explored the different options and identified the features that will bring an added value to their users and finally, developed their idea into a clear concept.

If a difficulty is assessed in this module it is recommended for the project managers to promote ideation sessions, make innovation assessments on the proposed solutions and help the company validate the problem they are proposed to solve and their offer.

4.1.2. Business Model Canvas

The BMC is a strategy/business management tool created by Alexander Osterwalder, on which a proposal of nine “building blocks” is proposed to map and to overview the business development of a company. These “blocks” are comprised of Key Partners, Key Activities, Key Resources, Value Proposition, Customer Relationships, Channels, Customer Segments Cost Structure and Revenue Streams. (Osterwalder *et al.* , 2014) Because a lot of “blocks” fields are being developed and explored in other modules, it was decided that this module would mostly focus on the experience of the actual building of a business model tool, defining a business model and focus on the Cost Structure and Revenue Streams of the company.

Examples of questions that came up are *“What is your experience in designing a complete BMC representation? Have you defined your business model? What are other potential revenue streams? How much value does everyone capture? Is the business model scalable?”*

Considering all the information gathered, some key activities/tips that were suggested are:

- Experience in using business modeling tools is essential;
- Exploration of different business models;
- Definition of a validated business model and its assumptions;
- Exploration of additional revenue streams;
- Definition of the Cost Structure of the project;
- Have a realistic and validated return of investment/profitability strategy;
- Growth and Scalability assessment.

If a difficulty is assessed in this module it is recommended for the project managers to mentor the startups by building a BMC or other business modeling tool, ask for detailed cost structure and future cash flow requirements.

4.1.3. Customer Development

Customer Development is a movement led by Blank & Dorf (2012)'s philosophy of a clear understanding of the product a company wants to sell, matching with its customer's needs and where it should fit in the market in order to succeed.

The lack of this entrepreneurial activity was mentioned in every single interview that was made to ESA BIC project managers, so it can be concluded that it is important and undeveloped among the entrepreneurs' mindset.

Some examples of questions one can ask: *“Is there a specific niche to focus on? Do the customers want my product? Have you interviewed your target user group? Is the marketing opportunity compelling enough? Have you tested a prototype with users, if so, what was their feedback?”*

Key activities/tips suggested:

- Understand and validate the problem faced with the public;
- Validate the user's group needs and implement their feedback;
- Check if there is desirability;
- Market awareness in terms of timing and opportunity;
- Market fit strategy.

It is clear that this module requires validation so, as it is an end-user based topic, it is proposed that the project managers ask for metrics and quantifiable tasks like their customer database, the number of people interviewed and the outcomes taken from it, market figures statistics and values.

4.1.4. Marketing

Marketing is a huge concept that couldn't be defined in this work, so, as a suggestion of Luís Andrade, Coordinator of Marketing services of IPN, the topic was developed following Marketing Mix principles - 4Ps - (McCarthy, 1960) that provide a better understanding of the services to provide to reach the marketing and objectives. These

are Product, Price, Place, and Promotion. As some characteristics are being developed in other modules, the Marketing Module will focus only on the Place and Promotion categories.

The Place is defined by bringing the product to the customer. It considers the strategies and channels used in order to provide convenience to the customer. Promotion is based on the communication of the company, its message strategy and how they interact with their target group.

Examples of questions that came up are *“Have you defined a Visual Identity for your company? Do you know if customers tell others about their memorable interactions with the company? Do you provide any customer service? Have you developed a distribution and promotion strategy?”*

Some key activities/tips for the module are:

- Definition of the company’s brand and Visual Identity;
- Encouragement on a distinct way to connect to customers and channels to use;
- Development of a promotion strategy;
- Constant update and effort on Online Platforms and Social Media;
- Development of a Customer Service strategy;
- Promote warranties and assurances for the customer.

If there is a lack of knowledge by the startups in this area, easily monitored by the lack of customers, social media statistics or complaints. It is recommended for the project managers to mentor them in specific ways to reach their customers. If the problem is promotion-related, subcontracting and designing a new Identity to the company might improve their status.

4.1.5. Finance

This module was developed based only on the inputs and information given by Alexandra Almeida and José Ricardo Aguilar. It regards mostly about the knowledge of Finance management within the company.

The key activities/tips suggested are:

- Understanding financial management laws in Portugal;
- Internal company knowledge on accountancy;
- Budget and invoicing experience;
- Understanding of spending management;
- Define profit margins.

As it is a more practical-based skilled module, it can be easily assessed by the continuous monitoring of the companies' finances and initial assessment of the team's experience on this matter. Workshops on Treasury management and accountancy guides can be provided by the team, as they were done in the past.

4.1.6. Investment Programs

This module was entirely developed with the help of Paulo Santos, Director of Incubation and Acceleration of IPN. It focuses mainly on different topics related to the application of Investment Programs.

The key activities/tips suggested are:

- Knowledge of investment applications;
- Development of an investment strategy;
- Awareness of different types of investment and their requirements.

Another technical-skilled module which requires knowledge in this field. Project managers can guide the company towards successful applications by matching the right programs to specific companies and review and feedback on their requisitions.

4.1.7. Pitch

Pitch is a module dedicated entirely to the development of a Pitch Deck, which is a presentation generally given to audiences in order to present the business plan of a

company. There are many ways to build a Pitch Deck, but this module will be based on Jorge Pimenta's contribution and a guide Mey (2018) retrieved from the Board of Innovation website. Basically, the pitch presentation is based into 3 areas: **Framework/Storytelling/Content, Body Language/Attitude, and Slides/Design**. These areas have to be evaluated for the module assessment.

The structure of a pitch can be divided into 5 steps. **The Problem to Solve** should be the first topic as the general information of the market and the problem is presented, then the **Solution** where one makes use of their Value Proposition to prove why their offering is better, the third topic is the **Value of solving the Problem** in terms of money expected to earn, market size and financial figures, the **Credibility** is also present where the assumptions and learnings should be presented and lastly the **Call to Action/Next Steps** of the future of the company, investment needed and long term vision.

The key activities/tips that were retrieved, and are essential for this module are:

- Prior experience on delivering pitches;
- Knowledge of different types of pitch;
- A clear understanding of a Pitch structure;
- Comfortable public speaking;
- Knowledge of production of the design, image and presentation tools.

Project managers, in order to assess this module, can ask for video presentations of past Pitch Decks or examples of pitch decks used by the company. To act accordingly, it is suggested that a simple Training or Workshop about Pitching be delivered to tackle any lack of knowledge in this field.

4.1.8. Intellectual Property and Legal

IP and Legal is also a very hard-skill based topic and was developed with the assistance of José Ricardo Aguilar, lawyer, and Intellectual Property Manager of IPN.

As it is a very recent and unexplored area in Portugal, all the information retrieved was with José's help.

As IPN can't provide legal services, powers of attorney or proxies to the companies in their IP management, their work is based on the guidance and connection between the startup and the lawyer. The simplified process can be described in 6 steps:

1. A general overview of the project and the solution/product is made.
2. Check if there is a possibility of patenting.
3. A specific and broader analysis of what already exists in the market is made.
4. Check if there is a degree of novelty and innovation and proceed to protection.
5. A descriptive analysis and detailed proposal is developed with the technologies' background information and the outcomes of the market search.
6. A connection to a patent lawyer is made, who follows the process and takes care of all the legal matters.

Following these steps, the key activities/tips that were suggested are:

- Understanding the basic mechanisms on the creation and legal management of a company in Portugal;
- Previous Lawyer experience;
- Knowledge of Intellectual Property applications;
- Development of an Intellectual Property strategy.

José gave an overview of three different types of formation:

- **Workshops and Training** - to a general audience as they sometimes invite speakers from Stanford and Yale Universities.
- **1 on 1 Support** - "*tailor-made*" training made on purpose to companies in order to help them with specific IP issues and strategy.

- **Mist Model** - which comprises a bit of the two mentioned above. Usually, the company provides a case study with its own technology that later becomes a more interactive and didactic workshop.

4.1.9. Networking

Networking is the professional contact network and information exchange a company has. For this specific module, these topics were addressed as well as participation in events and the reputation among external stakeholders.

Some examples of questions that came up during the research were *“Does the company work with other firms or surprising collaborators to develop new offerings or test new products? Conversely, does the company enable the offerings of other players by lending permits, channels, processes, brand or other unique assets? Does the company promote itself in different events?”*

Considering all the information gathered, some key activities/tips that are suggested are:

- Definition of a networking strategy;
- Identification and connection to people/organizations that are useful for their business;
- Suppliers and significant partnerships information;
- Experience in international activities or projects;
- Awareness of reputation among other peers.

Quantifiable metrics and tasks can be asked in order to assess this module, like partners databases, professional social media network assessment statistics, the number of events attended and feedback from companies partnerships’.

4.1.10. Humarn Resources

5 out of the 20 reasons that the CBIInsights (2018) stated on their report *“Why Startups Fail”* are based on Human Resources consequences. These are *“Lack of Passion,*

Burnout, Disharmony Among the Team, Lost Focus, Not the Right Team”.

Faced with this and with findings from the research and interviews, the module was entirely promoted by the author as he thought this was a necessary area that needed to be addressed.

Some examples of questions that appeared: *“Is this the first time the team is working together? Is the team uniquely capable to validate/execute the startup? Is there a continuous learning mindset? Is the company known for attracting top talent in a particular field or function? Does the company use hard assets in ways that are very different from competitors?”*

- Organizational Structure definition;
- Experience using Management Tools;
- Recruitment Strategy;
- Internal Motivation knowledge.

For the project managers to assess the need for this module they may ask for the structure of the company, their recruitment objectives and goals though for this specific module, as it is very internal, it may be difficult to do a non-subjective assessment.

4.2. The Prototyped Tool

After the Empathizing phase of the work (posterior the ESA BIC startups interviews), an initial prototype was made for the assessment of the startups' needs. It was built on an online questionnaire platform like Google Forms Documents and its objective, back then, was to assess the needs of all the startups that were incubated in the ESA BIC program.

The prototype was expected to gather information of all the startups incubated since the inception of ESA BIC Portugal (more than 20) to create a big database of past troubles had by startups to be compared with difficulties new applicants might had. The prototype was neglected shortly after because it was concluded that an assessment

of the past needs of startups wasn't that interesting considering the Literature Review and the feedback given by the international ESA BIC managers, also, it wouldn't exactly address the main problem of this work that new companies have different needs from each other, so comparing difficulties between startups would eventually become fruitless.

The approach was pivoted and a new strategy was sought. A new idea came up when the author discovered the Pimento Map platform: a traffic light coloured-based system that would evaluate the different business areas of a company. (Pimento, 2019)

It is important to mention that the following tool is a prototype for the main objective which is the startups' assessment. It is an adaptive and conceptual tool, available for modification and adjustments. And it is presented here as a basis or foundation for further developments of the ESA BIC Portugal team.

4.2.1. Guide and Step by Step

The completed tool can be consulted in Annex III.

How does it work?

Each module has 4 or 5 questions. Each question has four points with different answers related to the question.

- The answer *a.* is expected to be answered by entrepreneurs that had a previous successful experience and are comfortable in that field, so their assistance need is reduced. These answers are worth 4 points.
- The answer *b.* is expected to come up when the entrepreneur has some knowledge of the topic but not an expert and requires feedback from professionals. These answers are worth 3 points.
- The answer *c.* will mostly come up when the entrepreneurs have little knowledge of the topic or that previously have tried to do something related to it, but unsuccessfully. These answers are worth 2 points.
- The answer *d.* is likely when the entrepreneur has no knowledge of the question or that it's not in their interest to develop it. These answers are worth 1 point.

Point System

The concept of this tool is built on a point-based table evaluation. Each of the ten modules will be evaluated by the answers made by the entrepreneurs. Each module's value will be the sum of the points of each answer in it. In the end, the modules will be assessed to a determined colour – red, orange, yellow or green - according to their valuation and percentage of the total points in that specific module. As there are only modules with 4 or 5 questions, the total maximum points for them are 16 or 20, respectively.

The proposed assessment is based on a simple percentage system presented in Figure 4.1, as x represents the total points obtained in the module. The colours were stamped on rocket ships, to make the assessment results more attractive and intuitive but also to fit with ESA's space applications theme.





COLOUR	PERCENTAGE (%)	TOTAL 4 QUESTIONS	TOTAL 5 QUESTIONS
	0 - 39	$x < 6,4$	$x < 8$
	40 - 64	$6,4 \leq x < 10,4$	$8 \leq x < 13$
	65 - 89	$10,4 \leq x < 14,4$	$13 \leq x < 18$
	90 - 100	$x \geq 14,4$	$x \geq 18$

Figure 4.1: Percentage System Evaluation

The proposed percentage system was based on the total of points in each module, because it evaluates the entrepreneurs' knowledge when questioned 4 or 5 times about

different topics of a specific module.

So, it is considered that if the total percentage of points is under 40%, then the current knowledge is *unsatisfactory* and reveals severe lack of awareness or interest on the subject. While between 40% and 64%, the result can be considered *poor*, as it displays a serious need of information and inadequate ability to develop the activities regarding that topic. Between 65% and 89%, the result is *satisfactory*, as it exhibits familiarity with the module and a few key insights are, although not perfectly, being developed. 90% or over the total of points, can be considered as *good* because it shows that whoever answered, has complete expertise on the topic and is currently establishing the right activities and progressing in a healthy and sustainable way.

An example of how the results of the assessment may be presented can be seen in Figure 4.2.




STARTUP NAME	BMC	MARKETING	NETWORKING
QUESTION 1	a	a	c
QUESTION 2	b	c	d
QUESTION 3	c	a	c
QUESTION 4	c	c	d
QUESTION 5	d	-	d
TOTAL POINTS	12	13	7
RESULT			

Figure 4.2: Example of the results of three modules' assessment

4.3. Next steps and assistance

When the project/innovation manager finishes reviewing the results, he should have a clear understanding of the current state of the startup. Whether it is a newborn project from laboratory researchers who have no experience with innovation, a visionary with a Nobel Prize winning idea that needs help developing it and making it usable and understandable for the common user, a group of open-minded friends who stumbled across a crazy idea and it's their first attempt on building a company with all the legal and financial matters or a veteran entrepreneur who knows exactly where he is getting into and only requires assistance on that extra mile that can be the difference between a regular company or becoming the next Tech giant like Google.

Considering the main problem studied in this work – difficulties in assessing different startups' needs – the following Table 4.2, exemplifies some metrics that can be measured or transformed into tasks that can be asked to different types of startups. They are divided based on their age: Early stage startup, Startup Infancy and Mature Venture.

These topics, together with the key activities and modules assessment that were made, can be further developed and worked on to guide the ESA BIC Project Managers to develop tailor-made strategies for their tenants, no matter their age or their field of activity.

4.4. Service Matrix

In regular talks with the team a final idea was presented – the Service Matrix - it is a grid that will position the services provided by the IPN against the needs of ESA BIC incubatees. From the wide range of activities and knowledge of IPN and ESA BIC, such a matrix can provide an overview of all its services. An example can be seen in Figure 4.3.

The services that were suggested to be provided were:

- **Training** – Public workshops about a specific topic.
- **Mentoring** – Personal and private counsel about an exclusive difficulty of a startup.
- **Consultancy** – Ask for third party help.

Table 4.2: Metrics and tasks for different aged startups. Adapted from Lewis L. T. (2018)

Early Stage Startup	Startup Infancy	Mature Venture
Number (#) of customer interviews & conversations; # of customer problems identified; 1 clear problem selected; # of jobs-to-be-done identified; # of low fidelity prototypes built; #insight gathered; # ideas generated and killed; % of ideas selected; adding activities(logo and branding).	# of experiments designed and run; # of concepts validated; # of low fidelity Minimum Viable Products made; Clear Summary of Value Proposition; Validation of the right side of BMC Revenue per customer; Customer Acquisition cost and Lifetime Value.	# of recurring customers; # of patent filings; Validation of the left side of BMC Canvas; Customer satisfaction; # of improvements/pivots; Social Media coverage; Revenue;

- **Brokerage** – Make use of ESA’s technology transfer programs to overcome a technical difficulty.
- **Labs** – Make use of IPN’s own laboratories to develop technological solutions.

As the matrix gets more developed with the history of the services provided - matched with the problems faced - the objective is that, based on the difficulties of the startups, it becomes easier to decide which action to take. That way, some of the problems identified by the team on the SWOT Analysis may decrease, the usage of innovation assessment and service-matching tools ought to reduce the work of the project managers.

Services Provided	IP	VP	MKT
Training	Workshop "How does IP work in Portugal?" was given to startups with no knowledge of the field		
Mentoring		Ideation Session of building a VP for a specific company	
Consultancy			An outside company was hired to make a MySQL database engine for a startup's website
Brokerage	Matching of similar documentation of technologies used by two startups in different countries		
Labs		Usage of a IPN Laboratory R&D to test a startup's prototype	

Figure 4.3: Example of the Service Matrix

All the presented methodologies developed in this Chapter are suggestions and guidelines to be implemented by ESA BIC Portugal, they are only in the prototype phase and haven't been tested, however, they present a thorough research of each module and feasible, real and applicable metrics that can be asked for the startups' needs assessment.

5 Conclusions

5.1. Global Conclusions

It is impossible to predict the exact needs of future companies as they grow and differ at an untraceable rate, the best one can do is try to assess, understand and support them.

This thesis had, as its main goal, the conceptualization of a new incubation process for ESA BIC Portugal. One that - no matter the age, type or field of the applicant - would be able to adapt itself to their needs and requirements by providing essential information to the project managers of ESA BIC's team, that would allow them to identify and assess the weaknesses of their tenants, in order to prepare the best possible answer to tackle those frailties in different innovation areas.

As the thematic of the dissertation was inserted in a big ecosystem, filled with constant flows of information and unpredictable changes, the use of the Design Thinking philosophies in the development of this work can be considered pivotal for its success. The chosen methodology allowed a strategic structuring of the work, the definition of steps along with its development, adaptation to step backs and the freedom to test new approaches and ideas. The use of an innovation tool like Design Thinking to address the innovation-based goals/problems faced by this work ended up being a positive choice that facilitated its progress.

The validation of the proposed modules was made possible by the initial interviews of project managers and ESA BIC's incubatees, the information gathered allowed to corroborate the importance and usage of the nine proposed fields in the incubation process. Later, with advice from the international managers from European BIC's, a new module was introduced and proposed to fit in the assessment tool. The Human Resources module covers important matters of recruitment, organizational structure, and internal situation within a startup - topics deemed essential in a healthy environment and successful business by the state of the art review and insights from professionals.

The prototype tool that was presented should be used by the project managers when a recently accepted company enters the program. It allows the evaluation of key topics and major difficulties of the startup and, with this, to match the modules that best fit their needs. It was developed by a thorough investigation of essential activities and actions to be taken, from inputs of professionals and Literature Review, in order to the startup's achievement of success. It is expected to be a platform easy to use, as it was designed through a colored-based system, which allows the ranking of the tenant's knowledge on a specific module.

The Assessment Matrix is also presented in this work as a tool to help project managers in the identification and choosing of the best service to provide according to their incubatees' needs. By comparing the services provided by IPN to the different modules available, it aims at easing the manager's work at guiding and supporting their tenants by providing a broad range of choices of all the actions he/she can take to engage in the startups' struggles.

In sum, and though they weren't tested, the development and conceptualization of the Needs Assessment Tool, together with the Assessment Matrix, provide a clear overview, understanding, and assessment of the Modular strategy. According to the main challenges faced by this work, the main objectives that were proposed were fulfilled.

5.2. Limitations, Recommendations and Future Work

The main limitation of the work developed is, of course, the lack of testing its outcome on ESA BIC's applicants. Although it was established at the beginning of the work that the main objective was the proposal of a prototype that was capable of assessing the different modules, as the next batch of companies to enter the program would only occur in September- which limited and made impossible any testing trials - the absence of formal validation is felt like an unfinished quest.

During the several interviews made along the progress of this work, it was felt that sometimes, the respondents didn't fully understand the objective of the work and because of that, couldn't provide plausible, real and useful answers that would help the author in the specific topic. This was a limitation because some topics and parts of the work had to be developed almost entirely based on the Literature and on incubation

guides when, a straightforward answer or suggestion by the actual professionals, would aid in the topic's advancement.

It is recommended that adding up to the use of the developed tools, ESA BIC Portugal, asks for deliverables and sets specific targets for each of their incubatees. By increasing their monitoring strategy and meeting more often with their tenants - like their European counterparts - further assurance of the work being done by the startups is met and there is more probability of success. The requirement of tasks and the establishment of goals and metrics to be measured, may also provide an improvement in the incubation process. These key activities and tasks, which are presented in the fourth Chapter, are recommended to be used in a complementary way to the usage of the tool and should be an essential part of the incubation strategy provided.

Future work to be developed is, naturally, the testing of the tool as well as any modifications, adjustments, and adaptation of questions, topics, and values to use. As the Assessment Tool was built in a completely customizable way, it is easy to test new approaches and strategies for its purpose.

It was also mentioned that, in case of success, the proposed Assessment Tool may also be devised and developed into an online platform, accessible to all international ESA BIC's. The usage of this tool would allow for a clearer assessment and provide a better quality of services provided by the Agency throughout Europe. If turned into an online tool, it was also discussed the opportunity of becoming a pre-incubation mechanism, available to the applicants of ESA BIC's program to check if they have the necessary knowledge and are ready for a successful application.

The work developed for this dissertation allowed for the application of a Paper called "Heading Towards 4th Generation Incubators: Case ESA BIC Portugal", which not only studies and presents the problems the faced by this dissertation, but also provides a greater overview of Entrepreneurship and its importance on Education by matching it with the activities made by ESA BIC Portugal. The work was accepted and will be presented on the 13th of September at the CEE 2019 | Conference on Entrepreneurship Education.

5.3. Towards a 4th Generation

It was only in the past 30 years that business incubators started appearing more often and the concept spread around the world. Currently, as studied in this work, it seems their services stagnated and haven't changed through time.

However, with an ever-changing world, where new business ideas arise without warning, information travels faster than the speed of light and the mentality of the societies morphs, it is only plausible to conclude that, to succeed, the business incubation sector must accompany those changes.

ESA BIC Portugal's new ventures and activities can be the start of a new generation of incubation - as can be seen in Figure 5.1 - **the 4th one**.

Their willingness to adapt to its surroundings by changing their internal incubation strategy in order to give their incubatees better assistance, one which fits their needs like an "*à la carte*" menu, shows that they are ready to make the change happen as it will be tested and implemented on the next batch of companies accepted in the program.

This new philosophy of going beyond walls by bringing information to the people directly, expanding its network in the process and increasing awareness of its services through their activities, as well as teaching and promoting entrepreneurship and innovation, might be the spark that ignites a new way of doing business incubation.

So, it is believed that ESA BIC Portugal's strategy is a potential way heading towards 4th Generation Incubation.

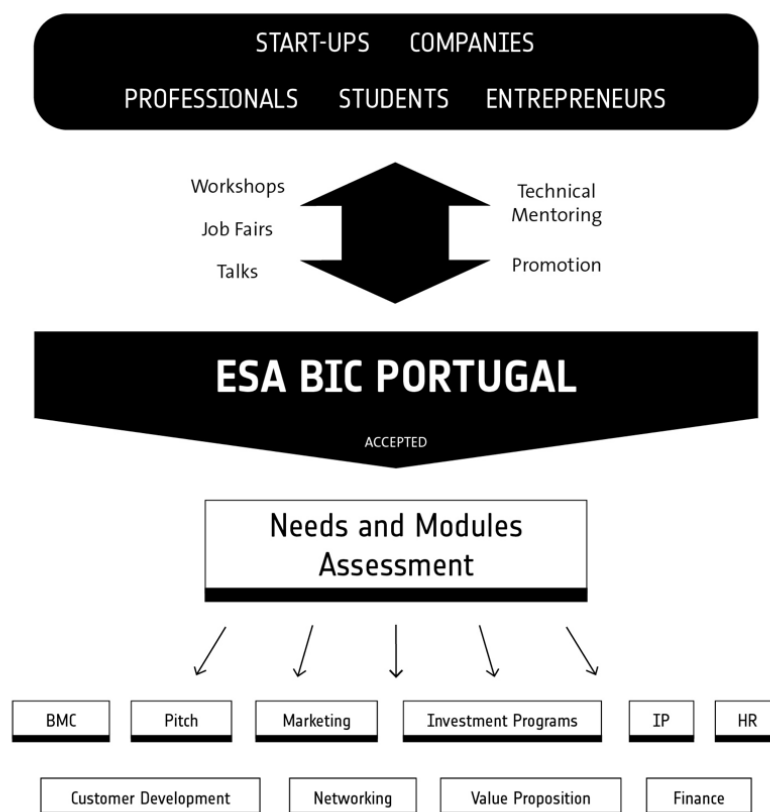


Figure 5.1: ESA BIC’s Portugal incubation strategy. A step towards 4th Generation Incubation.

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A Appendix I

Interview Schedule for ESA BIC Incubatees

Hello, I am interested in getting to know more about your business idea. I'm going to ask you a few questions from your business' inception to its development and its current stage but more importantly on how ESA BIC programme has affected that process. All of the data will be anonymous if you so desire and your privacy will be respected.

1. Firstly, can you tell me briefly about your business idea?
 - a. Where did your idea come from?
 - b. How was it developing before you applied for the ESA BIC Portugal programme?
 - c. What kind of knowledge(Tech and Market) did you have related to your idea?
 - d. What were your biggest difficulties back then?

2. Let's move on about coming to ESA BIC Programme.
 - a. What made you apply for this programme?
 - b. And how did you find out about its existence?
 - c. How did you find the application procedure? Why?
 - d. In your first official interview, was there some kind of needs assessment? How?

3. Onwards to the programme itself.
 - a. Could you start from the Day 1 and describe me the development of your idea and support by the ESA BIC in as much detail as you can?
 - b. In your point of view, what influence has ESA BIC Portugal programme had on the development of your business idea?
 - i. Which services provided were the most useful for you? Which ones weren't?
 - ii. Why and how were those services implemented?
 - iii. How did the people of ESA BIC, advisors and mentors contributed to the development of your business?
 - c. How was the communication with the ESA BIC team?
 - d. What did the possibility of physical incubation brought to your business? And in terms of localization, what were the benefits?
 - e. What were the biggest difficulties and obstacles you had to go through during the incubation process.

4. Future
 - Value Proposition
 - Business Model Canvas
 - Customer Development
 - Marketing
 - Finance
 - Investment Programs

- Pitch for Investors
- Intellectual Property
- Networking

- a. What are your thoughts about these services? Would they have tackled any of your problems? Why?
- b. Can you please pick the top 3 that you believe would fit best in your incubation process? Why?
- c. What are your plans about the future? In what way has your strategy been influenced by your stay in ESA BIC Portugal?
- d. (if it's an Alumni) What are your biggest difficulties after graduating ESA BIC Portugal?

If you have any last remarks or add something about the whole incubation process you have that opportunity.

Thank you very much.

B Appendix II

Interview for Incubators

Hello, since the INCUBATOR X is a highly regarded institution, it is of my interest to ask you a few questions about your incubation process. This questionnaire will focus on your involvement with the startups, from the pre incubation stage to its maturation.

1. Let's start with some general information.
 - a. Do you have an established Mission or Vision?
 - b. What kind of community is your incubator inserted into?
 - c. How do you promote yourselves to the stakeholders?
 - d. Do you provide any services besides incubations to startups?

2. Can you describe me in as much detail as you can about your incubation programme.
 - a. In terms of pre-incubation(Scouting, Value.P,
 - i. What services do you provide,if any? And how?
 - ii. Do you have any kind of assessment or evaluation?
 - iii. What is your application procedure?

 - b. What services do you provide to your startups?
 1. Value Proposition
 2. Business Model Canvas
 3. Customer Development
 4. Marketing
 5. Finance
 6. Investment Programs
 7. Pitch for Investors
 8. Intellectual Property
 9. Networking
 10. Teamwork and Soft Skills

 - ii. How do you provide them? (Subcontracting,own resources)
 - iii. What is your implementation strategy? In terms of timetable and scheduling?
 - iv. What is your monitoring strategy? What KPIs do you gather?
 - v. How do you communicate with your incubatees?
 - vi. In terms of networking, what is your biggest asset?

3. Post Incubation
 - i. Do you provide any exit strategy? How?
 - ii. What kind of success indicators (KPI) do you measure?

If you have any last remarks or add something about the whole incubation process you have that opportunity. Thank you very much.

C Appendix III

The assessment tool

1. Value proposition

1. About the general problem.

- a. We are aware of the situation we want to solve and the problems and opportunities to start from.
- b. We have defined the problem to fix, but still need further researching.
- c. We know exactly what we want to fix, but the problem wide and complex and we could use some help narrowing it down.
- d. We still haven't found the right puzzle to solve.

2. Solution

- a. We already validated our final solution and are ready to work on it.
- b. We had several rounds of ideation and the most promising concept of solutions were identified.
- c. We have a lot of ideas but we require a proper ideation session.
- d. We don't know where to start...

3. Have you defined the value proposition of your company?

- a. We have clearly defined the added value we will bring to our customers.
- b. Our offer is fairly well defined, but we will adapt it case by case if needed.
- c. We have a good idea of what we want to offer and hope that customers will be receptive.
- d. We haven't clearly defined what we want to sell.

4. Does the product or service you provide have a clear "unfair advantage" against your competitors?

- a. We are aware of our competition and believe our solution possesses unique strengths.
- b. We know what our competitors offer but we still can further develop our product.
- c. We believe our solution is innovative but we still haven't explored what our competitors are providing.
- d. We need further research on our product and competitors.

2. BMC

1. Are you familiar with a business modeling tool?

- a. Yes. We have tried some and can build one from scratch easily.
- b. We completed a few, but still have some difficulties filling every area.
- c. One of our few attempts was on this project and could use some feedback.
- d. Business modeling who?

- 2. Regarding the specific business plan of your company.**
 - a. We have a solid business plan prepared and reviewed by professionals.
 - b. We have a business plan put together that needs feedback and validation.
 - c. We have put together a business plan that isn't complete and requires some attention.
 - d. We have some post-its in different fields. Please help!

- 3. Regarding the Revenue Streams. What is your revenue model?**
 - a. Our price policy is set with accuracy as we have been able to test it on customers.
 - b. We have made some revenue projections and have defined our pricing policy.
 - c. We have not yet precisely defined our pricing policy nor made projections.
 - d. We still haven't figured out our sources of income.

- 4. Cost Structure - about your cost model.**
 - a. We have clearly identified fixed costs, variable costs, investments, and cash flow requirements.
 - b. We have identified most of the costs but need some feedback and external review.
 - c. We have an idea of how much it will cost but haven't developed and scrutinized them enough.
 - d. Still don't know what's it gonna cost us.

- 5. About the Return of Investment, profitability, and recurrence.**
 - a. The margins are high and incomes are guaranteed for very long periods.
 - b. Margins are comfortable but some costs impact on the overall profitability of the project.
 - c. Margins are under pressure and customers do not want to engage in the long term.
 - d. The margins are almost zero and not enough to finance all costs.

3. Customer Development

- 1. Have you defined a user group of your product?**
 - a. Yes, we know exactly who we want to sell our solution to and have a database of possible clients.
 - b. From our research, we believe there's a need for our product but still need validation.
 - c. We have some ideas on who can buy our solution but nothing certain yet.
 - d. We are focusing on making a good product first.

- 2. Customer engagement**

- a. We know exactly what our buyers want and their feedback is currently being applied to our product.
- b. We have interviewed and talked to many of our possible customers but don't know how to implement the feedback given.
- c. We know who they are, but don't quite know how to reach them or what to ask them.
- d. You mean get out of the office?

3. Customer Pains- Are consumers in need of your product or service?

- a. Many different entities expressed a clear need for the product or service we will offer.
- b. When we present our product or service prospects people quickly show an interest.
- c. After some arguing and debating, we managed to convince our prospects.
- d. Most of the people we've presented our product to aren't convinced yet.

4. Market

- a. We have a clear idea of the market expressivity and where our solution will position itself.
- b. We are aware of the willingness to pay of our prospects but need to learn more about the market.
- c. We are not sure if our product can be successful in the existing market.
- d. We haven't searched for markets and don't know where to fit our product.

4. Marketing

1. Do you have a defined Visual Identity?

- a. Yes, our image is clear and was developed in the way we want our customers to see our company.
- b. We have developed our brand but still haven't thought about what feelings we want to arouse on people.
- c. We still don't have a clear brand positioning for our products or services.
- d. We haven't thought about our brand, logo or identity yet.

2. Social Media and Online Platforms

- a. We are online and running! Across multiple social networks and with a cool looking website.
- b. We have social media pages and website, but they could use some assistance and feedback.
- c. We are not comfortable with social media and have difficulties on maintaining them. Our website needs to be reviewed.
- d. We don't have online platforms and need help to create them.

3. What are the distribution and marketing channels you will use?

- a. We have perfectly defined our channels of distribution, sales promotion, and marketing plan.
- b. We know what channels will be useful, but haven't yet defined the exact scope of each.
- c. We have an idea of channels to use, but we haven't yet decided on any of them.
- d. Still have no idea how we will distribute our product and how we will communicate.

4. Customer Service

- a. We have a clear strategy on this. With warranties and other forms of customer assurances around our offerings.
- b. We have some user-friendly policies but we require a long term strategy.
- c. We believe our product is easy to use we but have no information on other customer services.
- d. We are interested in providing the best experience for our customers but don't know how to start.

5. Finance

1. About the basic mechanisms of the financial management of a company in Portugal.

- a. Our team has the knowledge and people related to this field.
- b. We've done this in the past but we need some feedback.
- c. We know the basics but are not comfortable with these topics.
- d. We could use some help!

2. Have you ever worked with an accountant?

- a. We have one right now for our startup.
- b. Yes, however for non-company related matters.
- c. We have done all the financial stuff on our own.
- d. We need advice on financial issues.

3. About invoicing.

- a. We are experienced people on this matter and have the necessary tools to do it.
- b. We always ask for help to do this.
- c. We have issued some invoices but are not sure if they are correct.
- d. We have no idea how to do this!

4. Cost evaluation and budgeting

- a. We have clearly identified the fixed costs, variable costs, investments and cash flow requirements and know how to manage them.
- b. We have identified the main cost items but you have not yet determined the investments and cash requirements.
- c. We have a range of costs but you haven't itemized them yet.

- d. We have no idea of the costs right now.

6. Investment Programs

1. Do you need important investments to achieve your growth?

- a. We believe our growth requires no investments and no need for cash.
- b. Our growth requires little funding.
- c. Our development requires significant funds, it can only be done by seeking external capital.
- d. Our growth will depend on the ability to find external investment programs and investors.

2. Do you have an Investment Plan?

- a. Yes. We have a clear and detailed investment budget.
- b. We have drafted some ideas about external help we might need but need some feedback.
- c. We don't understand the process of investment. Need more information.
- d. We haven't even thought about this.

3. Investment Application

- a. Piece of cake! Our team has already made several successful applications.
- b. We have made Grant applications in the past that weren't accepted. Need feedback.
- c. We are interested in applying but don't know how to do it.
- d. You mean give away my company? Hell no!

4. Investment Seeking

- a. We are aware of venture capitalists, crowdfunding platforms and different investment programs, and how to reach them.
- b. We know some investment programs but would like to know what other options are there for us.
- c. We have no idea where to start and how to do it.
- d. Shouldn't the investors come to us?

7. Pitch

1. Pitch Decks

- a. We have a lot of experience delivering presentations: elevator pitch, 20 minutes long, product, investment, you name it. We rock!
- b. We have made some but we want to improve and learn some new tricks!
- c. We are no strangers to the concept but we have some past unsuccessful experiences.
- d. This is new to us, help!

2. Content

- a. We know exactly the key elements of a pitch. The audiences love us!
- b. We have been successful in our presentations but we don't know how to adapt our pitch to different audiences.
- c. We don't feel comfortable with our presentations and may give the wrong impression of our work.
- d. No idea what topics to address in a Pitch.

3. Body language and attitude

- a. I should've applied for acting school, my speaking skills are just like Steve Jobs!
- b. Usually, we don't have any trouble, but sometimes we make some gaffes.
- c. We get really nervous, don't know what to do with our hands or where to look.
- d. We have Glossophobia (Fear of Public Speaking).

4. Make it happen

- a. Our designers make our pitch decks stunning and know how to use many presentation tools.
- b. Our slides are good looking, but we could learn better ways to do them and change from PowerPoint to a new thing!
- c. Our visual skills aren't the best and we could use some help improving.
- d. We aren't comfortable with using presentation creation tools.

8. Intellectual Property and Legal

1. Is there interest in Intellectual Property to protect the technology/product that is being developed?

- a. Yes, and we already have an IP strategy.
- b. Yes, but we don't know how to do it.
- c. No, but what can we gain from it?
- d. What is Intellectual Property?

2. Have you ever worked with lawyers?

- a. We have one right now for our startup.
- b. Yes, however for non-company related matters.
- c. We have done all the legal stuff on our own.
- d. We need advice on lawyers and legal issues.

3. About the basic mechanisms on the creation and legal management of a company in Portugal.

- a. Our team has the knowledge and people related to this field.
- b. So far we didn't have any trouble but we would like to learn more.
- c. We know the basics but are not comfortable with these topics.
- d. We don't want to go to jail! Help!

- 4. Are you aware of ESA's international patent portfolio and broker network?**
- a. Yes, we have already used them.
 - b. We are aware of the licensing policies and brokerage support.
 - c. We know they exist but still haven't explored them.
 - d. We haven't got that far.

9. Networking

1. Networking Strategy

- a. We have a defined networking strategy in order to deliver the best possible offerings.
- b. Although no formal strategy, we possess some contacts that help us with our products.
- c. Previously we tried to contact possible partners but were refused.
- d. Having partnerships is important?

2. Contacts

- a. We possess a detailed and complete database with information about our partners, clients and important people for our business.
- b. We have some contacts but need to improve our search methods.
- c. We know by sight some important people in the business but don't know how to find better ways to network.
- d. We have major difficulties in contacting other people and organizations.

3. Events

- a. Always on the lookout. We proactively search for events and new venues to promote ourselves and meet new institutions.
- b. We only apply for big networking and promoting events like WebSummit.
- c. How do you apply to participate in events?
- d. We have no interest in networking events.

4. Reputation

- a. We are very well known and respected in the industry and our network trusts us.
- b. We have a good reputation in our quiet little network.
- c. We have had some bad experiences in the industry, which affected our credibility.
- d. We will work in a new sector for us.

5. ESA BIC's national and European network

- a. We have explored it and are in touch with different startups across Europe.
- b. We know it exists but haven't used it yet.
- c. We just got accepted in the program, but want to know more!
- d. Not interested in meeting other incubatees from ESA.

10. HR

1. Do you have a defined organizational structure?

- a. Yes, we already have an organizational chart.
- b. We have decided the founder's roles and our C-Suite but haven't thought about the rest of the crew.
- c. We have some ideas but don't really know how to do it.
- d. Does this really matter?

2. Management

- a. We are experienced in managing a proactive team. We are used to using HR and Project Management tools.
- b. We are comfortable with delegating and organizing our work but don't know any tools.
- c. We have some problems meeting deadlines and coordinate different tasks, but we use some tools to help us.
- d. We require internal trainings in order to improve our work methods.

3. Recruitment

- a. We have a solid recruitment plan and believe will have no difficulties finding applicants.
- b. We know the type of people we want to board our team but don't know how to do it.
- c. We are not sure what kind of skill set we are looking for.
- d. We have no need for other collaborators.

4. Motivation

- a. Our team is highly and constantly motivated because of our friendly environment. We're gonna make this work!
- b. Although there are team-buildings and people usually get along, sometimes there are low-spikes on the team's motivation.
- c. There is a lack of motivation in our company and because of that people could do better.
- d. Most of the people are demotivated and don't look forward to work here.