Cloud Incubator HUB: Startup ecosystem for Engineering Students

Connecting with other European ecosystems through the Startup Europe innitiative

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***Abstract*—This paper presents the evolution of a startup ecosystem at a technological university both for teaching engineering students about entrepreneurship-related issues and for offering them another professional alternative. After three years of operation at a regional level, the ecosystem is connected with other European ecosystems by means of the Startup Europe initiative, thereby gaining better results with regard to the number of accelerated startups, the scope of the experience and future possibilities for enterprising students.**

Keywords—, Internet of Things, continuous training; technological entrepreneurship; startups;

I. INTRODUCTION

Fostering entrepreneurship, and in particular the creation of technological startups, is a key factor for engineering universities because of very different reasons. On the one hand, it encourages creativity, innovation, competitiveness and productivity among students and, on the other, it is a clear-cut career option that ultimately promotes job creation, especially among the young. Back in the year 2000, the European Council in Lisbon [1] set out a strategy to make the European Union "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, with more and better jobs and greater social cohesion", with entrepreneurship being one of the basic skills in order to achieve this. Since then, there have been countless reports aimed at making European universities aware of the importance of entrepreneurship in education at very different levels [2][3][4][5]. As a result, in recent years there has been a dramatic increase in the number of higher education institutions interested in promoting entrepreneurship among students and which have included teaching methods and activities to improve entrepreneurial attitudes and skills in their curricula. However, much remains to be done at universities and especially at engineering schools, where despite the emergence of a good deal of truly disruptive business ideas, most of the training still takes place at business schools.

Therefore, it is important to develop entrepreneurial capacities and mind-sets at technology-focussed institutions. In one study [6] promoted by the European Commission and prepared by a group of experts in entrepreneurship, a number of specific recommendations are proposed whereby higher education institutions could improve their entrepreneurial ecosystems. Some of these are to:

- set up a strategy and an action plan for teaching and research in entrepreneurship, embedding practice-based activities, and for new venture start-ups and spin-offs;
- create an entrepreneurship education department, which would serve as an entrepreneurial hub within the institution and spread the teaching of entrepreneurship across all other departments;
- offer an introduction to entrepreneurship and self-employment to all undergraduate students during their first year. In addition, give all students the opportunity to attend seminars and lectures in this subject;
- acknowledge the academic value of research and activities in the entrepreneurial field; and
- award academic credits for entrepreneurial practical projects outside the established courses; and

In line with these recommendations, the Cloud Incubator HUB [7], was set up in late 2011 at the Technical University of Cartagena in order to create a hub at which many of the above recommendations would be implemented. In the first three years (2012-2014), the hub was built up by organising various acceleration programmes primarily aimed at engineering students and people from the region of Murcia (Spain) with great potential for innovation. After the first two editions, we found that it was necessary to attract entrepreneurs not only from the region, but also from other regions of Spain and even Europe. This conclusion was reached after observing that in just three years a good deal of the entrepreneurial talent available in the region had been attracted, so it was essential to look beyond its borders.

In late 2014, support was secured from the European Commission to organise two startup acceleration programmes with a pronounced international and European focus: EU-XCEL and Startup Scaleup. Both programmes were funded by the European Union under the Startup Europe initiative of the H2020 ICT research and innovation programme.

In this paper, the Startup Europe initiative is described and how it has contributed to transform the Cloud Incubator HUB from a regional ecosystem focused on early stage startups working in mobile technologies to a European ecosystem focused on late stage startups developing IoT products. The paper is structured as follows; section 2 presents the first experiences carried out in the Technical University of

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Cartagena under the Cloud Incubator HUB. After this, it is presented the Startup Europe initiative and how it has contributed for the internationalization of the HUB throughout the implementation of the Startup Scaleup acceleration program, the IoT acceleration programme of Startup Europe. Later, Startup Scaleup and some best practices to maximise the acceleration process of IoT startups are detailed in section 4. Section 5 discusses the results obtained in the last 1st period (2015) of the programme, lessons learned and future works. Finally, section 6 contains the conclusions of this work.

II. FIRST EXPERINCES AT THE CLOUD INCUBATOR HUB

The goal of the Cloud Incubator Hub from the outset was to foster entrepreneurship among engineering students outside established academic courses and to help create new startups and grow them via acceleration programmes. The startups came mainly from students studying engineering at the University, while a good deal also came from young graduates who had been working outside the university at companies and returned after a few years to fund a startup. In the first case, the startups tended to be in a very early stage or a concept stage. During an eight-month acceleration process at the University, they successfully became early-stage startups. In the second case, the startups tended to already be in an early stage and the acceleration process took them to the growth stage (or late stage), which is one stage prior to being an SME. Table I summarises the main features of each of these types of startups.

TABLE I. STARTUPS STAGES

Concept stage	Early Stage	Growth or Late Stage
Earliest stage of startup	Alpha/beta product	Market ready product developed
Addressing basic value proposition	Researching market and potential opportunity	Significant levels of funding rising
Beta project in development	Refining the business model	Strong levels of customer validation
No revenue	Some traction	Experienced team that is expanding
Often a sole founder	Growing team	Business has initial revenue (€500.000-1M€)
No customers		
Need to stablish a business model		

In the case of the acceleration of startups that were in a concept stage, the programme lasted eight months (see Figure 1), two of which were dedicated to the incubation of the idea and the final six to the acceleration of the startup. The programme was aimed primarily at telecommunications engineering, industrial engineering and computer science students, with around 60-70 of them requesting a place in the accelerator. Meanwhile, the incubation phase lasted about two months and the goal was to create 12 or 13 new startups (24-39 students). During this stage, various basic training courses and workshops were held: entrepreneurship training, brainstorming business ideas, teamwork, business models, customer development, funding, investment rounds, elevator pitch, etc. The incubation period ended with a competition between the startups in order to select 12 which would pass to the next stage. The competition consisted of an elevator pitch to a panel of entrepreneurs and investors and the subsequent defence thereof.

Fig. 1. Acceleration Programme for Early Stage Startups

The second stage of the programme lasted about 6 months, divided into two periods of three months each. In the first three months, the focus was on the business model, in an attempt to prove its commercial viability; and in the last three months, a prototype was developed and other aspects were addressed, such as the business plan, marketing plan, action plan, legal issues, etc. The programme ended with a Demo Day, where the startups showcased their products and business models to investors interested in early-stage startups, most of them business angels and also some companies keen to attract talent.

As for early-stage startups that wanted to be accelerated to the growth or late stage, there was no regulated programme. In this case, most of the startups were formed by University alumni, who after at least two or three years of professional experience decided to embark upon an entrepreneurial career as a startup. Most of them had already completed basic training in business, had legally registered the startup as a company and were already invoicing clients. These startups came to our Hub seeking access to our networking systems, use of our technological facilities and equipment, technical advice on very specific aspects and also access to funding. In most cases, after a period of 6 to 8 months in which they fine-tuned the business model and/or technically improved the product, we put them in contact with other accelerators, such as Lanzadera, or we provided them access to the European Union SME Instrument programme, which funds startups with large sums of money (€300,000 to €1,000,000).

Table II summarises the different results according to Key Performance Indicators (KPI) obtained in the first three years (2012-2014) and in which four startup acceleration rounds were held.

TABLE II. EVOLUTION OF MAIN INDICATORS

KPI	Results			
	1st Round Jan12-Aug 12	2nd Round Sep12-Apr13	3rd Round Sep13-Apr14	4th Round Sep14-Apr15
Number of entrepreneurs at the beginning of the incubation stage	72	60	62	67
Startups at the beginning of the program (entrepreneurs between brackets)	18 (55)	13(33)	12(27)	13(39)
Startups that finish the program (entrepreneurs between brackets)	10 (32)	9 (19)	10 (18)	9 (25)
Staff part time / full time	2 / 1	2 / 2	2 / 4	2 / 8
Mentors/ Coachers / Researchers	3 / 4 / 3	3 / 7 / 6	5 / 10 / 6	7 / 10 / 10
Business Angels / Venture Capital	1 / 0	2 / 1	4 / 2	4 / 2
Other incubators and BICs	1	2	2	2
Alumni	0	32	51	69
Raised funds	€120.000	€130.000	€170.000	€180.000
New employments	32	19	18	25

This initial three-year experience showed how important it would be in the future to connect our Hub with other startup hubs at other universities and in other countries, accessing not only the talent of students from our University. The entrepreneurial ecosystem in Murcia had ended up too small for our needs. It did not have the adequate number of investors (Venture capitalists and business angels) and mentors with experience in startup acceleration. Meanwhile, it was necessary to attract talent from beyond our borders in order to appeal to the best startups, thereby allowing our students to benefit from such contact. In this sense, the Startup Europe initiative has been a great opportunity to connect the Cloud Incubator Hub with other entrepreneurial ecosystems in the EU, such as in Dublin, London, Berlin, Vilnius, Lisbon, Madrid, etc., thereby lifting the restrictions of the scope of our Hub when it was purely regional or national.

III. STARTUP EUROPE INNITIATIVE

Startup Europe is a European Commission initiative created in March 2014 and which aims to strengthen and grow the European entrepreneurial ecosystem that develops web and ICT products and services. The key players in this ecosystem are startups, scaleups, unicorns, investors, accelerators, universities and companies, all of which are invited to form part of Startup Europe. The ultimate goal is that any business idea can start up and grow within the European Union.

Under this initiative and in the last two years (2015-2016) several actions have been driven directed to:

TABLE III. EUROPEAN ECOSYSTEMS OF STARTUP EUROPE

European Ecosystem	Connected Cities
Digistart **digistart.unidemi.com**	Lisbon, Malmö
e-Plus **epluseurope.eu**	Baden-Württemberg, Lisbon, Nice
Startup Scaleup **startup-scaleup.eu**	Cartagena, Dublin, Madrid, Vilnius, Zoetemeer
Twist **www.digitaltwisters.com**	Lille, Rome, Stockholm, Warsaw
Welcome **welcomestartup.eu**	Berlin, Dublin, Madrid, Milan, Salamanca

TABLE IV. EU NETWORKS OF STARTUP EUROPE

Network and Web-site	Purpose of the European Network
European Digital Forum **europeandigitalforum.eu**	To empowering web entrepreneurs and growing Europe's digital economy
Startup Europe Partnership **startupeuropepartnership.eu**	To link the most promising European startups with the large and medium corporates
Failing Forward Learning (LIFE) **failingforward.eu**	Collaborative learning from failure in entrepreneurship and collaborative actions to bring entrepreneurship forward
Young Adults Entrepreneurs (My-Way) **mywaystartup.eu**	Enhancing and improving the collaboration and efforts of web entrepreneurship initiatives, web/business experts, educational actors and young adults as beneficiaries.
Female entrepreneur (WeHUBs) **wehubs.eu**	Support women web entrepreneurs in Europe and coordinate existing web entrepreneurs' ecosystem to provide dedicated services to women
Accelerator Assembly **acceleratorassembly.eu**	To support and promote web-friendly accelerators in Europe
SEP Investor forum **startupeuropepartnership.eu**	An internal conversation channel for the European Investment Fund and European Commission with a large group of investors from all over Europe
Unicorns forum **welcomestartup.eu**	Bring together the members of the SE Unicorns forum to share best practices, understand global web entrepreneurship trends and reflect on future models for supporting entrepreneurs
MOOCs for web talent network **moocstalent.eu**	Network of universities and business schools in Europe interested in developing MOOCs for web talent
EU Tech Writers **failingforward.eu**	To discuss best practices in Tech coverage, to share views and stories concerning the different European digital ecosystems.
European Disruptos´Network **mywaystartup.eu/disruptors_network**	To bring together Young European Disrupters at summits, regional events, leadership development programmes and community-organized gatherings
ICT Law Incubators Network **ilincnetwork.eu**	To facilitate the provision of free legal support to start-ups.
Startup Europe Regions Network	To invest in new instruments and pilot schemes, in line with the priorities defined by the European Commission and the Committee of Regions and for the benefit of European startups

- Connecting local entrepreneurial ecosystems across 5 European ecosystems, which themselves interconnect 16 cities in the European Union (see Table III).
- Connecting the key players in the European entrepreneurial ecosystem through a set of thematic networks (see Table IV).
- Helping startups and scaleups to land in other markets, such as Silicon Valley, India, Africa and the United Arab Emirates.
- Holding networking events and spreading results among the members of Startup Europe.

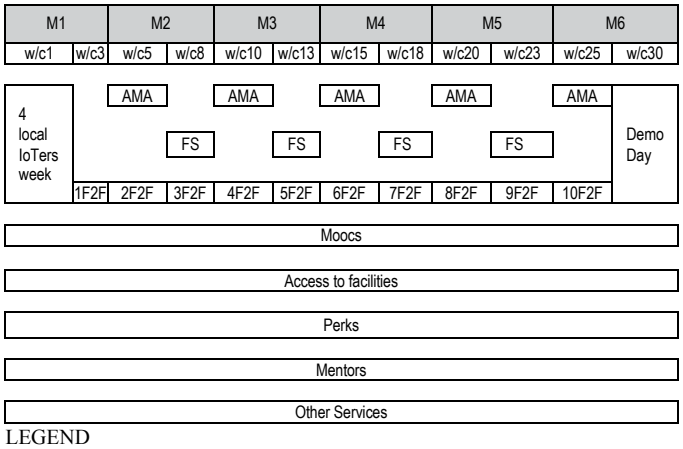
Participation in many of these activities has resulted in connecting the Hub with other European ecosystems and launching partnerships that have improved many aspects: visibility, reputation, business development (access to new startup markets, creation of alliances with other accelerators and investors), improved knowledge of the global entrepreneurial ecosystem and access to key contacts.

IV. STARTUP SCALEUP

Startup Scaleup is an entrepreneurship programme aimed at accelerating startups operating in the field of the Internet of Things (IoT) and is intended for late startups, i.e. startups in a stage prior to being an SME, and at a later stage than an early startup. The programme has a blended character, with five centres where participants can engage in face-to-face activities: Cartagena, Dublin, Madrid, Vilnius and Zoetermeer. Both the initial week and the final event are face-to-face, while the other scheduled activities are held online, although the startups always have the option of heading to one of the four ecosystems to perform the activity face-to-face if they wish.

As can be seen in Table V, the acceleration programme lasts for 6 months.

TABLE V. STARTUP SCALEUP PROGRAM STRUCTURE



LEGEND
w/c: Week commencing
AMA: Ask me anything session
FS: Follow up session
F2F: Face to face meetings with the complete cohort of startups

The programme begins with a week of training, known as IoT'ers Week. This face-to-face activity is held in parallel at four venues in Europe (Dublin, Madrid, Vilnius and Zoetemeer) to facilitate the movement of startups. Although the precise content may differ according to the skills and experience of the startup teams attending IoT'ers Week, the broad outline for the kick-off is shown in Table VI.

TABLE VI. KICK-OFF WEEK PROGRAM

Time	Day 1	Day 2	Day 3	Day 4	Day 5
9.00-11.00	Introduction to Startup Scaleup	Customer Discovery	Customer Development	Building a pitch deck	Financial Modelling
11.00-12.30	Business Model Innovation	Customer Discovery	Customer Development	Pitching	Financial Modelling
12.30-14.00	Business Model Innovation	How to attract money and approach investors	IoT Successes and Failures	Life after investment	Scaling-up Internationally
15.00-16.30	Business Model Innovation	IoT Technologies-Round Table	Developing a product from start to finish	Refining and Challenging your Business Model	Startup Self-Assessment
16.30-18.00	Investors: Who are they and what are they looking for?	Trends and Challenges for the future	R&D funding for your IoT Startup	Refining and Challenging your Business Model	Continent by Continent (EU, Asia, US)

In addition to training aspects, the kick-off week gives a detailed insight into each of the startups taking part in the programme, maps out an action plan for the coming months and detects which mentors are required during the acceleration process. This week also provides explanations about which digital tools will be used to perform monitoring, as well as the structure and goals of the programme.

After the IoT'ers Week, there is a series of activities aimed at completing various training aspects and monitoring the startups. These activities are essentially:

- *AMA (Ask me anything) sessions*. These activities set out to complete certain training aspects and to provide a recognised expert in a given topic to answer very specific questions from the startups. Examples of AMA sessions are 'Future of the Internet, Standards & Protocols', 'Crowdfunding Tendencies', 'Hardware Club Opportunities', etc.
- *Follow up sessions*. These activities review the status, evolution and future actions related to the action plan established after the IoT'ers Week.
- *Face to face activities*. Several face-to-face activities are held throughout the programme, often coinciding with a Startup Europe event (i.e. Startup Europe Summit, South Summit, Startup Europe comes to Silicon Valley, etc.), and are used to hold demonstrations of products developed by the startups, networking events, presentations to investors, meetings with companies, etc.

Finally, the programme ends with a Demo-Day event in which the leading startups attend an important IoT event (World Mobile Congress, Connected Conference, World IoT Congress, etc.) with a stand where they have the

opportunity to showcase their products and business models to the IoT community.

V. RESULTS, LESSONS LEARNED AND FUTURE WORKS

The first round (November 2015-May 2016) of the Startup Scaleup acceleration programme involved forty-nine startups in IoT technologies (37) and Internet services (12). They were selected from 174 applications. Thirty-seven startups successfully finished the programme, and twelve were selected to showcase their products to the IoT community during the Connected Conference held in Paris in May 2016. The distribution of the startups among the different ecosystems is shown in Table VII, while their stage (early, intermediate, late) and specialisation (IoT, Internet Services) are shown in Table VIII. Table IX shows the results obtained in terms of funds raised.

Finally, other key performance indicators (KPIs) can be found in Table X. They provide monitoring of the impact of Startup Scaleup during the first round.

The following lessons can be learned from the activities conducted and the results obtained:

1) Forming part of Startup Europe has enabled us to reach out to more startups and consider an ecosystem focussed on a specific technology (IoT), as the startup market is larger than the one at which the programme was aimed. One hundred seventy-five applications were received during the startup prospecting campaign, a result which we would not have achieved from our regional Hub.

2) Making the leap to an international level has made the programme much more competitive and the quality and maturity of the startups involved much better. This on one hand has improved the overall results of the Hub, but on the other has excluded the many startups of the University which were in very early stages. The search for ways to work with and include these startups is a challenge which needs to be resolved in the near future.

3) There is still much ground to cover with regard to mentor attraction and the mentor-startup relationship. For there to be a good mentor-mentee relationship, successful two-way communication is required, as is a display of mutual interest. Although better mentors have been secured with the Startup Scaleup experience, given the international character of the experience and maturity of the startups, the number of them and level of specialisation achieved is insufficient for the size of said experience.

4) The partnership between the four ecosystems in the initiative (Madrid-Cartagena, Dublin, Zoetemeer and Vilnius) has been very fruitful. Communication and the exchange of experiences with other startups through networking events have been highly valued by the startups taking part in the programme.

5) Closing events such as the Demo-Day type are not highly valued by the late startups. Many startups feel uncomfortable at such events, as they compromise the confidentiality of their developments and, in some cases, end up being a pure show without tangible results. By contrast, participation in professional trade fairs is valued very positively, given that interesting contacts are made and new business opportunities are opened up.

6) Finally, our experience has underlined the importance of the acceleration programme being very well planned from the outset, so that the startups can see the true extent of it and what they can expect from taking part.

TABLE VII. NUMBER OF STARTUPS DURING THE 1ST ROUND

	Madrid	Dublin	Zoetemeer	Vilnius	Tot
Applications	50	51	34	39	174
Start the program	14	11	14	10	49
Finalize the program	11	10	9	7	37
Selected for the Final Event	4	2	3	3	12

TABLE VIII. TYPE AND PROFILE OF STARTUPS DURING THE 1ST ROUND

	Madrid	Dublin	Zoetem.	Vilnius	Tot
Selected Startups	14	11	14	10	40
Ratio in Early Stage	7/14	8/11	5/14	7/10	28/49
Ratio in Intermedium Stage	2/14	3/11	7/14	2/10	11/49
Ration in Late Stage	5/14	0/11	2/14	1/10	10/49
IoT oriented applications	9/14	10/11	11/14	7/10	37/49
Internet Services	5/14	1/11	3/14	3/10	12/49

TABLE IX. RAISED FUNDS DURING THE 1ST ROUND

Ecosystem	Startups nationality	No of Startups	Reached Funds	Sources
Madrid	Cyprus UK Argentina Switzerland Spain France	14	€904,000	Grant, SME instrument, F&F, Angels, National Government
Dublin	Ireland Israel Poland	11	€315,000	Unilever Competition, Government, Kickstarters
Zoetemeer	Italy Austria Spain France Sweden Greece Estonia Hungary UK	14	€1,645,000	Grant, Angels, Loan and equity, F&F, VC
Vilnius	Lithuania	10	€330,000	Grant, Angels, F&F, EU

TABLE X. RELEVANT KPIS DURING THE 1ST ROUND

Key performance indicator (KPI)	1st Round
Number of HUBs participating in Startup Scaleup	4
Number of applications submitted to the acceleration program	175
Number of countries involved during the application process	30
Number of startups running in the acceleration program	49
Startups in early stage	3
Startups in early-late stage	19
Startups in late stage	22
Number of countries of the startups	15
Number of business angels	26
Number of Venture Capital groups	11
On-line platform (startup-scaleup.eu) sessions	11,811
On-line platform (startup-scaleup.eu) users	8,930
Number of mentors	57
IoT contacts at universities	968
Institutional contacts at universities	225
Other contacts at universities	445
Accelerator contacts	435
Accelerators reached	280

Regarding future works, the specialisation of the entrepreneurial ecosystem and collaboration with companies are considered two key aspects. The first of these will help provide even more specialised services. The IoT is still too broad a technological field to be covered by a reasonable number of mentors and investors, and also to ensure a more effective exchange of experiences between startups. We need to approach more vertical industries.

The second aspect is more related to the sustainability of the ecosystem. After two years of operation, the need is to search for external resources. Working with companies may be appropriate, not only to receive revenue, but also to meet the needs of these firms when it comes to talent search and innovation applicable to their traditional business areas

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VI. CONCLUSIONS

Engineering education has the responsibility to explore new ways to train students in the field of entrepreneurship, and to ensure that once they graduate or spend a couple of years acquiring professional experience, they can set out on the adventure of creating a startup with chances of success.

Our experience has shown that at engineering universities it is possible to create startup ecosystems with a strong international component and which are connected to other ecosystems in other countries. In this sense, the Startup Europe initiative is an excellent opportunity for European Universities

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