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Skills to evaluate startups maturity in Science Parks - a case study of co-creation between Brazil and Spain

Parallel session

Global talent: the coveted treasure

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Executive Summary

This paperwork introduces a evaluation model to measure the level of maturity of start-ups companies. It was developed based upon the experiences of the authors in a post-doctoral course made in collaboration between Ulbratech, a science park, in Brazil, and Science and Technology Park of Universitat Jaume I of Castellon (Espaitec), in Spain. This system proposes a range of skills, classified by knowledge, abilities, proficiency and attitudes that we consider very important for the development of both the entrepreneur, as its enterprise, starting from the experiences of both employees and, as well, some methodologies used in the Brazilian and Spanish markets.

These skills generated a Startup Maturity Model (SMM), which were grouped a set of 6 axes or dimensions: marketing, personnel, financial, innovational, management and complementary skills, which, to allow a better view of the evolutional maturity level, were divided into 6 stages. At the end of it, is possible to reach a clear view of the startup development, from its beginning to the end of the project.

1. CONTEXT

In this chapter, we presented the scenario that motivated the research theme and, the complexity of the problem at stake.

1.1 SCENARIO

According to an evaluation of the National Association of Entities Promoting Innovative Enterprises (ANPROTEC) [1], the topic of incubators in Brazil has matured, and now lives a phase of professionalization and qualification processes management.

In year 2011, from ANPROTEC[2] data, Brazil had 384 incubators supporting to around 3,700 companies (local and associated), generating about 17 thousand direct jobs and a turnover of approximately € 111 million, together with about 2,500 already graduated which generate about 30 thousand direct jobs and a turnover of € 833 million average.

This same publication targets a growth in the number of science and technology (STP) in Brazil parks. In year 2000 10 parks were identified, and by 2013 this number had grown until 94, with more than 900 operating companies and generating more than 32,000 direct jobs.

This study also highlights that the first efforts for the development of STP in Brazil have generated good and significant results, such as incubators, which form important innovation environments, with strong economic impact.

Most STP in Brazil has at least one incubator, which corroborates the importance of the subject of incubation and its direct relationship with the STP.

In Spain, based on data from the Association of Science and Technology Parks of Spain (APTE), in 2014 there were 68 STP that provide location to 6,452 companies, which generate about 151,500 jobs and a turnover of more than € 22 million.

One of the objectives of the STP, especially in incubators, is to sustain and support the survival of technology innovative companies, either in product and service, supporting companies to use best practices business management, and converting ideas and concepts into a viable and competitive business, through the promotion of entrepreneurship related to entrepreneurship activities[3].

According to Oliveira[4], graduation occurs when companies consider that their entrepreneurship initiative is ready to jump into the market with some growth guaranties and getting, during the incubation period, several competencies and entrepreneurial skills and managerial attitudes.

It is easily understandable that incubators want that the graduated companies could continue on the path of development of innovative products and services and, above all, they could stay in the science and technology parks.

Bizzotto[5] points out that one of the ways to measure or evaluate the success of an incubator is through observation of the companies that completed the incubation program. Through visits to different STP and access to documents, we can conclude that it is common for assessing the level of maturity of the companies, especially startups, residents in incubators,

[1] ANPROTEC. Portfólio de Parques Tecnológicos no Brasil. Brasília, 2008.
[2] ANPROTEC, MCTI - Ministério da Ciência, Tecnologia e Inovação. Estudo, Análise e Proposições sobre as Incubadoras de Empresas no Brasil - Relatório Técnico. Brasília, 2012.
[3] LICHTENSTEIN, G. Incubating New Enterprises – a guide to successful practice. Lichtenstein, 1996.
[4] OLIVEIRA, Renata Melo e Silva de. Ferramenta baseada em benchmarking para Avaliação do Processo de incubação de Empresas. Dissertação (Mestrado em Engenharia de Produção) - Programa de Pós-Graduação em Engenharia de Produção, Universidade Federal de Santa Catarina. Florianópolis, 2007.
[5] BIZZOTTO, C. E. N.; DALFOVO, O.; SENA, A.; FALLGATTER, M. G. H. Acompanhamento e orientação de empresas incubadas. Seminário de Parques Tecnológicos e Incubadoras de Empresas, 2002. São Paulo: ANPROTEC, 2002, V.1.

is given in a very subjective way, or until it only by issues related to billing, time spent in the incubator and need for expansion of physical space.

1.2 PROBLEM

In this scenario, becomes very important to know what are necessary in terms of skills for the development of Startup Company in an innovation environment, such as the case of Science and Technology parks (PCT in Portuguese and Spanish or STP in English). This subject has two distinctive aspects to analyze in this article: the first one related to the mission of a tech park and a business incubator, the second related to the nature of the business enterprise.

Finally, the PCT and the incubator implement a set of services offered to entrepreneurs and startups and monitor the development of projects to assess and grade the companies .The entrepreneurs, for instance, will have a macro view of the development process of startup (business maturity). Due to the level of implication by PCT and incubators in the entrepreneurs or startups business model and value chains there is an explicit knowledge of the the skills required to be develop by them in order to plan their growth and self-evaluate themselves.

2. INNOVATION TERRITORIES MANAGEMENT MODELS AND DEVELOPMENT STARTUPS

The methodology adopted in this article is inspired in management practices experiences of PCTs ULBRATECH and ESPAITEC in CERNE model - the New Ventures Reference Center (Garcia et ali, 2014) [6], of SEBRAE / ANPROTEC[7], and Bill Aulet methodology for creating a successful startup[8].

2.1 CERNE Model

According to the Executive Summary[9], the CERNE methodology suggested from studies with ANPROTEC (National Association of Entities Promoting Innovative Enterprises) and SEBRAE (Brazilian Service of Support for Micro and Small Enterprises) in a Brazilian context, incubators have an important role in national development over 384 of them serving approximately 3,800 companies.

Also According to the data gathered from ANPROTEC archives, these environments have graduated more than 2,500 companies, with total revenues exceeding US $ 1.13 billion, and generating more than 30,000 jobs.

However, ANPROTEC realized the need to tune the facilities and services of incubators, seeking new demands of society, seeking environments that help in promoting innovation in increasing the competitiveness of enterprises.

The main goal of CERNE methodology is to create a standard model upgrade, in order to expand the incubator's ability to generate, in a systematic way, innovative and successful enterprises and, therefore, to create a baseline for the incubators, so different areas and sizes establishments can reduce the level of variability in achieving success of the incubated companies.

The CERNE model is structured on three levels: the incubator (incubator), processes (process) and the enterprise (company). This model has the basics: focus on processes, responsibilities,

[6] GARCIA, F., BIZZOTTO, C., PIRES, S., CHIERIGHINI, T. Reference Center for Business Incubation: a proposal for a new model of operation. ANPROTEC. Disponible en: http://www.anprotec.org.br/Relata/artigoCernNBIA.pdf. Acceso en marzo de 2016.
[7] ANPROTEC. CERNE – Centro de Referência para Apoio a Novos Empreendimentos. 3ª ed. Brasília, 2014.
[8] AULET, Bill. Disciplined Entreupreneurship: 24 steps to a successful startup. Ed. Wiley, 2013.
[9] ANPROTEC. Cerne - Centro de Referência para Apoio a Novos Empreendimentos - Sumário Executivo (v.1). 3ª ed. - Brasília: ANPROTEC, 2014.

transparent and participatory management, human development, sustainability, ethics, focus on the development and continuous improvement.

Because of the quantity and complexity of the processes to be implemented, the CERNE is structured as a maturity model of the incubator's ability to generate, in a systematic way, successful enterprises. And so is structure in four increasing levels of maturity: CERNE 1 - the enterprise; CERNE2 - the incubator; Heartwood 3 - partner network; Heartwood 4 - continued improvement in turn, each maturity level has a set of key processes that seek to ensure that the incubator use all the good practices related to that level of maturity, according to the following figure, allowing an overview of the degree of complexity of deployment each level.

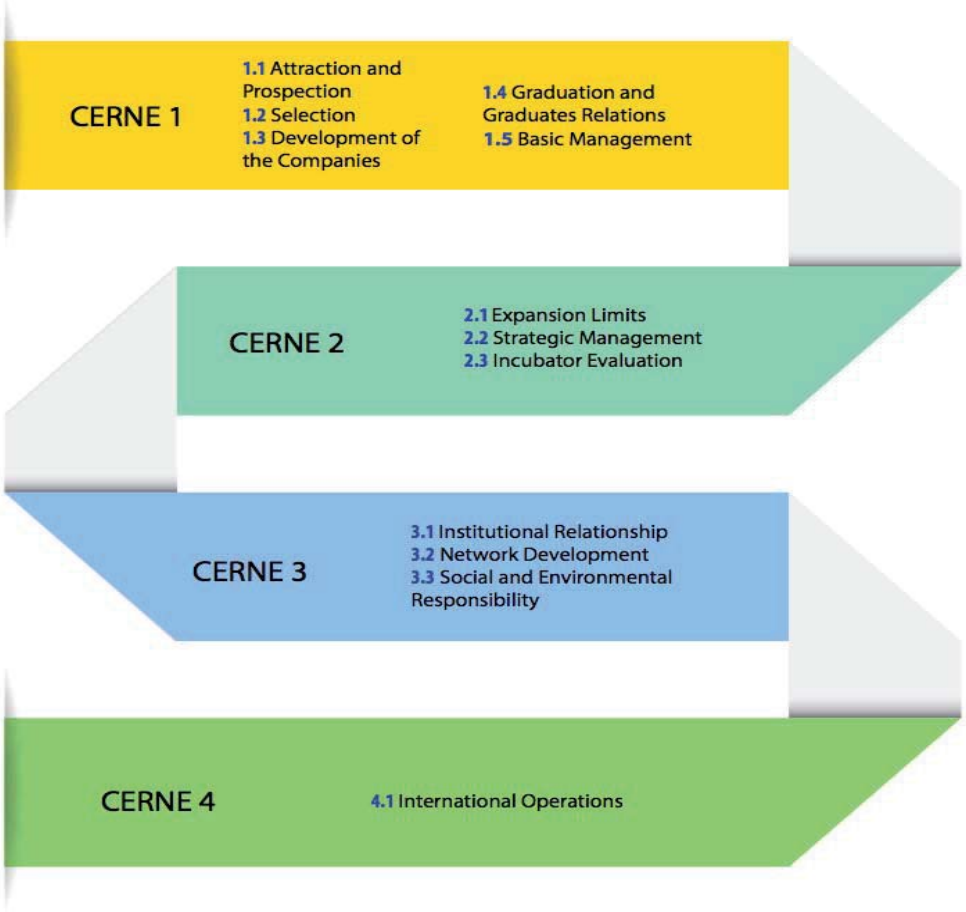

Figure 1: CERNE Model

With the implementation of the CERNE model, the incubator starts to act proactively in promoting sustainable development through innovation, with the use of systematic processes that enable the quantitative and qualitative expansion of generated projects.

It is expected that with the use of this management model, the hatchery can generate so successful enterprises systematize and repeatedly.

2.2 MODEL OF THE DISCIPLINED ENTREPRENEURSHIP

Bill Aulet (AULET, 2013) proposes a methodology drawn from the successful experience of MIT with innovative projects, and works as a toolbox for the entrepreneur building her startup.

This methodology is fully directed to the entrepreneur, proposing 24 steps grouped into six major themes, which will help the entrepreneur to create an innovative and sustainable company, conforms to the following figure.

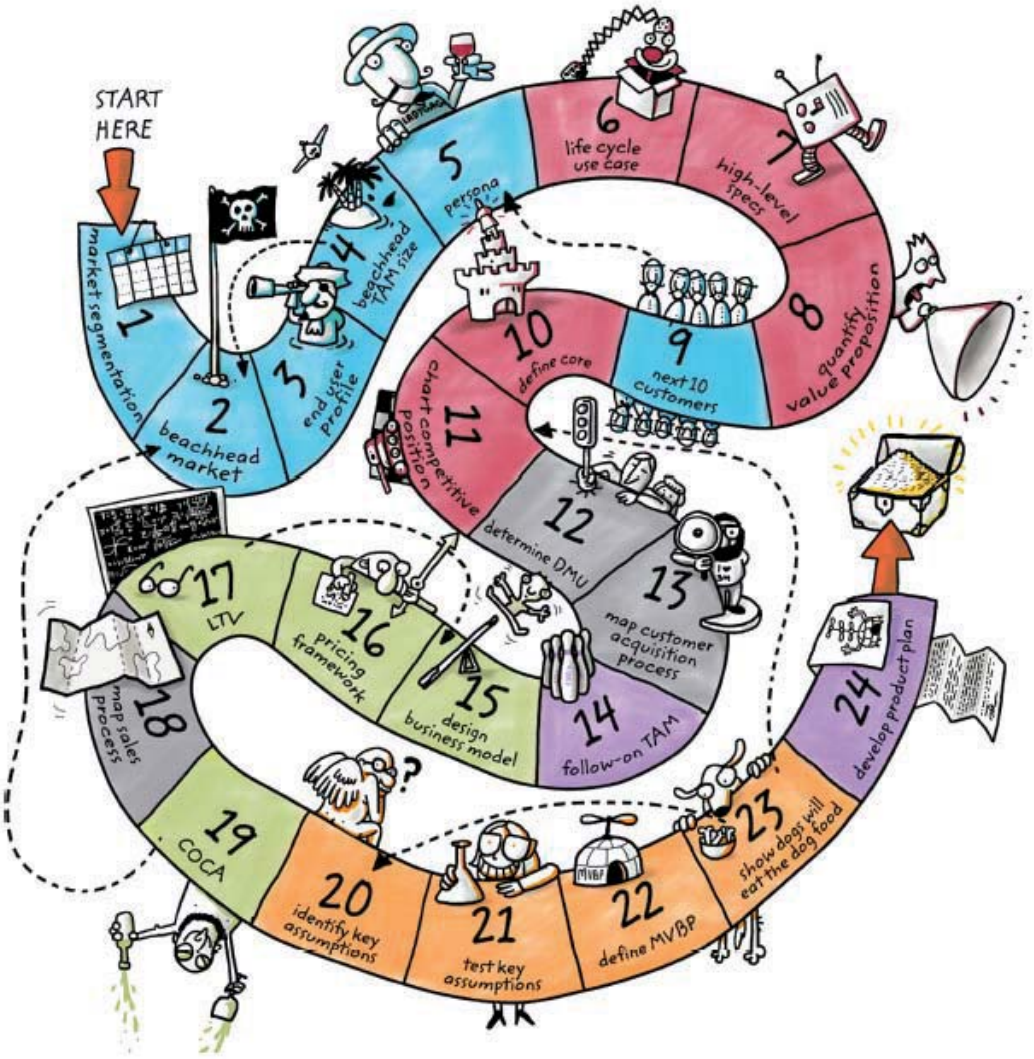

Figure 2: Disciplined Entrepreneurship Map

Figure 3: Disciplined Entrepreneurship - 6 themes 24 steps

In this methodology, we can select many skills that are implicit in each step, and then sort on knowledge, skills and attitudes.

3. METHODOLOGY PROPOSAL

Given the references presented, together with the practices implemented by the PCT ULBRATECH and ESPAITEC, it proposed a **Startup Maturity Model (SMM),** and a tool to help the implementation of this model. This tool is beneficial for both the PCT and for the entrepreneur and her company.

The proposed methodology comprises the entire life cycle of a project, from starting in a PCT to its shutdown (graduation).

It is not rigid and can easily adapt to any working model of each PCT. She believes that it can exchange skills and demands of each.

Thus, this methodology is a flexible and adaptable to any type and from a startup level of development.

This adjustment is made in the first phase, where the PCT manager have the opportunity to propose, based on their experience, the skills considered to be important for the development of startup.

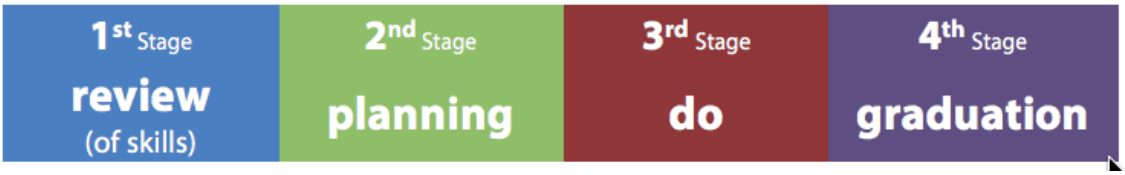

Figure 4: Stages for implantation to SMM

1ª) Review (skills): to review the needs of the entrepreneur, depending on the type of project or area of activity. At this point you can make adjustments skills and their position within the development cycle. They can also delete and include some skills according to need.

Although there are common skills for developing areas of different developments, some of these powers have different degrees of importance (priority) according to the business area.

For example, the power to "make the intellectual property registration" may have more importance to developments in the field of health than for software projects.

This review should be made in agreement between the entrepreneur and the manager of the PCT, and in the final analysis, the decision of the importance of certain skills is PCT manager's responsibility.

2º) Planning: create an action plan for the project considering the skills to be developed, the expected date and the costs for this development.

On the one hand, the entrepreneur will have an action plan; on the other hand, the PCT will also have conditions to have an overview of all the skills that their enterprises require for the maturing process. Thus, the PCT will plan the services to offer to their companies, as well as defining alliances with service providers that can assist in this development.

3º) Execution: Follow up the action plans of the enterprises, providing guidance, and correct evaluations of the strategic plans created for the startup companies. This is the stage where the entrepreneur will invest most of his/her time during the staying at PCT.

4º) Graduation: checks the final guidelines for the conduct of business to their independence. At this stage the company no longer depends on the incubator support and can leave to settle in a PCT or any other location.

To implement this model, in a first version, a Microsoft Excel spreadsheet has been created. This worksheet provides support for all phases of the methodology from the review, through the planning, monitoring and implementation, until graduation.

The model has six organizational dimensions (market, people finance, innovation, management and complementary) and a set of classified skills knowledge, abilities and attitudes.

And the maturity level is classified evolutionary and temporal form, in 5 stages, which make the analogy means of logistic.

In the following figure (Figure 5) shows the purpose of each of the development phases of maturity of a startup.

 PHASE 1 PROBLEM and SOLUTION	In this phase, the entrepreneur has an Idea or technological issue to be resolved. He needs to do some marketing research, identify his clients and review or evaluate his goals. After That, he proposes and validated hypothesis with the customers, bringing solutions to the main questions. The central issue remains on the problem and its viable and sustainable solution, perceived and validated by customers.
 PHASE 2 BUSINESS MODEL	In this phase, the entrepreneur needs to define and validate a viable, sustainable and scalable business model, covering, at least, the amount of resources that needs to be invested in communication channels and relationships, partners and planned costs of structure and revenues. He needs to create the projects profitability as well. The main theme is the BUSINESS MODEL validated by customers.
 PHASE 3 MATURITY	In this phase, the entrepreneuer, after set the business to a structure company processes, physical structure and human resources, It's time to put some order in the house. The main theme in this phase is ORGANIZATION.
 PHASE 4 INDEPENDENCE	Here, we find the entrepreneur seeking scalability, maturing processes and creating quality indicators. In this phase, The company is ready to leave the science park. The main theme is the search for quality and sustainability.
 PHASE 5 COMPETITIVITY	In this phase, the business is already mature enough, but the entrepreneur feels the necessity of develop the process and some quality indicators with the help of the business incubator. The main themes are acceleration and competitiveness.

Figure 5: SMM Methodology Phases

In each stage, the methodology presents knowledge and skills classified into six dimensions, plus another dimension grouping attitudes to be developed in stages. The Figure 6 shows a graphical representation of stages and their dimensions.

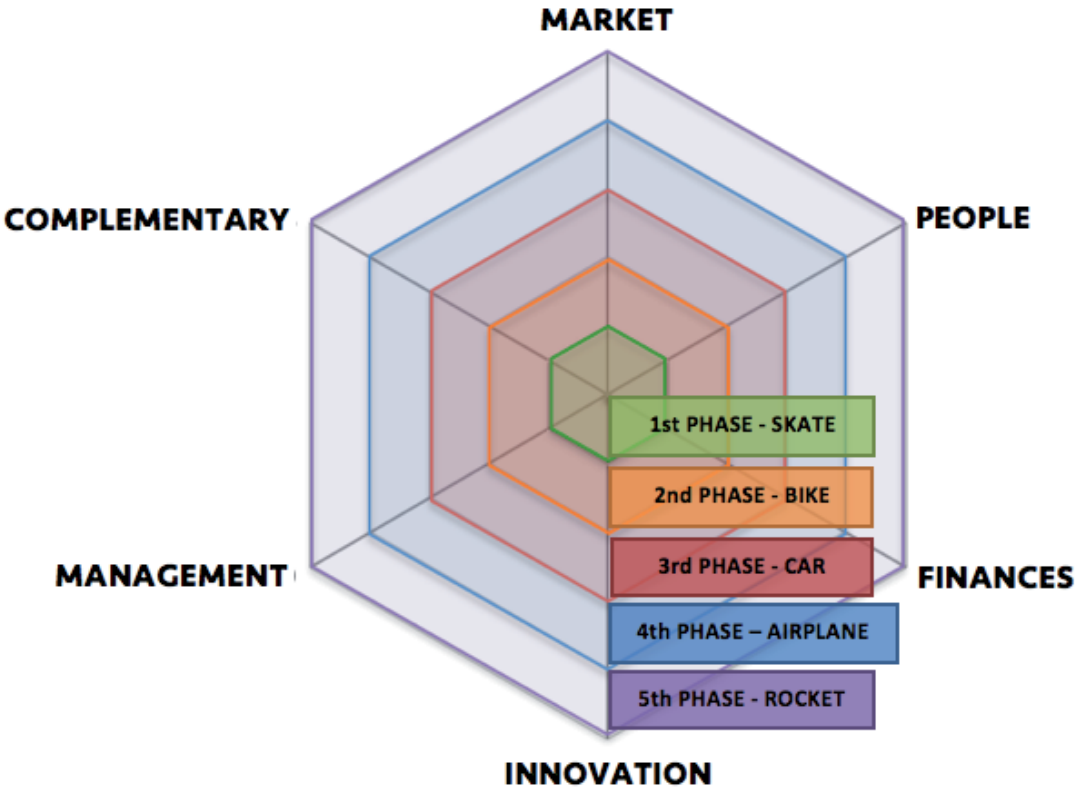

Figure 6: Graphic Representation of dimensions and phases to SMM

The table below shows some examples of the skills used in the model ESPAITEC and ULBRATECH:

Phase	Dimension	Skills
1 - Skate	Market	Know the customers' problems
1 - Skate	People	know the difference between entrepreneur and businessman
1 - Skate	Management	Know methodologies for internal and external diagnosis
2 - Bicicle	Marketing	Knowing methodologies to propose business models (Canvas)
2 - Bicicle	Marketing	Make a validation of price and profit margin
2 - Bicicle	Investments	Set the balance
4 - Airplane	Marketing	Knowing the tools for innovation management
4 - Airplane	Marketing	Make sales follow-ups, requests and feedback
5 - Rocket	Marketing	Finding new markets , particularly international

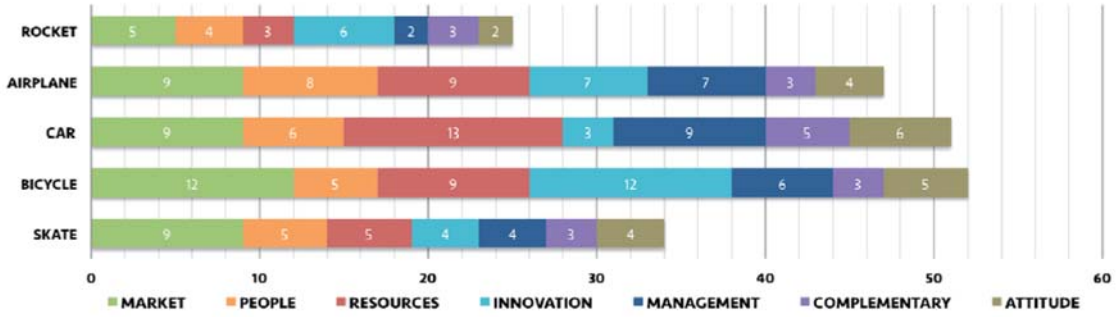

Figure 7: Amount of skills by project phase

Although a flexible methodology, where skills can be adapted according to the needs and way of working of the PCT, the tool offers some graphics that can show the quantities of powers provided for each phase or dimension.

These quantities may be adjusted according to the need and work methodology of each PCT. In the example in Figure 7, we present a customized methodology for PCT ESPAITEC

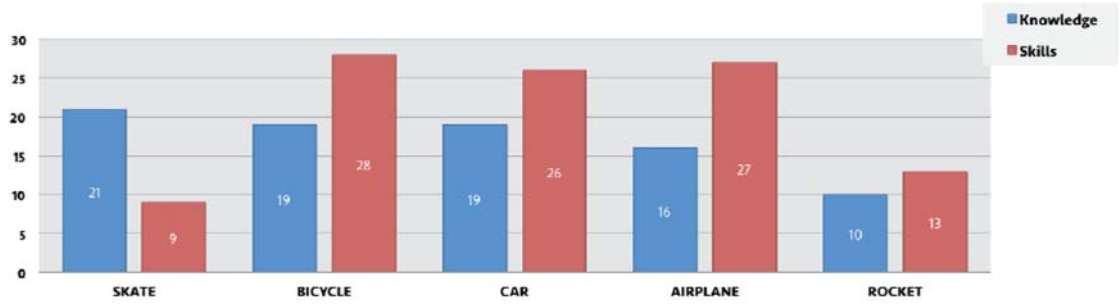

Figure 8: Skills by project phase (knowledge and skills)

4. FIRST VALIDATION

This model has two types of validation. First, after creating the initial proposal of skills and your organization through the stages, presented this scenario to PCT ESPAITEC in Spain and ULBRATECH in Brazil managers experts.

These managers have made contributions in the initial version of the model, analyzing the goals of each dimension in each of the phases. Then also have reviewed the planned powers in each of the phases.

For example, in the initial model, in phase 3, we provided the following mandatory financial competence: know to seek or attract investors. But after the interview with managers and entrepreneurs, it was noticed that in the specific case of some projects, the entrepreneur did not need foreign investment. Then move the priority of this competence so that it is not mandatory.

In the same way, some other skills had its priority changed to fit better to the enterprise reality.

The second phase AIMS to validate the model in practice with companies in real performance.

For this, the PCT manager makes an assessment on the point of view on the classification of each company in each dimension to know which phase each company was.

Then, after the evaluation of the PCT manager, entrepreneur, and before knowing the methodology, is asked to do a self-assessment of the situation of your company in relation to each of the dimensions to know at what stage of maturity it you believe that your company is.

Finally, an assessment of each of the proposed skills in methodology to find out if the entrepreneur had developed each of these skills is performed.

This assessment is made by means of a spreadsheet shown in Figure 9. The image data is not readable for confidentiality reasons both the PCT as the evaluated company, but can demonstrate the organization and dynamics of the methodology

Finally, a comparison of the views of the PCT manager and entrepreneur before the interview/evaluation, and vision generated by the tool is performed

In the first validation with a real company, made in a company installed in ESPAITEC, the entrepreneur had a very important role in the development of the tool.

He made some suggestions in the form of representation of some information (graphics), as well as some proposals for adjustments regarding the obligation of certain skills in certain phases.

These initial validations provide a view of the importance of the model for the PCT manager and for the entrepreneur.

The PCT manager reports a small degree of discomfort at having to make a model of the proposed revision to the framework of its working methods. But agrees that, after the review was made, the process as whole has a quiet stream.

The PCT manager also realize from the beginning of the review, better control of the entire development process of its projects, as well as the possibility of having a comparative view between the various developments of their PCT.

The entrepreneur also feels that his association process in the PCT has a development plan and that he (the developer) has to develop knowledge, skills and attitudes to succeed in your project. One of the entrepreneurs reported that started to give more value to the services offered by the PCT, we had a better understanding of the development process as a whole.

One of the pilot entrepreneurs made a very important comment, reporting that the model allowed him, as an entrepreneur, remembered some important points in the development process, which had been forgotten.

5. CONCLUSIONS AND PROSPECTS

The Figure 9 is not intended to be readable, but to illustrate the general statement of competencies to be developed by the company, through a spreadsheet.

Complementarily, made after a review of skills in each phase, the entrepreneur and the PCT manager can use the proposed schedule in Figure 10 to follow the development of the project.

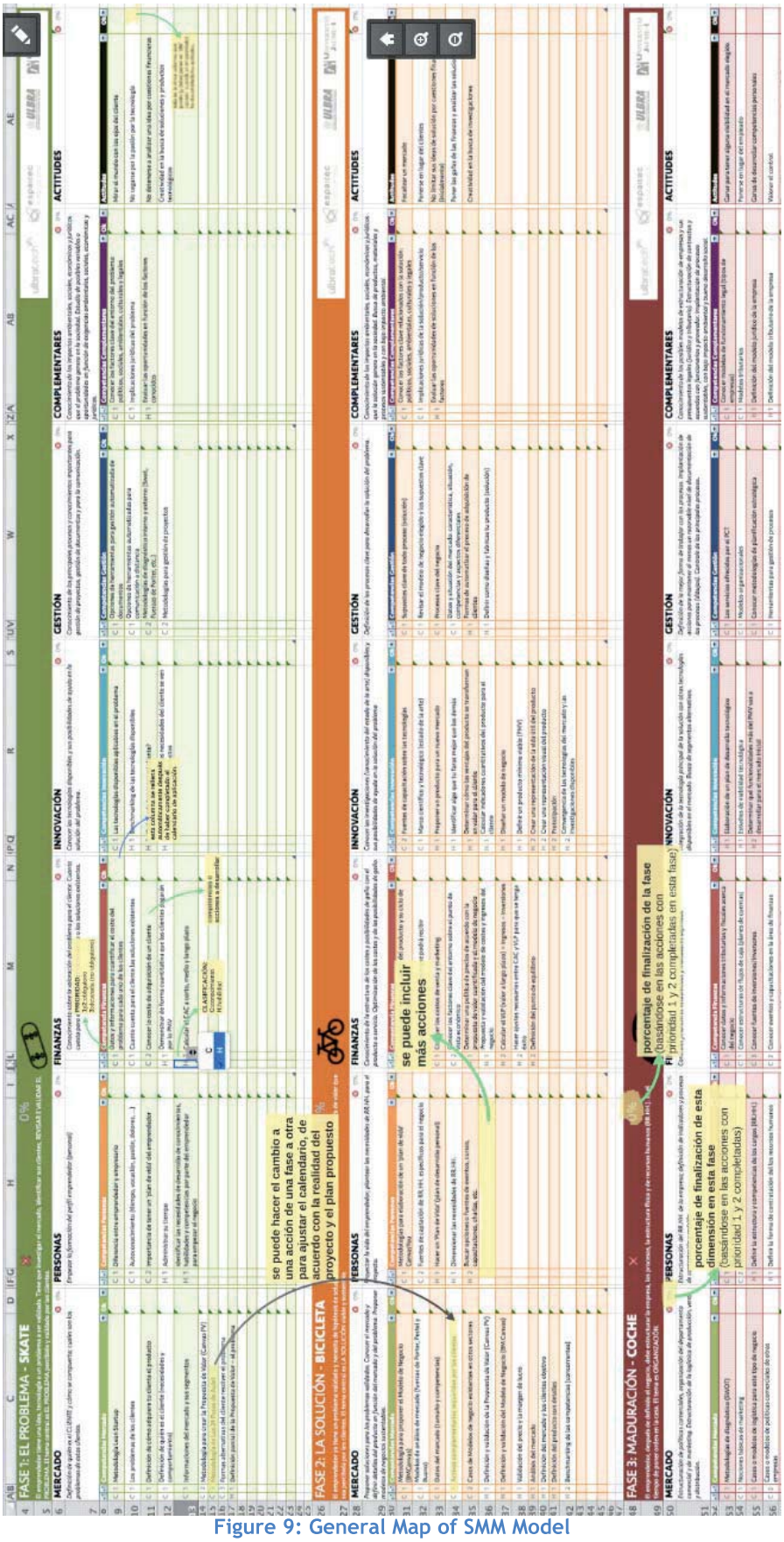

Figure 9: General Map of SMM Model

This schedule is used to help control the activities that the entrepreneur has to do to develop your project, track deadlines, costs and responsibilities in relation to where to look for the skills to be developed.

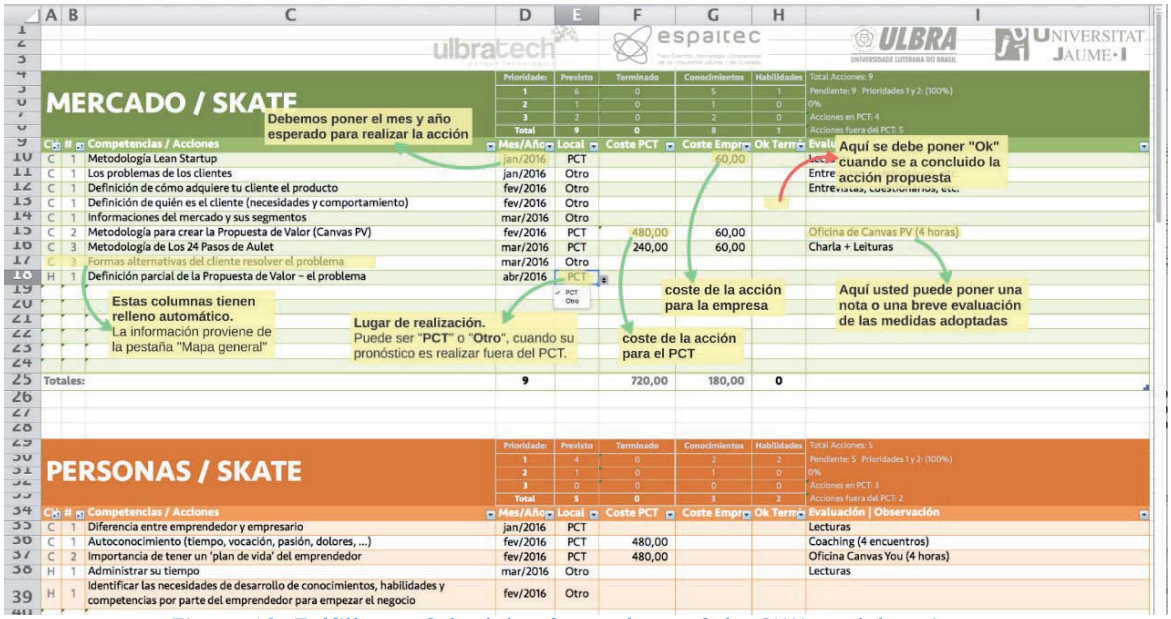

Figure 10: Fulfillment Schedule of one phase of the SMM model project

These two spreadsheets are shared and have outcompeted; feeding the graphics that will be presented later.

Also the SMM tool offers some charts that help both the PCT manager and the entrepreneur in monitoring the development of the project development.

In Figure 11 we can see the various types of graphics offered by the tool.

Graphics allows readers to analyze the development of the project by several aspects such as:

- Amount of skills to develop in each phase;
- View of the overall development of all skills at some stage;
- Planned development of comparison and carried home stage;
- Comparative dimensions in all stages;
- Comparing knowledge and skills provided and performed in each dimension and phase;
- Costs / investments required for completion of each phase (company and PCT);
- Costs / investments required for a given dimension (company and PCT);
- Evolution of spending / investments by size and stage (company, PCT and total).

Given these graphics and possibilities of analysis, the tool is configured as a tool to support the management that can be used both by the PCT manager, to know the reality of the companies associated with their PCT, the services to be offered to them , costs, etc.

It can also be used by the entrepreneur, so he can plan the development of their enterprise.

As future work, we intend to seek further validation in other PCTs and other companies, and then create an automated information system in the cloud that can handle large amounts of data and can make national and international comparisons.

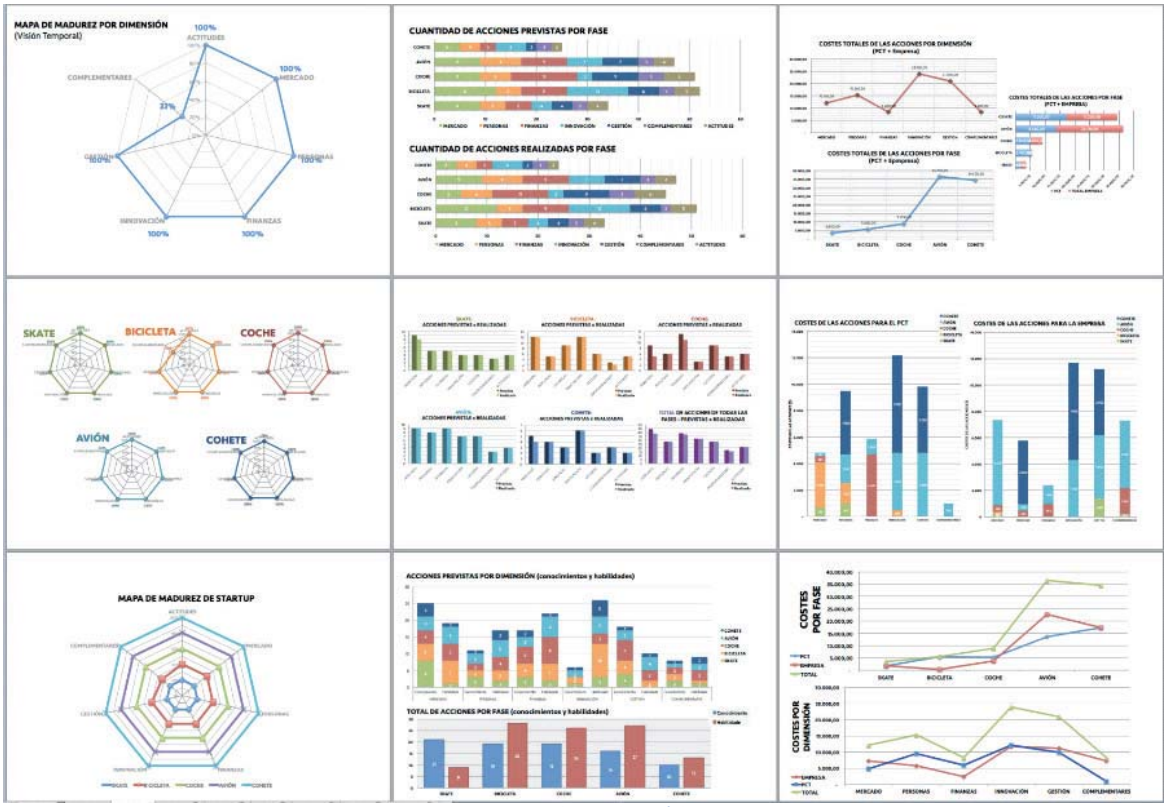

Figure 11: SMM Graphics