Deliverable due date: M31 – July 2019

D1.8 ECOSYSTEM FOR BOOSTING SMEs AT LOCAL LEVEL
WP1, Task 1.2

Transition of EU cities towards a new concept of Smart Life and Economy

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Project Acronym	mySMARTLife
Project Title	**Transition of EU cities towards a new concept of Smart Life and Economy**
Project Duration	1st December 2016 - 30th November 2021 (60 Months)
Deliverable	D1.8 Ecosystem for boosting SMEs at local level
Diss. Level	PUBLIC
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Work Package	WP1
Lead beneficiary	FUNDACION ESADE
Contributing beneficiary(ies)	NAN, HAM, HEL
Task description	Subtask 1.2.3, Ecosystem for SMEs, it is integrated in task 1.2, Smart Economy. This subtask will focus on the local economy that in its majority is composed by SMEs, start-ups and entrepreneurs. These small companies (commerce and services) are essential to reinforce the vitality of the city. Small players must find their way around, as they are capable of innovative and provide useful services to their citizens. Finding what are the elements that can help the development of this ecosystem (good practices for instance) will be interesting to benchmark and replicate. ESA and the municipalities will work on this direction. D1.8 (according to DoA): modelling of the city business models to illustrate where corresponding profit comes from and how it flows, and to identify a business model portfolio eligible for SMEs, start-ups and entrepreneurs in the urban field.

Date	Version	Author	Comment
April-May /2019	0.1	Carles Cervera and Dr. Francesc Pardo-Bosch (ESA)	Analysis and shared information of entrepreneurial ecosystems in lighthouse cities - NAN: Benoît Cuvelier and Camille Delanoe - HAM: Johannes Mielchen and Marie Finke - HEL: Marja Vuorinen
June-July/2019	0.2	Carles Cervera and Dr. Francesc Pardo-Bosch (ESA)	Advanced version with general content to validate by lighthouse cities: - HAM: Johannes Mielchen and Marie Finke - HEL: Marja Vuorinen
July/2019	0.3	Carles Cervera and Dr. Francesc Pardo-Bosch (ESA)	Final version sent to the partners reviewers: - ENH - KON

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Abbreviations and Acronyms

Acronym	Description
mySMARTLife	Transition of EU cities towards a new concept of Smart Life and Economy
EC	European Commission
EE	Entrepreneurial Ecosystems
EU	European Union
ICT	Information and Communications Technology
IoT	Internet of Things
GDP	Gross Domestic Product
LE	Local economy
SaaS	Software as a Service
SMEs	Small and Medium-sized Enterprises
VC	Venture Capital
VMP	Viable Minimum Product

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1. Executive Summary

The main goal of mySMARTLife project is to develop an urban transformation strategy implementing different interventions in three lighthouse cities in the fields of energy efficiency, electric mobility and ICT platforms to support cities in the transition from traditional to smart ones. This deliverable, which is part of WP1-Definition of an Innovative Urban Transformation Strategy, is dedicated to characterize and understand local entrepreneurial ecosystems in Nantes, Hamburg and Helsinki. The objective is to illustrate where corresponding profit comes from and how it flows, and to identify a business model portfolio eligible for entrepreneurs in the urban field.

Local economy is a key factor for Europe's development. Well organized, this economy can reduce the social disparity, increase citizens' cohesion, generate new qualified jobs, contribute to the foundation of companies and boost private sector investment. One important part of local economic ecosystems is made by small and medium-sized enterprises (SMEs), particularly customer-oriented enterprises that offer their clients what they need, which makes them very resilient. In smart cities ecosystems, among all these companies, start-ups are the most relevant ones. Centred on technological innovations and searching replicable and scaling-up business models, these companies are constantly offering new products and services to markets.

The authors contextualize the study analysing how entrepreneurial ecosystems (EEs) are or should be from an academic perspective. Once the theoretical framework is clear, the report studies, in terms of EE, what the current situation is in mySMARTLife lighthouse cities. In order to do that, researchers have established very fruitful contacts with the pilot managers and public workers in charge of innovation, economic development or start-up units of each city. A part from that, authors have built a new start-ups database for Nantes, Hamburg and Helsinki using complementary data from other two databases. Thanks to that new instrument, it has been possible to analyse per each lighthouse city very interesting aspects such as the entrepreneurs profile; the entrepreneurial activity in terms of industries or business models, or the growth stages; the amount and type of investments; and, finally, the exits. All this information has been essential to compare the three cities and to give to the European Commission (EU) a clear overview of their state. The report remarks that the entrepreneurial activity and entrepreneurial ecosystems are pushing hard in mySMARTLife project lighthouse cities. Local public authorities are giving priority to the topic in their economic policy strategies. Although there are differences among cities and countries, all entrepreneurs are facing similar barriers, tax rates, tax regulations, restrictive labour regulations, inefficient government bureaucracy and difficult access to credit and to finance.

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2. Introduction

2.1 Purpose and target group

This deliverable is allocated within Task 1.2, Smart Economy, subtask 1.2.3, Ecosystem for SMEs and concretely the role of start-ups. The report focuses on the EE in each lighthouse city of the project in order to reflect their situation. In this subtask, ESA, with the support of NAN, HAM and HEL analyses key aspects of EEs, such as framework conditions, entrepreneurs' profile and characteristics, entrepreneurial activity, investment and exits. The objective is to describe and state the situation of each EE in order to identify where corresponding profit comes from and how it flows, and to make out a business model portfolio eligible for entrepreneurs in the urban field.

2.2 Contributions of partners

The following table depicts the main contributions from participants in the development of this deliverable.

Table 1: Contribution of partners

Participant short name	Contributions
ESA	Overall theoretical research, methodological development and redaction of all the section of the deliverable.
CAR	Coordination of partners.
NAN	Information and technical assistance. Interview with the General Direction of Economic Development and International attraction of Nantes Métropole.
HAM	Information and technical assistance. Interview with the Director Startup-Unit at HIW Hamburg Invest.
HEL	Information and technical assistance. Interview with the PM of Ecosystems of Growth City Executive Office.
ENH	Information and technical assistance.
SAL	Information and technical assistance.

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2.3 Relation to other activities in the project

The following table depicts the main relationship of this deliverable to other activities (or deliverables) developed within the mySMARTLife project, which should be considered along with this document for further understanding of its contents.

Table 2: Relation to other activities in the project

Deliverable Number	Contributions
D2.1	This deliverable has provided the baseline information of Nantes demonstrator area.
D3.1	This deliverable has provided the baseline information of Hamburg demonstrator area.
D4.1	This deliverable has provided the baseline information of Helsinki demonstrator area.
D1.6	This deliverable has provided analysis on Value Creation Ecosystems and City Business Models to define how cities create, deliver and capture value for citizens in new smart solutions.
D1.7	This deliverable has found out what is the needed ecosystem (key drivers) for big players to replicate their participation in other areas of the city or other cities.
D6.13	This deliverable will find out what are the innovative funding schemes, opportunities, and best practices to create an investment plan for the implementation of the interventions.
D8.3	This deliverable focuses on the development of market analysis to identify and construct business cases and business models for industrial partners. The objective is to transfer the results from the Exploitation Roadmap of Results into economic feasible business models.
D8.9	This deliverable will focus its attention on the business models of the most promising intervention from the point of view of industrial partners.

2.4 Methodology

The main objective of this deliverable is to describe and state the situation of each EE to identify where the corresponding profit comes from and how it flows, and to make out a business model portfolio eligible for entrepreneurs in the urban field. The research team, led by ESADE Business School, has concentrated its efforts in

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analyzing EE for each lighthouse city with a concrete focus on start-ups. The main reason to target start-ups among SMEs is their important role in present and future scenarios for local and regional development. Furthermore, start-ups, which are characterized by growth oriented enterprise policies, present some important differences with traditional SMEs. Aspects such as creation, financing, scope, innovation, networks, international connections, entrepreneur's profiles, etc. differ from traditional SMEs. Local and regional public policies must consider them in order to help entrepreneurs and shape their ecosystems to create economic and social value according to new business logics.

The methodological strategy to describe and explain EE has focused on a mix of primary - databases - and secondary - academic and institutional country reports - resources, as well as interviews with city experts and project partners. The analysis of each EE lighthouse city has been divided in six sections: introduction, framework conditions, entrepreneurs, entrepreneurial activity, investment and exits. The research team has used country reports and city databases in order to approach the object analysis. In this regard, the task has resulted complex because there is not enough coherent and systematic data and information to compare same dimensions and variables of EE for each city. Most of the data and information about EE components refers to country level, while databases on cities just regards to entrepreneurial activities but with few information on real EE components. Furthermore, important initiatives on EE, such as Startup Europe[1] or Startup Genome[2] tend to focus on most important city hubs.

Following we present data and information used according to each different section in the analysis of each city lighthouse EE:

- Introduction: primary resources such as interviews with experts from cities, and secondary resources such as websites and reports.
- Frameworks conditions: databases and reports on global indexes such as Doing Business Score[3] (World Bank), the Global Competitiveness Index[4] (World Economic Forum), Index of Economic Freedom[5] (Heritage), the Global Entrepreneurship Index[6] (Global Entrepreneurship and Development Institute) and the Regional Entrepreneurship and Development Index[7] (European Commission).
- Entrepreneurs: Dealroom[8] and Crunchbase[9] databases on start-ups and the Global Entrepreneurship Monitors[10] (GEM).

[1] Source: http://startupeuropeclub.eu/
[2] Source: https://startupgenome.com/
[3] Source: https://www.doingbusiness.org/en/rankings
[4] Source: https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018
[5] Source: https://www.heritage.org/index/
[6] Source: https://thegedi.org/global-entrepreneurship-and-development-index/
[7] Source: https://ec.europa.eu/regional_policy/en/information/publications/studies/2014/redi-the-regional-entrepreneurship-and-development-index-measuring-regional-entrepreneurship
[8] Source: https://dealroom.co/
[9] Source: https://www.crunchbase.com/
[10] Source: https://www.gemconsortium.org/

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- Entrepreneurial activity, investment and acquisitions: Dealroom and Crunchbase databases on start-ups.

Finally, between all data and information analysed, authors have tried to identify mySMARTLife sectors of interest such as the industry of energy, transport and Internet of Things (IoT).

With the objective to facilitate the understanding some important theoretical concepts, the authors present the following annexes at the end of the document: Glossary and Start-up Financing Cycle.

2.5 Acknowledgments

The authors would like to thank all the partners involved in subtask 1.2.1., NAN, HAM and HEL for the material and technical assistance, in particular, Benoît Cuvelier, Camille Delanoe and Florence Le Goff from Nantes Métropole; Johannes Mielchen, Marie Finke, Doris Willmer, Jens-Ragnar Martinen and Veronika Reichboth from Hamburg; and Marja Vuorinen, Ari Seppänenfrom and Henrik Jakobsson from Helsinki, for their initiative, active collaboration, and constant support during the accomplishment of this subtask and the preparation of this deliverable.

3. Local economy

3.1 What is local economy?

Local economy could be defined as the system according to which the money, industry and trade is organized inside a “small” community established around a specific geographic location to serves its own population. Its main objective is, in its essence, the use and development of the endogenous potentialities of a community (municipal or regional). It is a continuously proven way to create wellbeing, quality of life and stable employment for its inhabitants.

Local economy is a key factor for the reactivation of western economies. Acting as a local facilitator, it can encourage the growth of local communities, which together have an immense weight within national or supranational economies. Local economy cannot, and should not, be understood as an oasis within the global economic system. This type of economic development must be related and integrated into national and international markets. Synergies are essential to take advantage of the resources generated at local level.

Many regions built their growth on foreign investment. An investment lead by large multinationals that allowed rapid and continued growth, based overtime on a constant improvement of profitability. When profitability is questioned, capital moves towards favourable territories. A strong local economy reduces the foreign dependence, creating own wealth and reinvesting it in its own people.

The real implementation of this productive model can reduce the social and wage disparity, increasing social cohesion, with the generation of new qualified jobs, contribute to the creation of companies and increase private sector investment. In any case, this new economy must be based on social and technological innovation to be competitive and sustainable in the long term. Public sector must lead, of course, this local development policy, offering, among many other things, technical assistance. However, it cannot do all the work alone, it needs the collaboration of other key actors. Local companies and non-governmental organizations must step up and work collectively with public authorities to create the best possible conditions to promote local economic growth and job creation. In addition, for doing it effectively, in no case, this set of actors can forget the fourth element of the equation, civil society.

3.2 The role of small and medium-sized enterprises in local economy

When talking about local economy, among all the actors that make up the private sector, small and medium businesses highlight by themselves. This type of enterprises develops a very important role for many and different reasons. SMEs help to draw and configure the identity of a region. Although they cannot generate as much revenue as large companies, they offer diversity to the economy making it more resilient and ensuring its success.

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These companies are in constant contact with their customers, they are very much customer-oriented. This is a very important competitive advantage, since they know their customers' needs, allowing them to adapt their products and services faster and better than their competitors. Having a real and direct contact with customers forces them to innovate. In fact, innovation is, in many cases, the principal axis of their existence. According to Bagley (2012), small business produce 13 times more patents than large firms. Small companies need to be different, they need to stand out from big competitors and innovation is the only way that they have for this purpose. Google, Amazon, and many other huge companies are the result of innovation processes that create sustainable competitive advantages. One reason for having this success in terms of patents could be that their employees experience genuine freedom on theirs daily tasks, making their own decisions and working independently from their superiors. It really creates a very positive virtuous circle for the development and consolidation of processes linked to innovation, because these companies usually attract workers willing to be creative when they have to face and solve problems.

SMEs companies are also capable to adapt their structures when facing difficult circumstances, like an economic crisis. In that sense, authors like Brown (2018) states that this type of companies have more capacity to resist economic changes since they accumulate less revenue than larger corporations, what means that they have lees to lose in times of economic crisis. Moreover, many customers and public administrations make efforts to continuing support local companies rather than large enterprises. Despite this intrinsic ability to adapt to difficult times, it would be advisable for public administrations, especially the central ones, to approve a fiscal structure that would offer these companies more chance to survive.

As economic actors, SMEs are essential to boost the local economy. Normally, their workforce is local. Hiring local people, and by extension, increasing the employment rate, they have a huge impact on the health of local community and its people. Beyond that, these companies also have local suppliers. Suppliers and workers paying taxes that stay local with their further benefits. In that sense, it is very important to highlight the role of owners, who normally live in the community itself, participating in the social and cultural life of the city, contributing and supporting those activities that need them from an economic point of view. In terms of owners, Natter (2018) remarks that small businesses provide opportunities for minorities to stablish themselves in significant roles starting their own entrepreneurial projects.

3.3 The case of start-ups, new ways of doing business

The last couple of decades have brought many challenges to our local communities. Nowadays, cities are living amazing times finding solutions for meeting them. Urban ecosystems are seeking new ways to growth, to retain young people's talent and to revitalize the life of urban spaces (Studer, 2018). Many cities are aware of that they are facing these challenges by promoting strong local economies driven by a particular type of SMEs, start-ups.

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A start-up is a company funded by individual entrepreneurs with the aim of finding a replicable and scalable business model, working to solve a problem which solution is not obvious and usually centred on technology-based innovation. In fact, technology is changing everything, including traditional industries, such manufacturing, energy production and distribution, transportation, etc. Smart cities are one of the most important levers of the technological and digital transformation, and consequently they are the foundation of a new paradigm that offers innumerable opportunities for and by start-ups.

Each city has the opportunity to participate and take advantage of this revolution (Mandel, 2017), although municipalities and regional governments have to play an active role to make it real and viable. Many cities, in order to encourage entrepreneurs and their start-ups, create training programs and made regulatory changes offering tax incentives or bureaucratic facilities. Policy-makers should encourage the foundation of start-ups, removing obstacles for their birth and growth. In that sense, it would be interesting to invest in higher education as an engine of innovation and attraction of international talent; build basic infrastructures; and invest in diversity and inclusion, erasing systemic biases, and enriching projects with different visions and cultures (Bussgang, Montuori and Brah, 2019).

An economy supported by start-ups is an economy supported by job creation. Growing start-ups have the potential of creating many jobs; in fact, these companies are reducing the unemployment rates faster than traditional old companies do. A part from that, these clusters of talent attract investment capital and support other businesses created around them that are key for new entrepreneurs, like co-working spaces, incubators, accelerators and other service providers. Having a powerful entrepreneur ecosystem that revolves around start-ups could attract large multinational companies willing to invest in successful projects.

The EC pays special attention to the start-up scene in its annual report on European SMEs. The last report (2017/2018) incorporates a section based on a recent research at a European level, the EU Startup Monitor (Steigertahl and Mauer, 2018), which confirms start-ups and scale-ups as drivers of economic growth and job creation within the European Union. Although we cannot make the mistake of idealizing the start-ups, nowadays, and despite that many of them fail, these companies are a great engine for our local and general economy. We should know them deeply to benefit from their resources on the transition from traditional cities to smart ones.

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4. Entrepreneurial ecosystem

The concept of entrepreneurial ecosystems (EE) is gaining much attention in recent years. From a research point of view, there is still a debate on how to define and understand successfully EE. According to Stam and Spigel (2016), although this research work is still in its infancy, there is quite enough research on EE to highlight that a rich EE enables entrepreneurship and subsequent value creation at a regional level. In fact, high levels of entrepreneurship are closely correlated with regional economic growth, growth processes, innovation, etc. (Chuang et. al, 2019; Acs et. al, 2018; Audretsch and Belitski, 2016). Therefore, understanding the determinants of entrepreneurship must be a priority for public policy makers at all geographical levels, but particularly at a local and regional level where entrepreneurship takes place. Furthermore, the Entrepreneurship 2020 Action Plan[11], based on the Small Business Act[12], states the importance to create an environment where entrepreneurs can flourish and grow.

The key point is that new business creation does not only depend on the relational aspects of an economy. There are other issues related to market development, human capital, finance culture, support, etc. that also have a high influence in the development of EE (Mack and Mayer, 2016). In this sense, according to the Mason and Brown (2014, pp. 5), an EE could be generally defined as:

> "*a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sellout mentality within firms and levels of entrepreneurial ambition) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment*"

According to this general definition, the focus on academic research on EE is dedicated to understand the key components and actors within a specific EE to explain how can entrepreneurship be foster in order to develop, growth and maintain the EE. To this extent, we must explain what is understood by entrepreneurial and what by ecosystem. The first term means a process in which opportunities for creating new goods and services are

[11] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions Entrepreneurship 2020 Action Plan Reigniting the entrepreneurial spirit in Europe.

[12] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - "Think Small First" - A "Small Business Act" for Europe.

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explored, evaluated and exploited (Stam and Spigel, 2016). Entrepreneur activity relates to high growth start-ups and scale-ups, which represent a source of innovation, productivity, growth and employment. From our point of view, according to different authors (Stam and Spigel, 2016), the term entrepreneur activity it is not just related to new ventures, it is also linked to the creation of networks, public-private partnerships, public policy…and at the end the social value of entrepreneurial activity to society (Zahra and Wright, 2016).

The second term of the concept, i.e. ecosystem, means where entrepreneurship takes place, specifically in a community of interdependent actors, with concrete infrastructures, policies and a social context. The idea, to sum up, is that entrepreneurial activity can be considered as an output of EE, but we must take into account that an EE also produces and changes value in the society, which should be considered as the outcome of an EE. In others words, it is not just a matter of quantity (firm creation), it is also a matter of quality (conditions, value creations, interactions, knowledge, etc.). Furthermore, in addition to this relation quantity-quality, the approach must focus on both agency and context matter (Acs et. al, 2016).

Among the different frameworks to understand EE, we must highlight a first approach proposed by Isenberg (2011). As can be observed in next figure 1, the author highlights six domains from an EE: policy, finance, culture, supports, human capital and markets. Each of these domains contains different components, which define them.

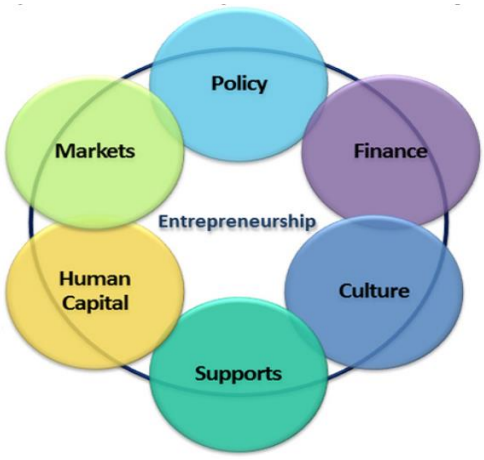

Figure 1: Domains of the entrepreneurship ecosystem (Isenberg, 2011)

From Isenberg (2010) perspective, an EE consist of a set of individual elements that combine each other in complex ways. The point that the author underlines is that these elements, although could lead to entrepreneurship, are not enough in isolation to sustain an EE. As the author mentions, many governments fail to see the whole picture and focus their efforts just in one or to domains or elements. Isenberg approach (2010) has been very popular and constituted an inflection point in EE research. Nonetheless, the approach presents some limitations regarding rigidity, causality or prediction ability.

Stam (2015) presents a different framework. It is quite similar to Isenberg model regarding domains and components, but the author structures these elements using four ontological layers (framework conditions,

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systematic conditions, outputs and outcomes). As depicted from figure 2, the ontological layers include upward and downward causation as well as intra-layer causal relations.

The upward causation implies how the fundamental causes of new value creation are mediated by intermediates causes, while downward causation shows how outcomes and outputs of the system over time also feed back into the system conditions. The intra-layer causal relations refer to the interaction of the different elements within the ecosystem and how the different outputs and outcomes of the ecosystem might interact. The elements of the EE are grouped in framework conditions and systematic conditions. As the author mentions, the systematic conditions are at the heart of the ecosystem: networks, leadership, finance, talent, knowledge and support services. The presence of these elements and the interaction between them determine the success of the EE. Different studies demonstrate the influence of framework and systemic conditions on outputs and outcomes (Chuang et al. 2019; Butler et al. 2015).

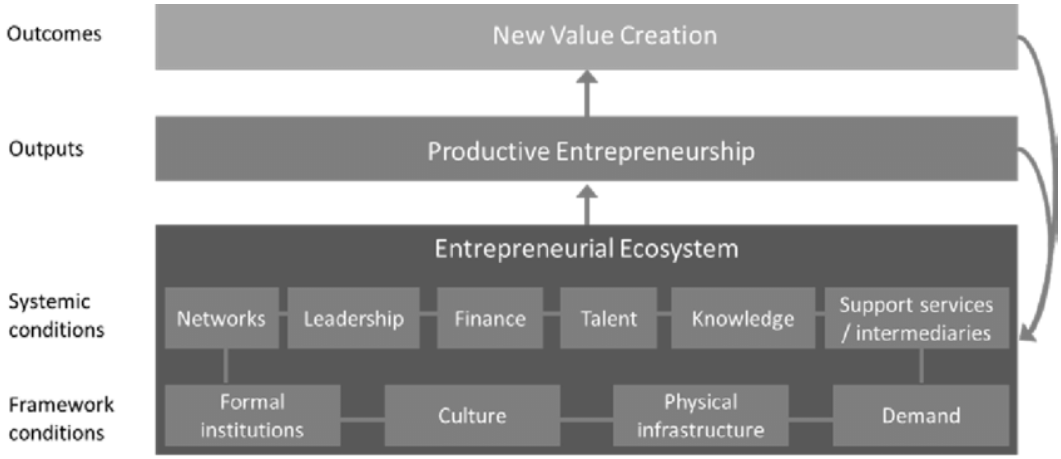

Figure 2: Key elements, outputs and outcomes of entrepreneurial ecosystem (Stam, 2015)

Besides both frameworks, it is important for policy makers to identify classical phases of EE. According to Mack and Mayer (2016) - see figure 3 - the first stage is the birth stage, which is characterised by more firm births than deaths. The rate of new firms is low, but there are some exits and the overall number of firms increases as entrepreneurs take risks and found new companies. Many of the EE components are underdeveloped or with not enough presence on it. The second stage is the growth stage, where components of the EE become more specialized and targeted towards entrepreneurship. The births still exceed firm deaths and markets go beyond regional to national and international. The dynamic of the EE increases and financial capital becomes more accessible and as the EE offers more confidence to investors. Normally, the framework and systematic conditions are quite good (in quantity and quality) to enable entrepreneurial activity (output) and new value creation (outcome) for EE. After this phase, there is the sustainment phase, which is characterised by a small number of firm births and some firm deaths. In this phase, market opportunities and networks start to weaken. Finance becomes harder to

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get. Finally, if EE actors are not successful to maintain this phase, the EE starts to decline. In this last phase, firm deaths are higher than births, many systematic conditions can disappear and entrepreneurship is not seen as a career opportunity.

The important thing about the cycle relies on the fact that framework and systematic conditions do not play the same role along the cycle. Thus, policy makers should contemplate actors, resources, connectors and orientations in different ways in order to allocate efforts and develop local strategies.

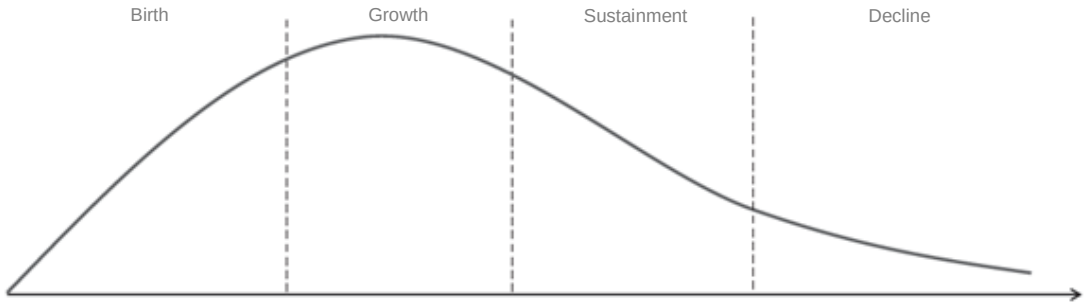

Figure 3: Evolution of an EE (Mack and Mayer, 2016)

To sum up, entrepreneurship plays a key role in economic development (Audretsch and Belitski, 2016), but as mentioned before, decision-making does not happen in isolation from local context where entrepreneurs operate (Acs et. al, 2016; Icenberg, 2011). In this sense, policy makers play a key role in supporting and creating framework and systematic conditions in terms proposed by Stam (2015). Furthermore, the misallocation of public resources could have important effects to productivity or on the contrary, a great influence in firm creation, survival, employment rates or net income (Butler et al., 2015) as wells as other social values (Zahra and Wright, 2016). To this extent, there are some general principles, in which several reports on EE coincide:

- Although there is empiric research on correlation and causality between entrepreneurial activity and economic growth, EE are very complex and often difficult to explain in terms of causality. Every ecosystem is unique (Mason and Brown, 2014; Icenberg, 2010).
- Pre-existing assets (framework conditions) contribute and condicionate successful EE. A minimum presence of these assets is required to foster EE. As Mason and Brown (2014, pp.19) mentions, "*you can not create something from nothing*".
- Initiatives based on isolation are likely to be inefficient (Stam and Spigel, 2016; Mason and Brown, 2014). A policy focused on start-up creation may be insufficient if there is a lack of framework and systematic conditions; in the same way, a policy based on attracting venture capital could be irrelevant if the EE does not present a significant volume of companies in growth stages.

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- Approaches to EE should take in mind different *continuums* such as quantitative and qualitative outputs and outcomes, entrepreneurial activity and context conditions as a whole picture, top-down and bottom-up approaches and public and private initiatives.

5. The case of Nantes

5.1 Introduction

The EE of Nantes is in a nascent phase. Nonetheless, as the Nantes St-Nazaire Développement[13] mentions "*start-ups are a rising phenomenon in Nantes*". Nantes St-Nazaire Développement agency is one of the principle resources at a regional level to start a business. They offer concrete information about procedures, sectors, coworking spaces, recruitment and events.

From a public perspective strategy, Nantes Métropole focuses its EE on the metropolitan strategy for innovation, nurtured by EUROCITIES network of major European cities report "Local Innovation Ecosystems: lessons learned from local government" (2017). One of the key problems of the EE of Nantes regards to the legitimacy and influence on the decision making process of the local innovation ecosystem. The French government, in its innovation strategy, focuses on measures to enforce European attraction of French start-ups with financial and technical national support (i.e. *Le Programme Investissements Avenir*) and one local leader and key player (the regions). Thus, cities are not identified as key players within local innovation systems. In this context, the Eurocities proposal is very important, as it stresses the importance of cities. It can support their will to remain and reinforce their role as key players on the ground.

At this point, as mentioned by Florence Le Goff[14], Nantes is reconsidering the start-ups needs, reinforcing funding efficiency and rationalizing the local innovation ecosystem. Nowadays, the challenge is to build a clear innovation strategy, based on a new role for the Métropole within the local innovation ecosystem, so as the city can be recognized as the creative, inclusive and experimentation city of tomorrow.

The innovation strategy is based on strategic sectors (digital, manufacturing, health, food, shipping and creative and cultural industries). The strategy tries to set up common framework based on personalization and optimization. Nantes Métropole focus on a quantitative approach (raise the number of start-up companies and unicorns) but trying to optimized resources and take advantage from framework conditions.

[13] International economic development agency. Source: https://www.nantes-saintnazaire.fr/en
[14] In charge of the innovation mission from the General Direction of Economic Development and International Attraction of Nantes Métropole.

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Some of the key strategy launched actions are:

- The Citylab[15]: Nantes City Lab, recently created, is a program to enable experimentation for innovative and collaborative projects of new urban services. Its target is to gain financial, technical or usage hypothesis feedback from life-size tests in a dedicated playground. The Lab is dedicated to start-ups, associations, SMEs, academics, etc.
- Help to develop the entrepreneurial culture and specically the student entrepreneurial culture. Nantes Métropole has been financing and helping academics incubators in their development for the first four years. They focus on projects from engineering and economic schools.
- Nantes Métropole has also created its own programme called “Maia Mater[16]” shared with the city of St. Nazaire. It is a programme of intensive training camp for young local, national and international start-ups in the field of digital and tech projects.

In addition, Nantes has developed many partnerships through its economic and innovation policy. In 2016, Nantes Métropole signed a formal and dynamic strategy with academics from university and higher national institutes called “Campus Nantes[17]”. The strategy aimed to structure a global, optimized financial and technical partnership in research programmes, building projects with international ambition, cross sectors relationships, training, incubation and fostering emerging sectors like artificial intelligence or health. Others partnerships exist at regional level (because of the Region increasing leadership in economic policies), and inter-regional level (University Bretagne Loire and Pôle Métropolitain Loire Bretagne, which gathers together the big cities of the French north-west area) for pooling events, trainings and actions, with the common ambition to be more attractive at national and international levels. Nantes Métropole has also a closer cooperation with the city of Saint-Nazaire, mainly on economic and innovation topics (including tourism and attraction), with shared programmes, common strategies (in digital or maritime sector for instance), common development and innovation agencies (such as Nantes Saint-Nazaire développement or Atlanpole) and huge events. Moreover, financial and technical partnerships with private innovation structures are strengthening to facilitate entrepreneurial projects and growth, and to foster emergent sectors. For instance, “Nantes tech” (a local derivation of French tech) is gathering digital actors, to promote local start-up and facilitate their growth (to do so, the cluster “La Cantine” is founded by Nantes Métropole).

5.2 Framework conditions

In this section, we use primary sources from different databases as well as secondary sources to have an overlook of main characteristics and framework conditions for the entrepreneurial ecosystem in Nantes and in the whole

[15] Source: https://www.nantesmetropole.fr/pratique/numerique/nantes-citylab-et-si-nantes-devenait-votre-terrain-de-jeu-developpement-durable-urbanisme-92851.kjsp?RH=Edemarches&RF=1490853364998
[16] Source: https://www.nantesmetropole.fr/actualite/l-actualite-thematique/maia-mater-un-camp-d-entrainement-pour-creer-sa-start-up-emploi-economie-93359.kjsp
[17] Source: https://www.campusfrance.org/es/ciudad/nantes

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country of France. Our main objective is to draw a picture from general (France) to particular (Nantes) to identify these conditions.

Our first approach to entrepreneurship and business is at national level through the following comparable world indexes (see Annex 1, Indexes, for descriptions): the Easy of Doing Business, the Global Competitiveness Index, the Index of Economic Freedom, the Global Entrepreneurship Index and the Regional Entrepreneurship and Development Index, which scores are presented in table 3. We have chosen those that are developed by important worldwide organizations and represent a primary source to consult for doing business in Nantes and France.

Table 3: Indexes (2018-2019)

	Easy of Doing Business[1]	Global Competitiveness Index[2]	Index of Economic Freedom[3]	GEI Index[4]	REDI Index[5]
Score	77.29	78	63.8	68.5	55
World rang	32	17	71	10	

[1] The World Bank. Doing Business. Measuring Business Regulations. 2019. Score: 0-100.
[2] World Economic Forum. The Global Competitiveness Index. 2018. Score: 0-100.
[3] Heritage. Index of Economic Freedom. 2019. Score: 0-100.
[4] The Global Entrepreneurship and Development Institute. Global Entrepreneurship Index (GEI). 2018. Score: 0-100.
[5] European Commission. Regional Entrepreneurship and Development Index (REDI). 2018. Score: 0-100.

The first index to take into account is the Easy of Doing Business score. According to Doing Business database information (2019), France ranks 32 out of 190 countries, with a score of 77.29. This score is under the regional average for OECD high income countries (78.9). As can be observed in figure 4, France scores high in *trading across bordiers* (scores 100 - ranks 1), *starting a business* (scores 93.27 - ranks 30) and *getting electricity* (scores 92.01 - ranks 14). Regarding starting a business, one of the most important variable of the index, France has a very good score above 90, and ranks 32 from 190 position, above the OECD high income countries, which score 91.19. Many of the variables related to this item such as *procedure - men*; *time - men*; *cost - men*; *procedure - women*; *time - women*; *cost - women*… score quite high. On the other site, France present low positions in *getting credit* (score 50 - ranks 99), *registering property* (score 63.33 - ranks 96), *protecting minor investors* (ranks 66.67 - scores 38) and *paying taxes* (scores 79.31 - ranks 55).

During last years, France made some reforms to make easier to do business. In 2019, France made getting electricity easier by streamlining the application process and reducing the time for the external works; made registering property easier by implementing an electronic registration system and improving efficiency at the land registry; and made paying taxes less costly by decreasing the corporate tax rate, increasing the rate of the competitiveness and employment tax credit (CICE), and decreasing the rates for the territorial economic contribution as well as social security contribution paid by employers. In 2018, France strengthened minority investors' protection by increasing corporate transparency, and made paying taxes less costly by lowering rates for social security and training contributions.

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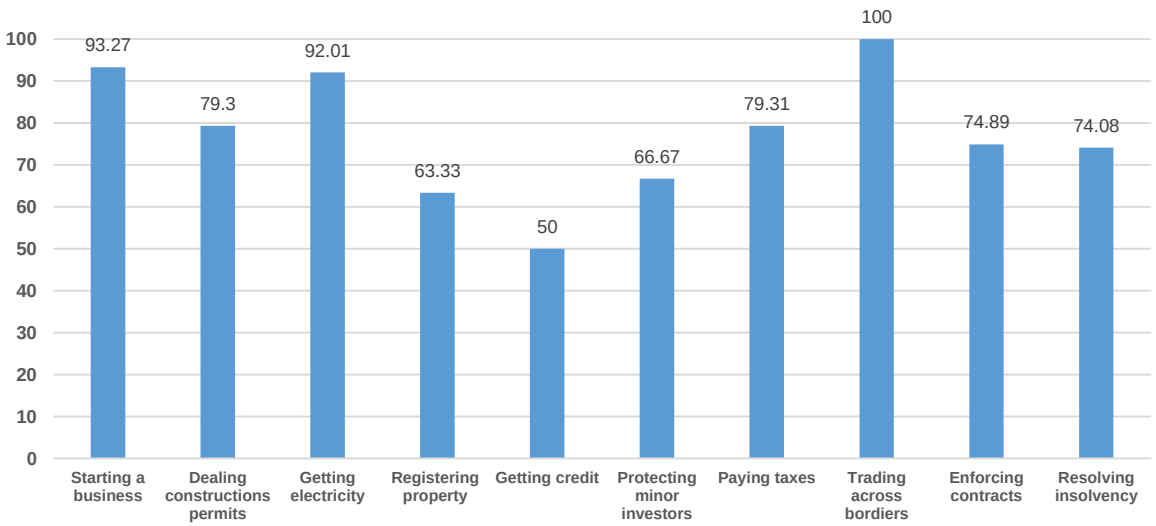

Figure 4: Scores for Easy of Doing Business Index (France, 2019)

The second index is the Global Competitiveness Index. According to the World Economic Forum database information (2018), Germany ranks 17 out of 140 countries, with a score of 78. In 2017 ranked 18 out of 135 countries. Comparing with the first index - Easy of Doing Business -, France scores much better. As depicted from figure 5, the index involves twelve pillars. France scores very high in *macroeconomic stability* (scores 99.9 - ranks 33). The rank position is 33, which seems not to be high, but the score is equal to many other countries. So it is a not a problem the position. France also scores high in *health* (score 99.1 – ranks 7), *infrastructure* (scores 90.1 - ranks 8), *financial system* (scores 82.9 - ranks 17) and *market size* (scores 81.5 and ranks 9). Also, has a good position in innovation capability but scores under 80 (score 76.1 - ranks 11). On the other site, there are some components, which France has to score better. This is the case for *labour market* (scores 61.5 - ranks 53), *product market* (scores 62.5 - ranks 31), *skills* (scores 72.6 and ranks 34) and *ICT adoption* (scores 71.1 - ranks 29).

The third index that we present here is the Index for the Economic Freedom (2019). France ranks 71 out of 169 countries with a score of 63.8. Compared with the previous mentioned indexes, it seems to be far from both, the Easy of Doing Business score and the Global Competitiveness Index. Its overall score has decreased by 0.1 point, with a sharp drop in the score for judicial effectiveness exceeding improvements in fiscal health and government integrity. France is ranked 35th among 44 countries in the Europe region, and its overall score is below the regional average but above the world average.

As reflected in scores presented in figure 6, we can highlight best scores in *property rights* (82.5), *business freedom* (81.2), *trade freedom* (83.3), *monetary freedom* (79.1) and *investment freedom* (75). On the other site, it seems that *government spending* is very low (3.9), but it represents 56,6% of GDP, quite a lot comparing to other countries. Another aspect that scores low is *labour freedom* (45.2) because labour market is burdened with rigid regulations and lacks the capacity to generate more vibrant employment growth. There is an extensive system of subsidies and price controls, for example for agriculture and clean energy.

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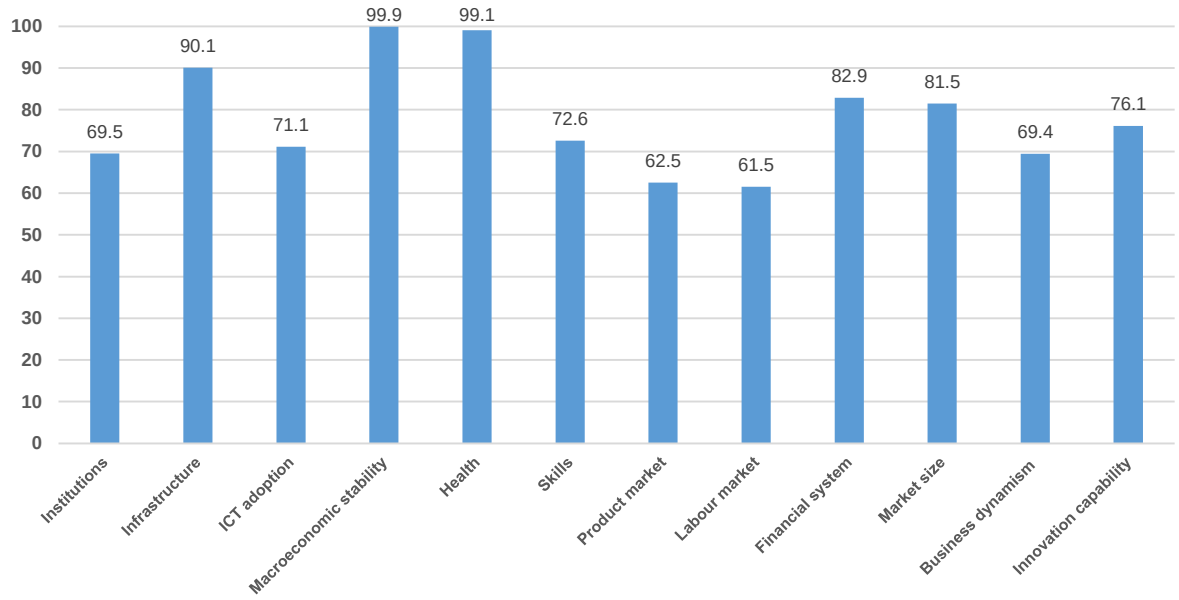

Figure 5: Scores for Global Competitiveness Index (France, 2018)

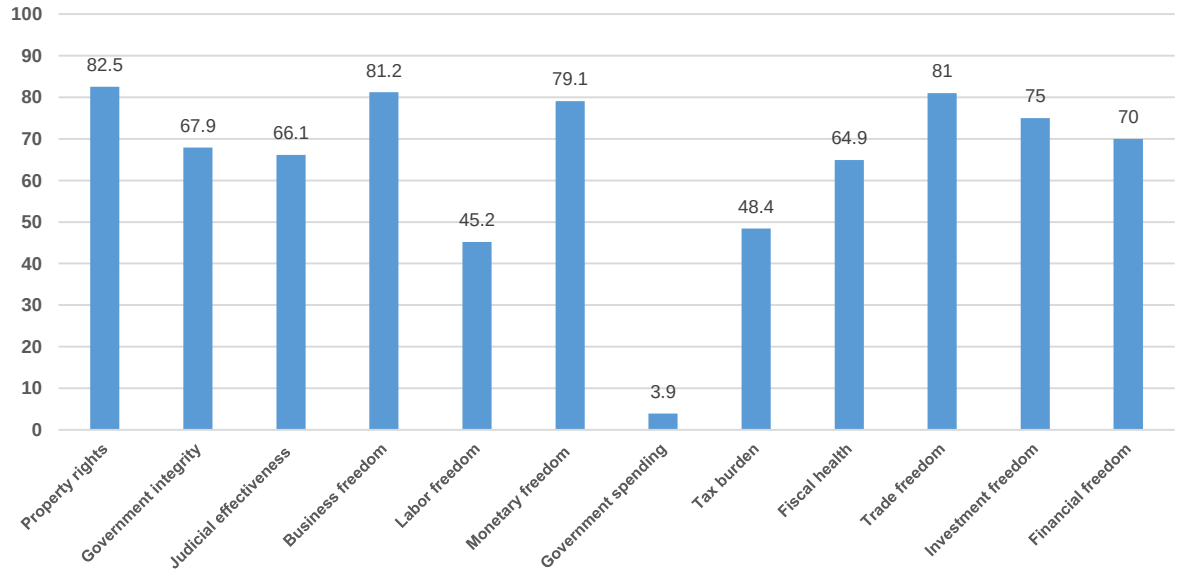

Figure 6: Scores for the Index of Economic Freedom (France, 2019)

Finally, we present the Global and Entrepreneurial Index (GEI, 2018) for France and the Regional Entrepreneurship and Development Index (REDI, 2018) for the *Ouest* region, which involve the city of Nantes. Regarding GEI, France scores 68.5 and ranks 10 out of 137 countries and regarding REDI, the Oust region scores 55. As observed in figure 7, France scores better in almost every item, except for the case of *competition* (business strategy and competitors), *technology absorption* (absorptive capacity and technology level) and *risk acceptance* (business risk and business acceptance). The *Ouest* region scores above eight for these three items, although France present also good scores. On the other site, we must mention some lacks that should be improved in the *Ouest* region such

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as *start-up skills* (quality of education and skill perception), *opportunity perception* (market agglomeration and opportunity recognition), *high growth* (clustering and gazelle) or *human capital* (education and training and education level).

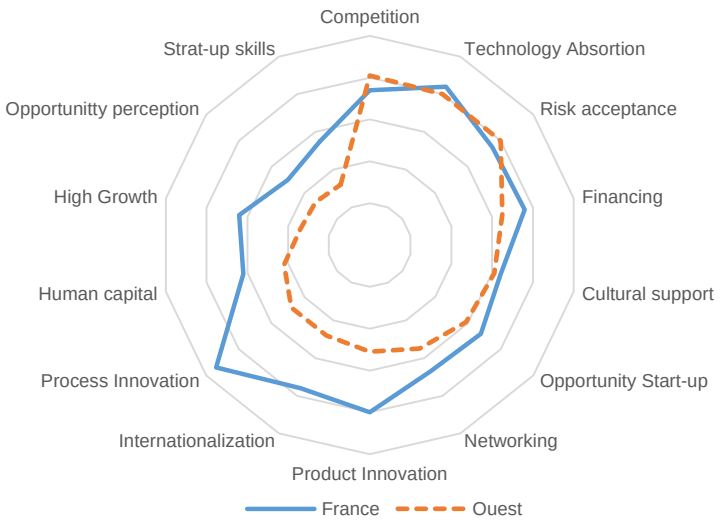

Figure 7: GEI and REDI indexes (France and *Ouest* region, 2018)

After the analysis at a country and regional level, the authors, to close this section, have revised a national ranking[18] for cities, which serve to compare Nantes with other French cities. In fact, considering just France the Nantes ecosystem ranks third in 2019, just below Lyon and Paris, and above important cities such as Bordeaux, Marseille or Rennes. Although Nantes ranks better, the scores for Bordeaux, Marseille or Rennes are quite close to Nantes.

5.3 Entrepreneurs

In this section, we use a database based on start-up companies founded during the period 2010-2017 and different reports to describe entrepreneur's profile and perceptions from Nantes.

According to our database, the mean of founders for start-ups in the above mentioned period is 1.77 with a standard deviation of 0.90. As presented in table 4, the percentages for the two first categories - one and two founders - compose almost 70% of the sample, being 53.80% for one founder and 15.40% for two founders. The statistical results are interesting. Mainly, they are telling us that entrepreneurship in Nantes is divided. 50% show that entrepreneurship is an individual activity, while 50% show that is a group activity.

[18] Source: https://www.startupblink.com/startups/nantes+france

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Table 4: Start-up founders (Nantes, 2010-2017)

Number of founders	Number of start-ups	Percentage
One	14	53.80
Two	4	15.40
Three	8	30.80
Total	**26[1]**	**100**

[1]Cases with information. Missing values 54.

Regarding founder's gender, at it is presented in table 5, start-up companies with female founders alone, represent 12% of the sample, while male founders alone represent 84%. There is 4% (just one case) of mixed teams in which there is at least one women. Taking into account that the global average is 16% for female founders, the amount of 12% is a value to improve. From this perspective, there is still an opportunity to include women in the entrepreneurial ecosystem of Nantes, particularly if we compare it to world city ecosystems like Chicago (25%), New York (22-24%) or Shanghai (22-24%). For the case of the European entrepreneurial city ecosystems, female founder's best scores are in Barcelona (15%), London (15%) or Copenhagen (14%) (GEM, 2016/2017).

Table 5: Start-up founder gender (Nantes, 2010-2017)

Gender of founders	Number of start-ups	Percentage
Female	3	12
Male	21	84
Both	1	4
Total	**25[1]**	**100**

[1]Cases with information. Missing values 55.

An important founder's characteristic is their previous entrepreneurial experience. As observed in table 6, 24% are start-up companies founded by entrepreneurs who have had prior experiences on launching start-ups and 76% are entrepreneurs for the first time.

Table 6: Entrepreneurial background of start-up founders (Nantes, 2010-2017)

	Number of start-ups	Percentage
Serial	6	24
No serial	19	76
Total	**25[1]**	**100**

[1]Cases with information. Missing values 55.

Another important aspect to highlight about entrepreneurs are perceptions. The Global Entrepreneurship Monitor (GEM) (2018), a unique global assessment of entrepreneurial activity, highlights some interesting ideas about entrepreneurs in France:

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- **Perceived opportunities**. The percentage of opportunity perception (adults 18-64 years) has grown in France from 34.13% in 2017 to 34.95% in 2018. Notwithstanding the growth, France is still below the global average for all countries (45.60%) and the high income countries level average (46.63%).
- **Perceived capabilities**. The percentage of having entrepreneurial capabilities (adults 18-64 years) to start a business has increased from 36.31% in 2017 to 37.46% in 2018. As for the case of the perceived opportunities, France is still above the global average for all countries (49.19%) and the high income countries level average (46.61%). Similar variables to take into account are start-up skills and human capital.
- **Fear of failure**. The percentage of feel of failure (adults 18-64 years) to set up a business has decreased from 39.07% in 2017 to 37.08 in 2018. However this percentage is higher than the global average for all countries (36.23%) and the high income countries level average (36.64%).
- **Entrepreneurial intentions**. The percentage of entrepreneurial intention (adults 18-64 years) who are latent entrepreneurs and who intend to start a business within three years has increased from 17.62% in 2017 to 18.60% in 2018. This percentage is still below the global average for all countries (23.68%), but above the high income countries level average (17.06%).

In figure 8, we present a list of most problematic factors for doing business in France (The Global Competitiveness Index, 2018), according to entrepreneurs and business survey (2017). Most problematic factors are *tax rates* (19.6%), *restrictive labor regulations* (19.1%), *tax regulations* (17.6%); and *inefficient government bureaucracy* (11.8%). These factors are quite common for OECD countries and as we will present in following chapters, very similar for the cases of Germany and Finland.

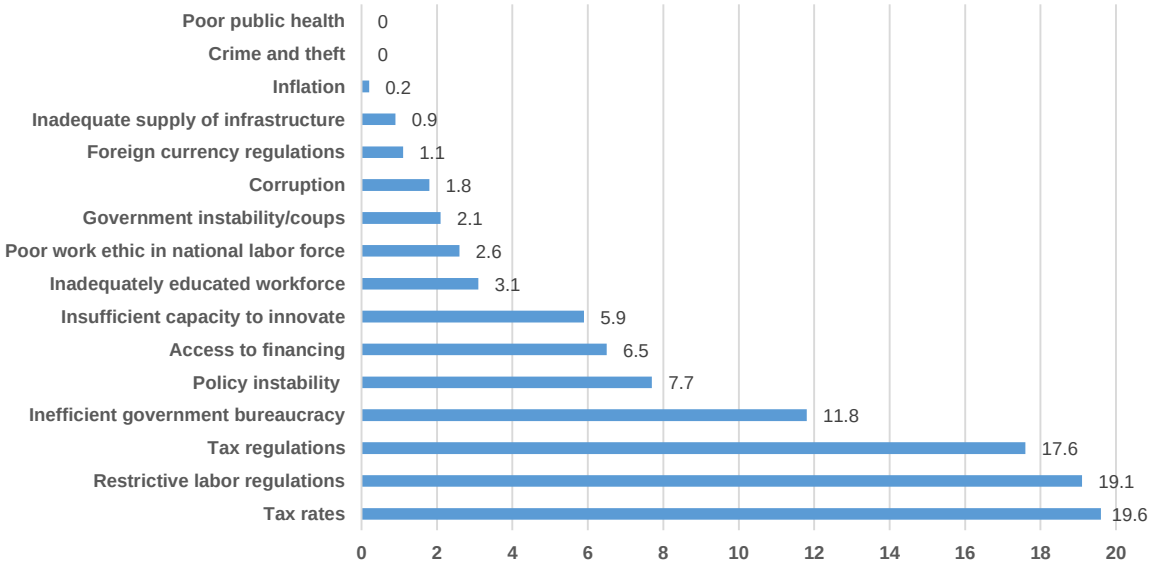

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Figure 8: Most problematic factors for doing business (France, 2017)

5.4 Entrepreneurial activity

In this section, we use a database based on founded start-up companies for the period 2010-2017. 80 start-ups were founded in Nantes during this period. This number represents 63% of all start-ups founded in the city if we take into account the whole historical record for start-ups. The percentage increases to 74% if we consider just the founded start-ups in the XXI century. These percentages are indicative given that the historical record for start-ups is incomplete.

As shown in table 7, all companies founded in Nantes during the analysed period are still operative. In some way, we can also consider that the 6.25% of companies acquired are operative too in terms of markets. It is important to remark that we do not have information regarding closed start-ups.

Table 7: Operational status of start-ups (Nantes, 2010-2017)

Operational status	Number of start-ups	Percentage
Acquired	5	6.25
Operational	75	93.75
Total	**80**	**100**

As depicted in figure 9, the foundation of start-up companies in Nantes has increased between 2010 and 2016. It has a pick in 2013 presenting 17 start-ups. It seems that maintains an average between 12 and 13 start-up companies per year between 2012 and 2016. It is remarkable that 2017 does not have an up to date complete information on new start-ups.

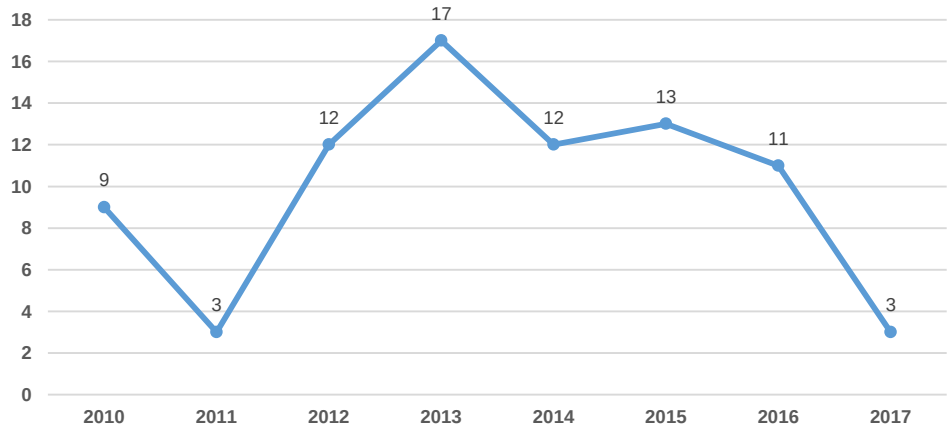

Figure 9: Number of founded start-ups by year (Nantes, 2010-2017)

Regarding employment, we do not have precise numbers (total number of employees per start-up), but we can estimate the numbers using employees categories. As can be observed in table 8, almost 60% of the start-ups

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employ between two and ten employees, and almost 36% between eleven and fifty employees. Based on these data, we can estimate a range for the total direct employment in start-up companies. In this sense, by multiplying the ranges (the minimum and maximum values) of every category by its corresponding frequency, we calculate a range between 582 and 2.231 employees. In terms of active population for 2016 (15-64 years old), the direct job created by these start-ups ranks between 0.4% and 1.45% in the city of Nantes.

Table 8: Employment in start-ups (Nantes, 2010-2017)

Number of employees by start-up	Number of start-ups	Percentage
1	1	1.56
2-10	38	59.38
11-50	23	35.94
51-200	1	1.56
201-500	1	1.56
Total	**64**	**100**

[1]Cases with information. Missing values 16.

Growth stages

One of the main variables for understanding the start-up ecosystem is the growth stage (see Annex 1, Growth stages, for descriptions) in which start-ups find themselves. Table 9 summarizes the situation for the start-ups in Nantes in the indicated period. We can observe that most start-ups are either in the “seed” stage (45.45%) or in the “early growth” stage (40.91%), being the ones in the “late” stage a minority (13.64%).

Table 9: Growth stages of start-ups (Nantes, 2010-2017)

Growth stages	Number of start-ups	Percentage
Seed	30	45.45
Early growth	27	40.91
Late growth	9	13.64
Total	**66**	**100**

[1]Cases with information. Missing values 14.

As observed, the fact that many companies are also in the seed stage (45.45%) is a clear sign that the ecosystem is pushing hard to create new companies, and that it has the financial support to grow up in the next years. Furthermore, the growth stage is an interesting variable for characterizing a start-up ecosystem. It tells us where start-ups are placed in terms of scaling in their life cycle. The term is related to the financing cycle. The percentages indicate that almost 41% of the sample is in an early growth stage. The early stage implies different aspects. On one site, these start-ups have overcome what is called “the valley of death” and have also overcome the “breakeven point”. This is when forecasted revenues exactly equals the estimated costs. It is expected that beyond that point the start-up business becomes financially viable. On the other side, this stage means that the

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start-up has acquired enough funding - own capital or seed capital from angels, family and friend, crowdfunding, etc. - to prove their MVP, tested it in the market and start operating on it. It is a sign to capture the attention of venture capitals, have possible acquisitions/merges and strategic alliances. At the end, it is a sign of scaling in the life cycle of a company. Finally, the late growth stage represents 13.64%. This is an important percentage because correlates with valuation (.773**), but also with an important variable such as funding (.332**).

Regarding acquisitions, 40% of them are made at the seed stage and 60% at the early growth stage. Seems that acquisitions are quite balanced among types of growth stages, except for the case of late growth where we do not find acquisition yet.

As one might expect, the valuation means differ according to stages. The valuation mean for the seed stage is EUR 4,967,513; for the early growth stage EUR 14,344,331; and for the late growth EUR 131,400,000. The ANOVA test to analyse differences between the growth stages regarding valuation, shows us that the means are significantly different, with a statistic F of 26.952 (sig. .000). Obviously, according to these data, there is a positive correlation among valuation and late growth stage of .773** (sig. .000).

To sum up, the growth stage variable reflects a regular and expected tendency in the ecosystem regarding stages, valuation and funding.

Industries and business models

Start-up companies operate in many different industries. Of 80 start-up companies, a sample of 65 has been analysed, as data were missing for the remaining 15 (18.8%). These 65 involve 80 industries (industry frequencies). There are more industry frequencies than start-ups. 50 (76.3%) start-ups operate in at least one industry and 15 (23.07%) in at least two industries.

Figure 10 shows that there is not an extreme concentration in any particular industry. Nonetheless, tops industries are in enterprise software with 13 cases (16.25%), marketing with 7 cases (8.75%), health with 6 (7.5%) and energy, fintech, food, IoT and media with 5 (6.25%) respectively. Regarding mySMARTLife sectors of interest, energy, IoT and transportation all together have 13 cases, which represent 16.25% of the sample. For the case of the energy industry, this is related to other industries, such as home living, enterprise software, education, and construction (1 case for each industry). Start-ups also operate in different sub industries closely related to relevant areas of smart city, such as cleantech (3 cases) and energy efficiency (4 cases). For the case of the IoT industry, except for one case, all start-ups are related to other industries such as transportation, home living or energy (1 case for each industry). Finally, for the case of the transportation industry, this is related to other industries such as IoT, food or semiconductors. We find a subindustry such as mobility (1 case).

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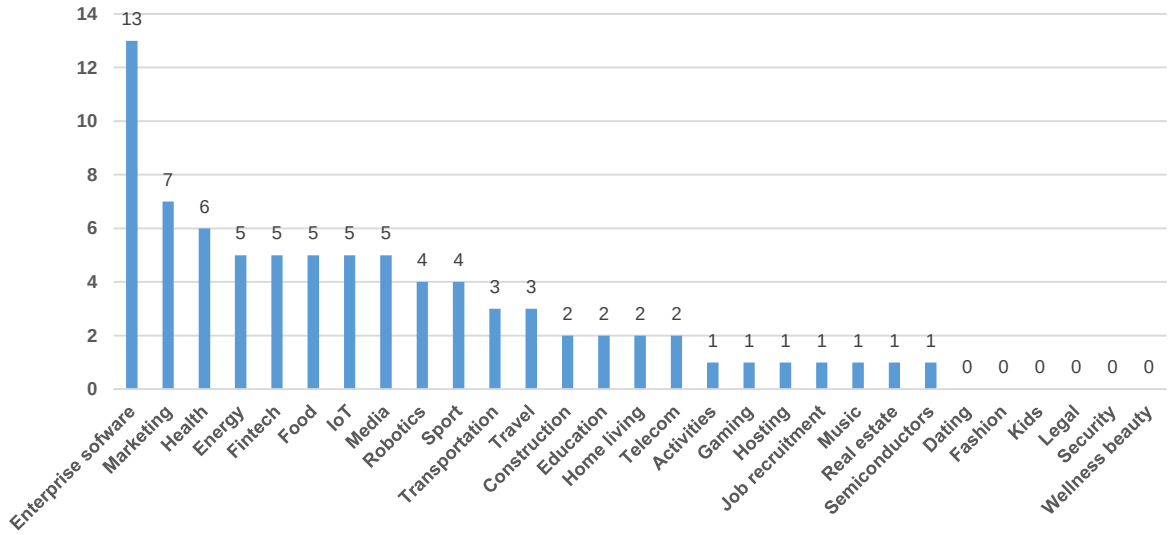

Figure 10: Number of start-ups in industries (Nantes, 2010-2017)

Figure 11 shows the evolution of the number of new start-ups operating in the eight industries commented above. As can be observed, the industries of enterprise software and marketing present the highest frequencies. Both industries present most of the cases during first years of the period, between 2010 and 2013. During recent years, 2015 and 2016, it seems that finch and IoT present 60% and almost 50% of the cases respectively. For the case of mySMARTLife sectors of interest, energy concentrates 80% of the cases between 2010 and 2013 while transportation does it between 2014 and 2016.

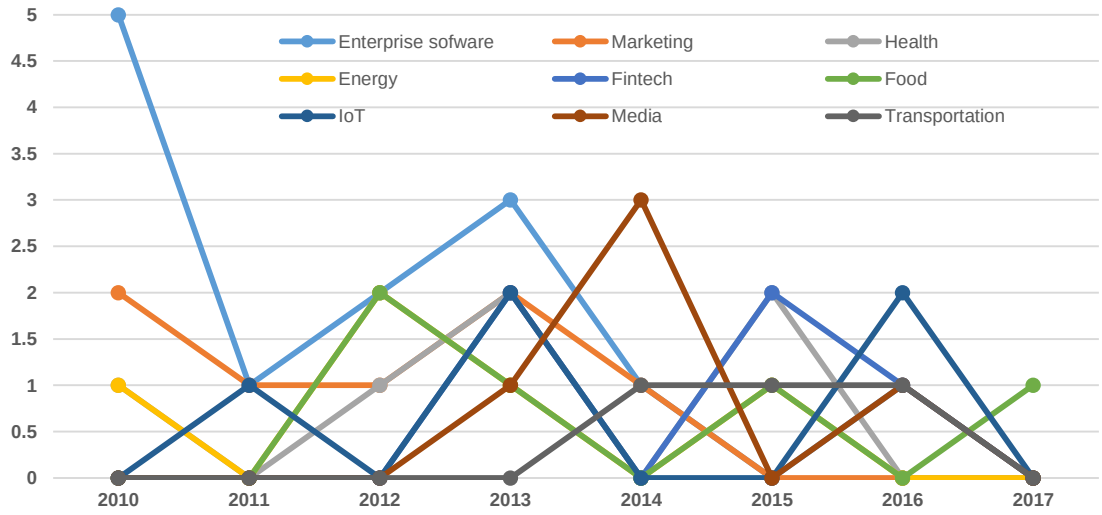

Figure 11: Number of new start-ups in the main industries by year (Nantes, 2010-2017)

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Figure 12 presents the main business models start-ups companies are using to create, deliver and capture value. Of 80 start-ups, a sample of 49 has been analysed, as data were missing for the remaining 31 cases (38.8%). These 49 involve 65 business models (business models frequencies). Considering the sample, start-up companies operate mostly just with one business model, 33 start-ups (67.34%). The data presents an average of 1.24 with a standard deviation of .48. In fact, operate just with one business model. Subscription model is the most used one, presenting 17 cases (26.15%), followed by manufacturing with 12 (18.46%) and commission and SaaS with 11 (16.46%) respectively. All other business models present very low cases. There is a relation between subscription and SaaS which present a positive correlation of .325** (sig. .003).

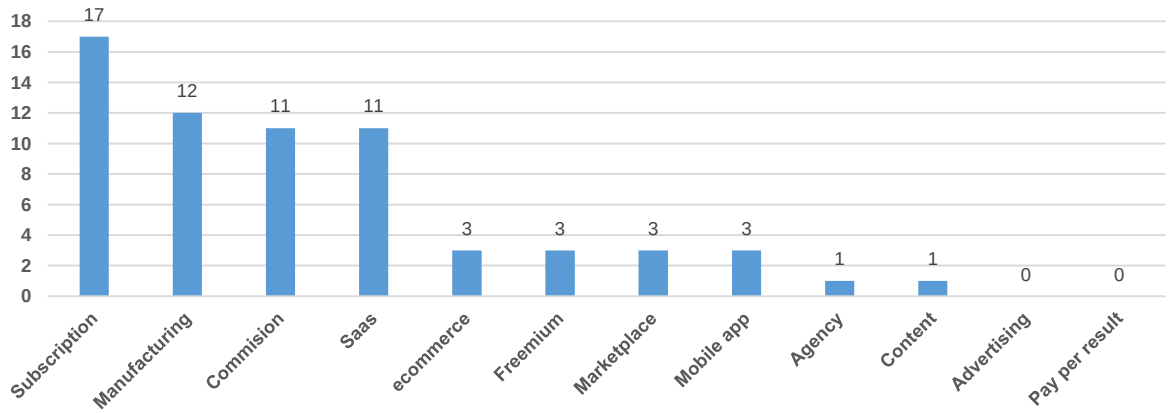

Figure 12: Number of start-ups by business models (Nantes, 2010-2017)

Figure 13 shows the number of new start-ups per year using each business model. Subscription is leading the path with a pick in 2013. Manufacturing has a pick in 2012 and after remains constant until 2016. Commission seems to grow since 2013, although does not present any case for 2016. And SaaS start quite high, with a pick in 2010, and most cases concentrating until 2013, and just few cases between 2015 and 2016.

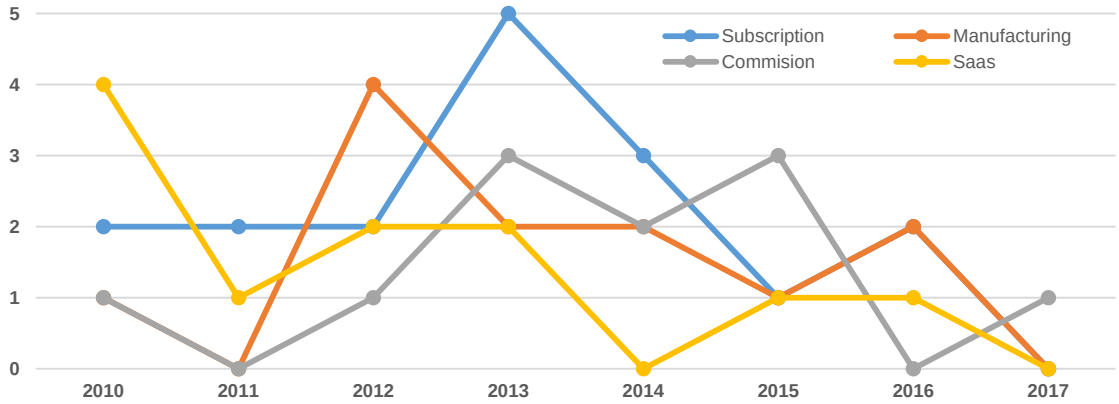

Figure 13: Number of new start-ups in the main business models by year (Nantes, 2010-2017).

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5.5 Investment

In this section, where our main objective is to describe the situation of investment in the start-up companies of Nantes, we use a database based on investment - funding rounds - for the period 2013-2018.

During this period, there has been 62 funding rounds in 42 start-up companies with headquarters in Nantes. As can be observed in table 10, almost 74% of start-ups have had one funding round, 11.90% two funding rounds, 9.52% three funding rounds and 4.76% four funding rounds or more. The average is 2.90 funding rounds per start-up, with a standard deviation of 1.56. This average is quite disperse because 27.19% of the sample had more than one round. Among these, almost 55% has had three or more rounds.

Table 10**:** Number of start-ups subject to funding rounds (Nantes, 2013-2018)

Investment	Number of start-ups	Percentage
One round	31	73.81
Two rounds	5	11.90
Three rounds	4	9.52
Four or more	2	4.76
Total	**42**	**100**

The average to get the first funding round, taking into account the foundation year, is 2.95 years; for the second round 4.36; and for the third round 4.66. These data are approximate since standard deviations are quite high, 2.37, 2.61 and 1.96. Despite this lack of accuracy, the averages obtained are quite reasonable.

In figure 14, we can observe the distribution of frequencies of founded start-ups and funding rounds along the period. The number of round increases quite a lot since 2015 but the foundation of start-ups decreases. We believe that there are missing values for the cases of foundation in Nantes.

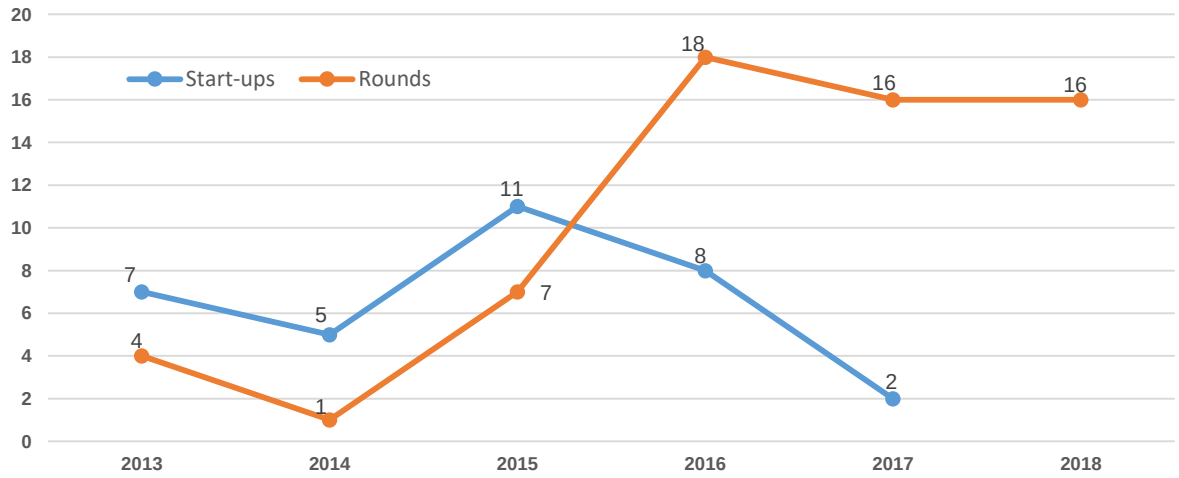

Figure 14: Number of start-ups and funding rounds by year (Nantes, 2013-2018)

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During the whole period, there was a total funding of EUR 57.35 million in Nantes. This represents less than 1% of the total funding amount in France, which was EUR 13,600 million. As it comes off from table 11, Paris represents almost 58% of total funding amount in France. Nantes is far from Lyon, the second city regarding funding, which got a total funding of EUR 360 million. An interesting aspect is that a huge amount of investment is located in other cities, representing almost 40% of total investment.

What seems interesting about Nantes is that presents an interesting increase of raised money from 2015 to 2017. Almost 91% of the total invest amount has been in these years. In fact, these coincide with an increase in number of rounds commented above.

Table 11**:** Funding (in million €) of start-ups (Nantes, 2013-2018)

	2013	**2014**	**2015**	**2016**	**2017**	**2018**
Paris	539	622	1,200	1,400	1,700	2,400
Lyon	10.7	41.5	23.6	79.2	83.4	121
Bordeaux	11.7	2.5	17.2	2.7	42.2	16.3
Nantes	**0.15**	**2.2**	**14**	**6**	**32**	**3**
Other cities	438.45	431.8	745.2	1,412.1	942.4	1,259.7
France	1,000	1,100	2,000	2,900	2,800	3,800

In table 12, we present the list of different types of funding rounds (see Annex 1, Investment rounds, for descriptions) and their frequencies. Almost 50% of rounds are at the seed stage. Initial investment rounds, represented by angel, grant and seed rounds represent all together 70% of all rounds. This is a good signal for the ecosystem. These types of rounds are crucial to cover the equity gap that most start-ups suffer when starting their business (see Annex 2, Financing cycle, for descriptions). Their importance is key since they cover the finance transition a start-up company needs to access venture capital or get partners in its projects.

Table 12**:** Number of funding rounds by type (Nantes, 2013-2018)

Type of funding round	**Number of rounds**	**Percentage**
Seed	30	49.18
Early VC	16	26.23
Grant	8	13.11
Series A	3	4.92
Series B	2	3.28
Angel	1	1.64
Series C	1	1.64
Total	61	100

[1]Cases with information. Missing values 1.

If we look at the average amount invested in initial investment rounds, we observe that the initial money is around EUR 1 million in all three actors. In particular, we have an average of EUR 400,000 for angels (but just one case),

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EUR 1,475 for grants and EUR 585,000 for seed rounds. It is important to indicate that 100% of angel rounds, 25% of grant rounds and 83.3% of seed rounds take place at the beginning, as a first round. These data clearly reveals that the ecosystem is helping start-up companies to cover the initial equity gap.

For the growing stages, the early venture rounds represents 26.23% of total rounds. This percentage increase by 4.92% if we take into account other funding rounds that are characteristic of the growing stages such as series A. The average of money invested is EUR 2,072,613 for early venture and EUR 6,969,696 for series A. These rounds are representative of a typical funding rang from growing stages between EUR 1 million and 5 EUR million. Rounds of early venture and series A concentrate around 60% in first rounds and 40% in later rounds respectively. Although these types of rounds follow an investment logic, it seems that they have a strong presence at first rounds. One possible explanation to this situation could be round type valuations. For example, a seed round valuation has an average of EUR 3,617,250, while an early venture or series A have averages of EUR 14,070,000 and EUR 42,000,000 respectively. Obviously, rounds valuation highly influence round investment.

For the maturation stages, the typical funding rounds are late venture capital and series B, C, D or E. For the case of Nantes, we just find a few cases, 2 for series B and 1 for series C. All together represent 4.92%. Although there are just 3 cases, the amount raised is quite high. There is a funding mean of EUR 10.900.000 for series B and a total funding of 32,000,000 for series C.

The funding rounds in Nantes follows the logic of the investment cycle. There is a strong presence of seed round and early rounds, but the percentage of late rounds in very low. This clearly correlates with the low percentage of start-up companies in late growth (9%) and indicates that the ecosystems is still emerging.

Industries and business models

As depicted in figure 15, the industry of marketing is the one which has raised more money, with a total amount of EUR 61.33 million (8 rounds), followed very closely by enterprise software with EUR 60.85 million (9 rounds). Leading a second group of industries, we find energy with EUR 8.68 million (9 rounds), home living with EUR 7 million (4 rounds), IoT with EUR 6.62 million (5 rounds) and transportation with 6.5 million (5 rounds). The distribution of investment is quite unequal. The reason respond to the fact that there is a start-up company, iAdvize, which operates in both industries, marketing and enterprise software. In fact, this start-up alone coups top funding rounds with EUR 14 million in 2015 (in a series A round) and EUR 32 million in 2017 (in a series C round). If we do not take into account this case, marketing and enterprise software still maintain first positions but the investment goes down until EUR 15.33 million and EUR 14.85 million respectively, which is still almost two times the second group of industries.

Figure 16 shows the investment by business models. Subscription, marketplace and SaaS are the most relevant and coup top investment. The reason as mentioned above is the case of the iAdvize start-up, which operates with these three business models. If we do not take into account this case, manufacturing is in first position, with EUR

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35.47 million, followed by subscription with EUR 20 million, commission with EUR 18.34, marketplace and SaaS with EUR 17.95 million and EUR 17.6 million respectively, and ecommerce with EUR 15.68 million. In general terms, money invested goes to these five business models, while others such as mobile app, content or freemium present low amount of investment. Moreover, advertising, agency and pay per result do not show any investment.

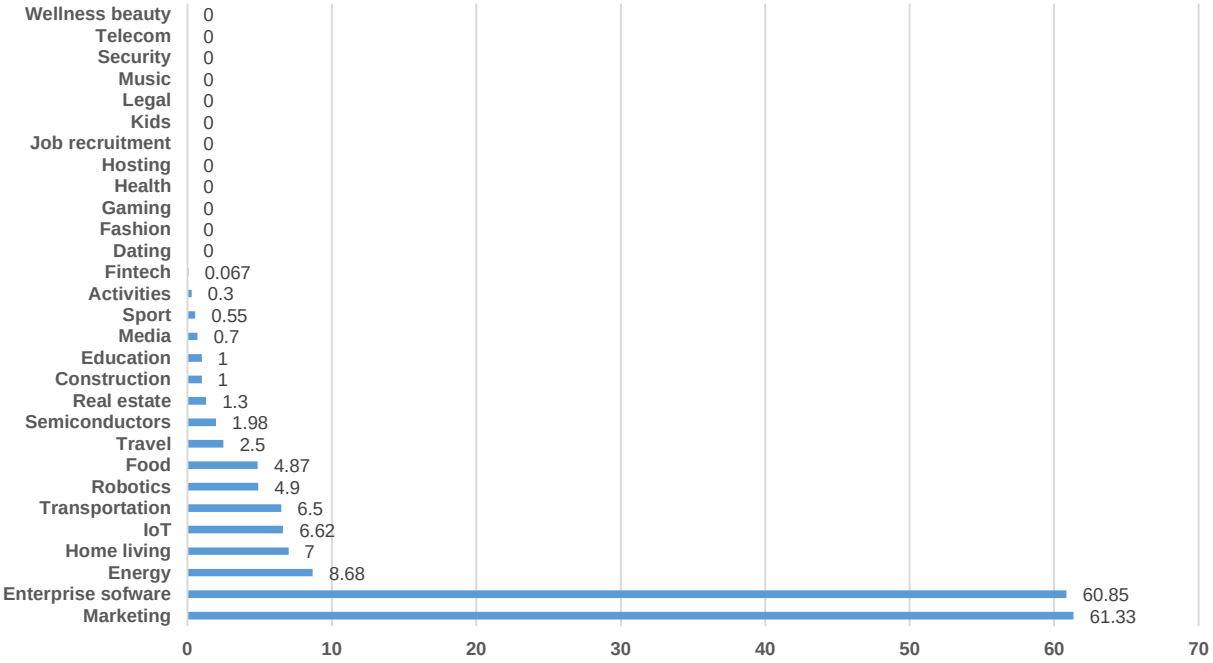

Figure 15: Funding (in million €) vs. industries (Nantes, 2013-2018)

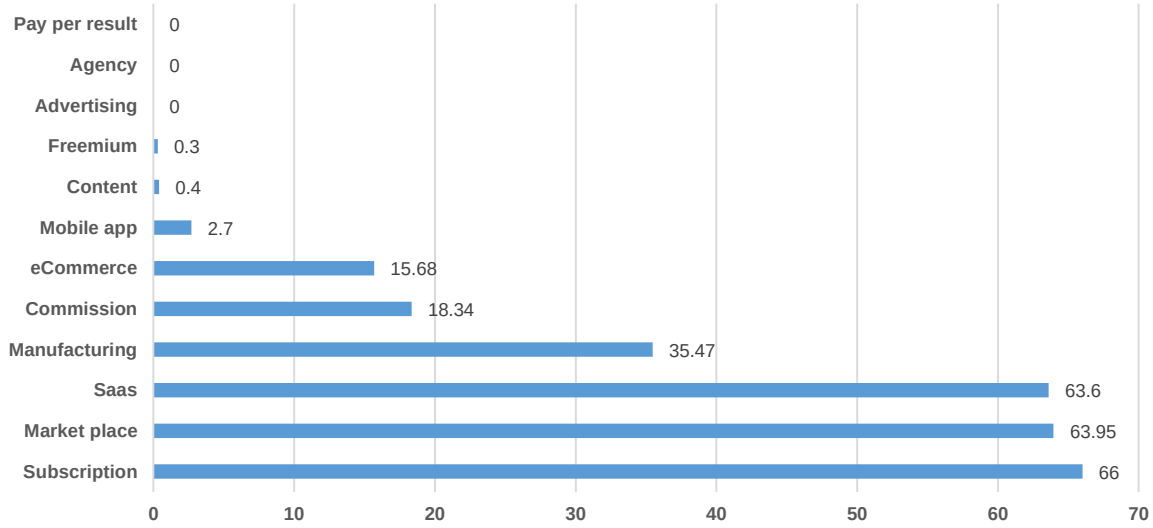

Figure 16: Funding (in million €) vs. business model (Nantes, 2013-2018)

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As can be observed in table 13, almost 62% of are carried out just by one investor per round and the remaining 38% by at least two or more investors. If we take into account the funding round types, the investors mean per round increases along the investment cycle.

Table 13**:** Investors by number of rounds (Hamburg, 2013-2018)

Number of investor	Number of rounds	Percentage of rounds
One investor	33	61.11
Two investors	7	12.96
Three investors	10	18.52
Four investors	3	5.56
More than four investors	1	1.85
Total	**54**	**100**

[1]Cases with information. Missing values 8.

Finally, we present the percentage of investors' origin. As we can see in figure 17, 79% of investors are from France, 13% from Europe and 8% from America. Regarding France, investor comes from many cities. Most representative are Paris with 55.40% and Nantes and Rennes with 11% respectively. There are many other cities such as Versailles, Mulhouse, Créteil, Courberoie, Lyon or Saint-Herblain but presenting between one or two rounds. Regarding Europe, almost 60% comes from Belgium (Brussels). The case of Belgium is related to EU grants. Most cases regard to the Horizon 2020 SMEs instrument. There are other countries but with a limit representation (just one case) such as Switzerland, Portugal, Russia or Netherlands (Amsterdam). Finally, for the case of America, all investors are from the United States of America, coming from different hubs such as San Francisco, Mountain View or New York.

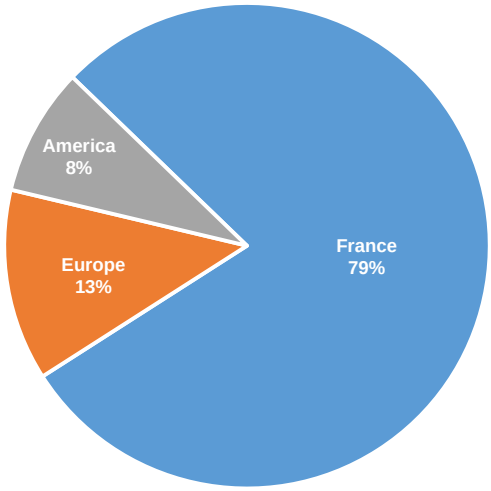

Figure 17: Percentage of investors by geography (Nantes, 2013-2018)

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5.6 Exits

In this section, we analyse the exits produced during the period 2010-2019 in the ecosystem of Nantes. The analysis focuses on two main actors, start-ups and acquirers. It is important to identify which start-ups and industries have succeeded, but it is also important who has acquired them and where the money comes from.

During the analysed period, the ecosystem has had 14 exits from 128 operative start-ups. As summarized in table 14, the majority of exits (13) are acquisitions (92.86%) and just one case corresponds to IPOs (7.14%). It is true that there are other types of rounds considered exits, for example a secondary sale, where a stakeholder sales his share from the company to another buyer. Normally, this is produced by one founder, an early employee, or an early investor, and has to be considered also as an exit. The problem is that there is not enough and concrete information about these types of exits in the ecosystem of Nantes.

Table 14**:** Exist by type of rounds (Nantes, 2010-2019)

Type of rounds	Number of exits	Percentage
Acquisitions	13	92.86
IPO	1	7.14
Total	**14**	**100**

As can be observed in figure 18, almost 79% of exits take place between 2014 and 2019. As mentioned in the introduction, Nantes is a nascent EE that starts to a higher volume of exits comparing with first years of the period.

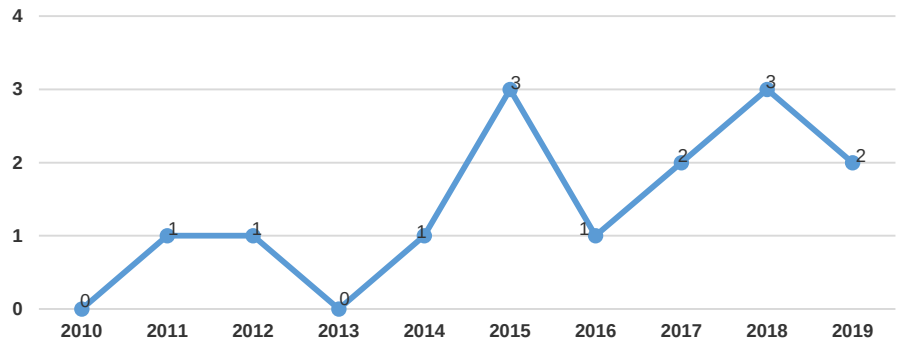

Figure 18: Number of exits by year (Nantes, 2010-2019)

An interesting indicator for the situation of the ecosystem is the number of years elapsed before an exit. If we take the whole sample for the period, 14 exits, the average of years from foundation to exits is 8.84 with a standard deviation of 7.55. This average seems to be reasonable time, but it is not really reflecting the situation in the ecosystem of Nantes. Such a high standard deviation is telling us that the sample is very scattered and has outliers. If we considered exits only for start-ups founded since 2000 - 11 exits (78.57%) of the sample -, the average decreases to 6.09 with a standard deviation of 3.04. During the 2013 and 2018, as depicted from table 15, there were acquisitions in Nantes for an amount of EUR 22 million. The database just records the amount invested

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(exit) for two cases. The same happens for Lyon and Bordeaux. As observed, Paris is who raises most money from investment, represents around 28% of total amount, EUR 10,694 million.

Table 15: City exists (€ million) by year (Nantes, 2013-2018)

	2013	2014	2015	2016	2017	2018
Paris	475	564	1,000	6,100	755	1,800
Lyon	17.3		26.9		138	
Bordeaux				54.3		
Nantes			**22**			
Other cities	707.70	1236	2,751.1	17,645.7	1,207	4,000
France	1,200	1,800	3,800	23,800	2,100	5,800

Industries

Figure 19, shows that the industry of health tops acquisitions with 4, followed by enterprise software, marketing and semiconductors with 2 respectively, and construction, education, energy, finch, home living, IoT, telecom and transportation with 1 for each industry. To some extend these numbers correlate with foundation and investment rounds. For example, the industry of enterprise software tops foundation (13) and it is second position regarding investment (EUR 60.85 million). Marketing is second regarding foundation (7) and first regarding investment (EUR 61.33 million). Health is third regarding foundation (6) but does not present invested amount.

Regarding mySMARTLife sectors of interest, energy has had 1 exits, which is in fourth position regarding foundation (5) and in fourth position regarding investment (EUR 8.68 million). Transport has had 1 exit, which is in eleven position regarding foundation (3) and in six position regarding investment (EUR 6.5 million). And IoT has had 1 exit too, which is in fifth position regarding foundation (5) and fifth position regarding investment (EUR 6.62 million).

The exits of companies can be classified by industry according to companies' status, this means *being operative*. Taking into account all operative companies by industry, the exit ratio changes the position of industries. As observed in table 16, health coups the classification with a ratio of 1.50, which means an exit every one and a half.

Table 16: Exit ratio by industry (Nantes, operative companies in 2019)

Main industries	Exit ratios
Health	1.50
Transportation	3.00
Marketing	3.50
Energy	5.00
Fintech	5.00
IoT	5.00
Enterprise software	8.50

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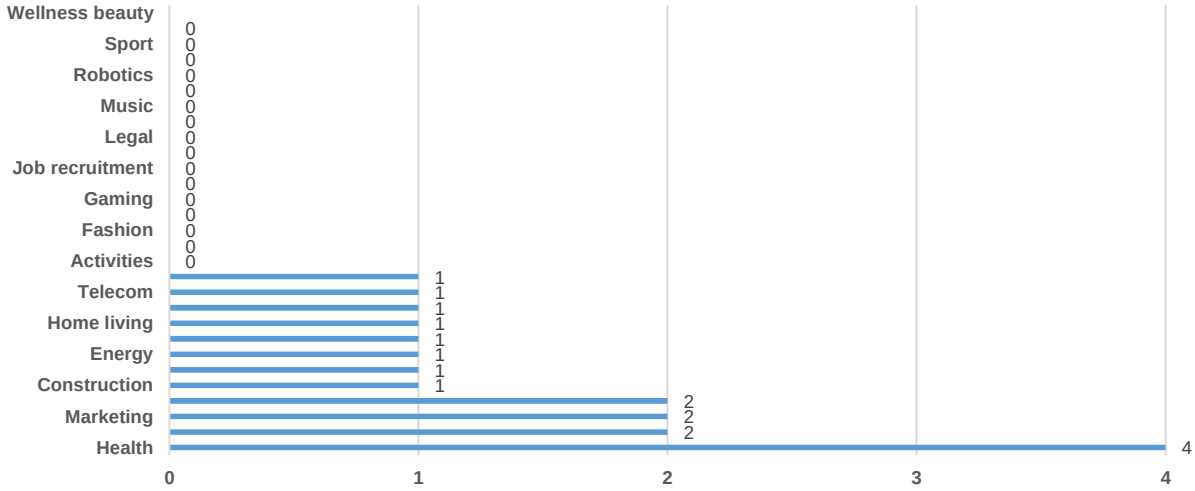

Figure 19: Number of exits by industry (Nantes, 2010-2019)

Acquirers

In terms of acquirers, the sample shows one acquirer per acquisition. Regarding the type of acquirers, 71.4% are corporates and 7.1% investment funds. The rest of percentages are missing values. Finally, 64.3% old start-up companies have not been funded before exit while the rest, 35.7% had at least one or more funding round.

As observed in figure 20, Europe concentrates almost 20% of all acquirers if we take into account France. France by its own represents 64%. America 19%. Regarding France, acquirers come from Nantes and Paris with a percentage of 18% respectively, and Antony, Grenoble, and Montreuil with 8% respectively. For the case of Europe, acquirers are from Czech Republic (Prague) and United Kingdom (London) with an 8% respectively. Finally, for the case of America, concretely the United States of America, we have just information from a city, Santa Clara.

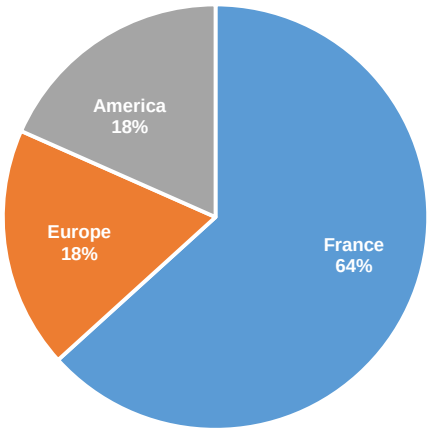

Figure 20: Acquirers by geography (Nantes, 2010-2019)

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6. The case of Hamburg

6.1 Introduction

The start-up scene in Hamburg is extremely growing and the city is becoming one of the principle hubs of Germany. With almost 760 operative start-ups in 2018, Hamburg decided to create the Startup Unit[19] in 2017 and started to operate in 2018[20]. It depends from Hamburg Invest[21], an agency for relocation and investment in Hamburg and a main partner of Hamburg business sector on all topics related to business development.

From a public perspective strategy, as mentioned by Veronika Reichboth, in charge of the Startup Unit, this is a new port of call for knowledge and technology oriented start-up business in Hamburg. By consolidating several different services under the umbrella of Hamburg Invest, Hamburg rapidly growing start-up ecosystem has been professionalized. This unit serves as a central point of contact for anyone looking for information on innovative start-ups, events and conferences, universities, public funding agencies, economic clusters, as well as incubators and accelerator programmes. Furthermore, this unit presents a Starter Kit, which provides a general overview for digital founders and start-ups in Hamburg. This kit focuses on general information and key topics such as business plan, legal advisory, financing, hubs, co-working spaces, recruitment, etc.

The strategy of the Startup Unit focuses in three main aspects: transparency, being the first point of contact from the public side and promoting Hamburg nationally and internationally. In this last aspect, the Startup Unit also serves as the main contact provider for entrepreneurs and investors with most important worldwide hubs. An important aspect from the Unit is that was established as a complementary, consecutive part of Hamburg start-up ecosystem with the aim of strengthening the entire system quickly and without bureaucracy. The Startup Unit main task is to market Hamburg as a start-up location even more intensely on an internal and external level and to become a contact partner integrated in the start-up ecosystem.

One of the main success factors for the entrepreneurial ecosystem in Hamburg is related to its economic sectors. Hamburg is a major international trade, transport and service hub and one of the most important locations for industry in Germany. There are global players such as Airbus, Nivea, Hapag-Lloyd, Helm, Montblanc, Olympus, Otto and Tchibo located in Hamburg. Furthermore, ten of the one hundred strongest German businesses in terms of turnover have their head offices in Hamburg. This is a good sign for the ecosystems because a strong industry sector is related with investment. In fact, Hamburg has many investors (around 162 investors), with a wide range from venture capital to business angels. Most representative investors (in terms of deal volume and portfolio size) are Deutsche Telekom Capital Partners, Neuhaus Partners, Hanse Ventures, Innovationsstarter Fonds, Cinco Capital, Helwort & Melon GmbH, IVPNetworks, CEE Group, Genui, etc.

[19] Source: https://en.hamburg-invest.com/startup-unit/
[20] Source: https://www.hamburg-news.hamburg/en/media-it/new-startup-unit-identifies-important-future-trend/
[21] Source: https://en.hamburg-invest.com/

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Another important component of its ecosystem is cluster strategy. Hamburg maintains cluster initiatives in media (next media Hamburg) and IT, renewable energies, logistics, aviation, maritime industries, financial services, life sciences food and creative industries. Working with clusters has led to create the basis for close links between all stakeholder clusters - companies, education and training entities, research institutions, associations and societies, chambers of commerce and trade unions. In this regards, the public sector follows a strategy that benefits everyone and particularly links small companies with research in order to foster networking, involvement and synergies.

Regarding public funding, one of the main actors is the Hamburgische Investitions-und Förderbank[22] (IFB). IFB Hamburg is the central point of contact for private individuals, companies and institutions for all funding queries. It advises on funding offers from the Senate of Hamburg, the federal government and the EU. IFB Hamburg supports the city with structural and economic policy, social policy and with the fulfilment of public tasks. It cooperates with banks, chambers and associations in Hamburg. Furthermore, it provides funding and financial offers, as well as free advice in four fields of service: housing, business, innovation and environment. The IFB has different funding programmes: the InnoFounder (lost grants/fellowship); the InnoRampUp (lost grants); and the Innovationsstarter Fonds (venture capital up to EUR 1 million in the form of open participations).

Another funding resource to strengthen Hamburg EE is the Hamburg Innovation Growth Funds[23] programme, managed by the Hamburg investment company Neuhaus Partners. Up to EUR 100 million in venture capital are to be raised for the fund with the Hamburgische Investitions- und Förderbank (IFB Hamburg) as anchor investor, contributing public funds of up to EUR 10 million on behalf of Hamburg. The funds will invest in existing start-ups with promising growth prospects and with particular emphasis on digitalization in all sectors relevant to Hamburg.

Another important actor of the Hamburg's EE, is the Chamber of Commerce[24]. They have a range of different free services for start-ups such as i) the online tool called Gründungswerkstatt Hamburg[25], which provides a variety of information on founding a company and enables people to elaborate virtual personal business plan supported if necessary by a tutor from the Chamber. This tool also enables people to improve the management of companies and to draw up a profile of corporate strengths and weaknesses. ii) initial consultation at a service centre; iii) information days; iv) seminars; v) forums; etc.

Finally, Hamburg is leading a pilot programme called Beyourpilot[26]. A digital platform for knowledge-based start-ups. It provides an interactive working environment with a variety of functionalities that are oriented towards the typical needs of founders with knowledge-intensive product ideas. All participating organizations (universities) have the possibility to embed their specific services in the structure of the platform. Thus, comprehensive start-up support organized according to uniform standards is available in order to increase significantly the number and quality of start-ups in the environment of universities and research in Hamburg and the metropolitan region.

[22] Source: https://www.ifbhh.de/fileadmin/pdf/IFB_Commited_To_Hamburg_Flyer.pdf
[23] Source: https://www.hamburg-news.hamburg/en/trade-finances/hamburg-innovation-growth-funds-now-ready/
[24] Source: https://www.hk24.de/en/produktmarken/startup/services-start-ups-businesses-hamburg/1147508
[25] Source: https://www.gruendungswerkstatt-hamburg.de/
[26] Source: https://www.beyourpilot.de/

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6.2 Framework conditions

In this section, we use primary sources from different databases as well as secondary sources to have an overlook of main characteristics and framework conditions for the entrepreneurial ecosystem in Hamburg and in the whole country of Germany. Our main objective is to draw a picture from general (Germany) to particular (Hamburg) to identify framework conditions.

Our first approach to entrepreneurship and business is at national level through the following comparable world indexes (see Annex 1, Indexes, for descriptions): the Easy of Doing Business, the Global Competitiveness Index, the Index of Economic Freedom, the Global Entrepreneurship Index and the Regional Entrepreneurship and Development Index, which scores are presented in table 17. We have chosen those that are developed by important worldwide organizations and represent a primary source to consult for doing business in Hamburg and Germany.

Table 17: Indexes (2018-2019)

	Easy of Doing Business[1]	**Global Competitiveness Index[2]**	**Index of Economic Freedom[3]**	**GEI Index[4]**	**REDI Index[5]**
Score	78.9	83	73.5	65.9	64
World rang	24	3	24	15	-

[1] The World Bank. Doing Business. Measuring Business Regulations. 2019. Score: 0-100.
[2] World Economic Forum. The Global Competitiveness Index. 2018. Score: 0-100.
[3] Heritage. Index of Economic Freedom. 2019. Score: 0-100.
[4] The Global Entrepreneurship and Development Institute. Global Entrepreneurship Index (GEI). 2018. Score: 0-100.
[5] The London School of Economics and Political Science. Regional Entrepreneurship and Development Index (REDI). 2018. Score: 0-100.

The first index to take into account is the Easy of Doing Business score. According to Doing Business database information (2019), Germany ranks 24 out of 190 countries, with a score of 78.9. This score equals the regional average for OECD high income countries (78.9). As indicated in figure 21, Germany scores quite high in many of the topic that set up the Easy of Doing Business score. Germany receives high marks particularly for *resolving insolvency* (scores 90.12 – ranks 4) and *getting electricity* (scores 98.79 – ranks 5). Related to the variable *starting a business*, Hamburg has a good score, 83.58, but ranks 114 from 190 position, bellows the OECD high income countries, which score 91.19. Many of the variables related to this item procedure - men; time - men; cost - men; procedure - women; time - women; cost - women… scores quite high. It seems that other important variables for business scores low, such as *getting credit* (scores 70 - ranks 44), *protecting minor investors* (scores 58.33 - ranks 72) or *enforcing contracts* (scores 70.39 - ranks 26).

In 2016, Germany made starting a business easier by making the process more efficient and less costly. The problem was that in 2015, Germany made starting a business more difficult by increasing notary fees. It seems then, that the country has arrange this situation. This is one of the reason why has increases its score recently.

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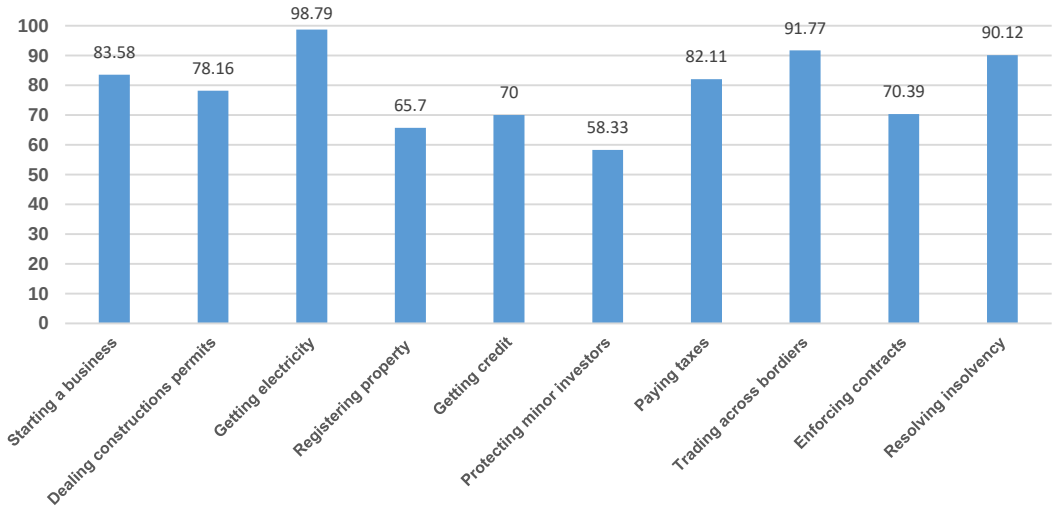

Figure 21: Scores for Easy of Doing Business Index (Germany, 2019)

Regarding entrepreneurship, the score of *protecting minor investors* seems to be a problem. Although this variable covers many types of investment, not just in start-ups, this topic results extremely important for entrepreneurs, who often need investment in initial and growing phases of their business to cover the equity gap as well as scaling. On the other site, *getting credit* does not score and rank on top, which could be a difficulty for entrepreneurs. The discussion here is not about making credit easy because this implies high levels of risk. In this sense, credit solvency is high in Germany and that is key for country finances. Obviously, giving credit to entrepreneurs could be a risk.

The second index is the Global Competitiveness Index. According to the World Economic Forum database information (2018), Germany ranks 3 out of 140 countries, with a score of 83. In 2017 ranked also 3 out of 135 countries. Comparing with the first index - Easy of Doing Business -, Germany scores much better. As can be observed in figure 22, the Index involves twelve pillars. Germany scores and then ranks first in *macroeconomic stability* (score 100 - rank 1) and *innovation capability* (scores 88 - ranks 1). It Also ranks very high in *business dynamism* (scores 82 - ranks 2), *skills* (scores 84 - ranks 4), and *infrastructure* (scores 90 - ranks 7) and *product market* (scores 72 - ranks 7). It seems that Germany is doing really well in variables related to the *innovation capability* (ranks 2, just below the United States); related to the *market components* - except the *financial system* and quite a bit of the *labour market* (ranks 6); and related to *human capital* components (ranks 8).

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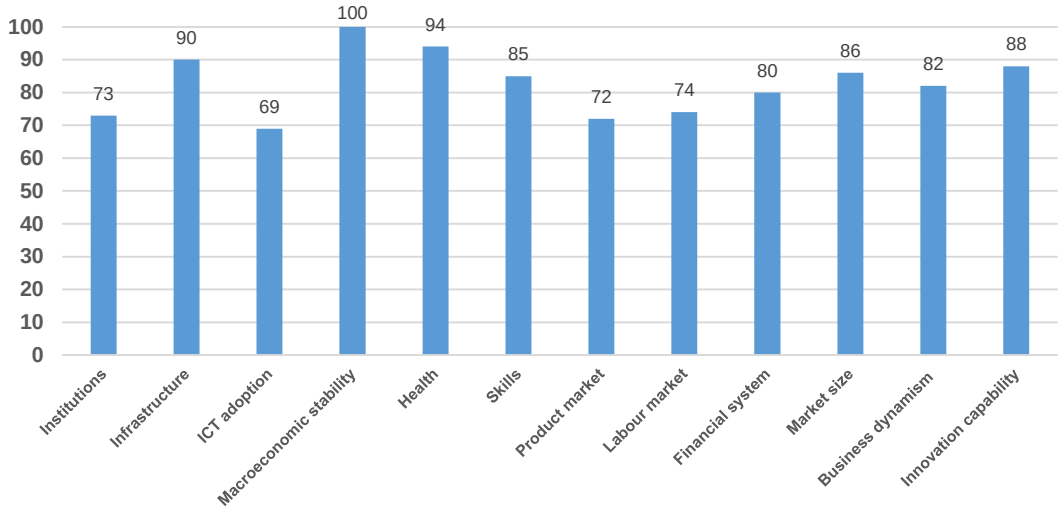

Figure 22: Scores for Global Competitiveness Index (Germany, 2018)

The third index that we present here is the Index for the Economic Freedom (2019). Germany ranks 24 out of 169 countries with a score of 73.5. Compared to previous mentioned indexes, it seems to be closer to the Easy of Doing Business score rather than the Global Competitiveness Index. Its overall score has decreased by 0.7 points, it ranks 14th among European countries (Europe region) and its overall score is above the regional and world averages. According to the Global Competitiveness report (2019), business freedom and investment freedom remains strong. Long-term competitiveness and entrepreneurial growth are supported by openness to global commerce, well protected property rights, and a sound of regulatory environment.

As reflected in scores presented in figure 23, we can highlight best scores in *fiscal health* (91.8), *trade freedom* (86), *business freedom* (83.3), *government integrity* (81.3), *investment freedom* (80) and *property rights* (79.9). On the other site, it seems that *government spending* is low (42.3), but it represents 43.9% of GDP, quite a lot comparing to other countries. Another aspect that scores low is *labour freedom* (50.3), due to changes in minimum hourly wages (2015) and restrictions in temporary employment. Besides these aspects, that could represent disadvantages for entrepreneurs and advantages for workers and their protection, the efficient regulatory framework strongly facilitates entrepreneurial activity.

Finally, we present the Global and Entrepreneurial Index (GEI, 2018) for Germany and the Regional Entrepreneurship and Development Index (REDI, 2018) for the Hamburg region. Regarding GEI, Germany scores 65.9 and ranks 15 out of 137 countries. As observed in figure 24, Germany and Hamburg scores really well in *competition* (business strategy), *technology absorption* (absorptive capacity and technology level) and *opportunity perception* (market agglomeration and opportunity recognition). Hamburg also reports very high in *start-ups skills* (quality of education and skill perception) and *opportunity start-up* (business environment and opportunity motivation). Compared to the country, it seems that Hamburg does not score well - 50 or below - in *cultural support* (open society and carrier status), *human capital* (education, training and educational level), *internationalization*

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(connectivity and export), *risk acceptance* (business risk and business acceptance), *process innovation* (technology development and new technology) and *high growth* (clustering and gazelle). On the other site, Hamburg scores better in *networking* (social capital and know entrepreneurs) and *product innovation* (technology transfer and new product). To sum up, according to these data, the region and city of Hamburg should consider following aspects for its ecosystem: *high growth*, *process innovation*, *risk acceptance*, *internationalization*, *human capital* and *cultural support*.

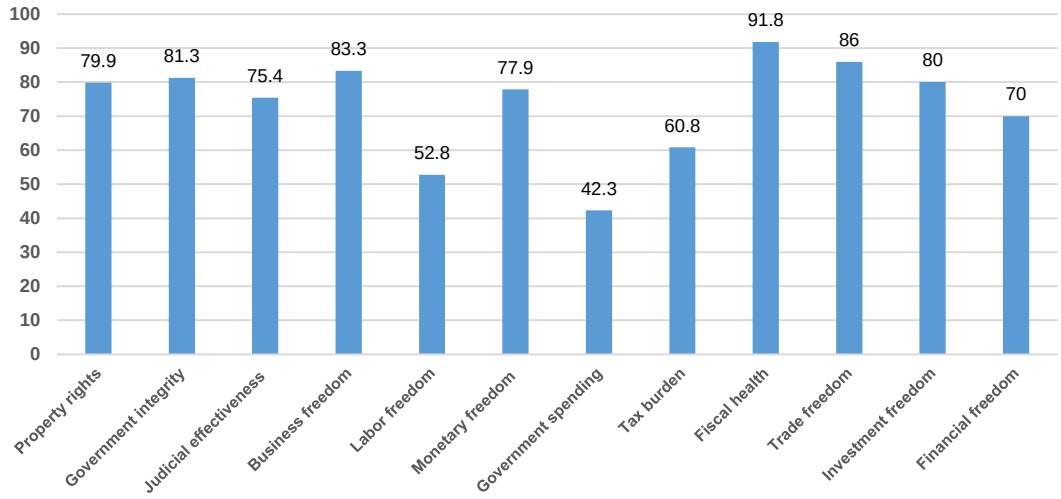

Figure 23: Scores for the Index of Economic Freedom (Germany, 2019)

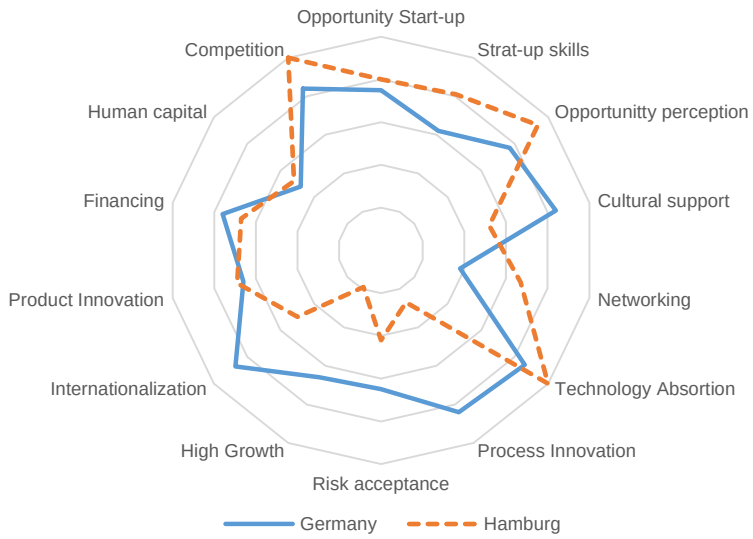

Figure 24: GEI and REDI indexes (Germany and Hamburg region, 2018)

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After the analysis at a country and regional level, the authors, to close this section, have revised a national ranking[27] for cities, which serve to compare Hamburg with other cities. Hamburg's ecosystem ranks third, just below Berlin and Munich. In fact, has been increasing its position by 13 since 2017. As we will see in next sections, Hamburg is getting on European start-up scene very fast.

6.3 Entrepreneurs

In this section, we use a database based on start-up companies founded during the period 2010-2018 and different reports to describe entrepreneur's profiles and perceptions from Hamburg.

According to our database, the mean of founders for start-ups in the above mentioned period is 1.72 with a standard deviation of 0.84. Most cases are between one and two founders. As presented in table 18, the percentages for the two first categories - one and two founders - compose 80% of the sample, being 50.90% for one founder and 29.30% for two founders. The statistical results are interesting. Mainly, they are telling us that entrepreneurship in Hamburg is divided. 50% show that entrepreneurship is an individual activity, while 50% show that is a group activity.

Table 18: Start-up founders (Hamburg, 2010-2018)

Number of founders	Number of start-ups	Percentage
One	59	50.90
Two	34	29.30
Three	20	17.20
Four	3	2.60
Five or more	0	0.00
Total	**116[1]**	**100**

[1]Cases with information. Missing values 226.

Regarding founders' gender, at it is presented in table 19, start-up companies with female founders alone, represent just 4.3% of the sample, while male founders alone represent 87,1%. There is a 8.6% of mixed teams in which there is at least one women. Taking into account that the global average is 16% for female founders, the amount of 4.3% is a value to improve. Particularly if we compare it to world city ecosystems like Chicago (25%), New York (22-24%) or Shanghai (22-24%). For the case of the European entrepreneurial city ecosystems, female founder's best scores are in Barcelona (15%), London (15%) or Copenhagen (14%) (GEM, 2016/2017).

Another important characteristic of founders is their previous entrepreneurial experience. As indicated in table 20, 30.2% of start-up companies are founded by entrepreneurs who have had prior experiences on launching start-ups.

[27]Source: https://www.startupblink.com/accelerators/hamburg+germany

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Table 19: Start-up founder gender (Hamburg, 2010-2018)

Gender of founders	Number of start-ups	Percentage
Female	5	4.3
Male	101	87.1
Both	10	8.6
Total	**116[1]**	**100**

[1]Cases with information. Missing values 226.

Table 20: Entrepreneurial background of start-up founders (Hamburg, 2010-2018)

	Number of start-ups	Percentage
Serial	35	30.2
No serial	81	69.8
Total	**116[1]**	**100**

[1]Cases with information. Missing values 226.

Another important aspect to highlight about entrepreneurs are perceptions. The Global Entrepreneurship Monitor (GEM), a unique global assessment of entrepreneurial activity, highlights some interesting ideas about entrepreneurs in Germany:

- **Perceived opportunities**. The level of opportunity perception (adults 18-64 years) is high compared to other EU Member States. 38.27% of population perceived good opportunities for entrepreneurship, while the EU average is 35%. This percentage raises to 42.11% in 2018. Regarding the opportunity perception among entrepreneurs (2018), as mentioned in the section about framework conditions, German entrepreneurs present a percentage of 77%, while Hamburg entrepreneurs present a percentage of 94%.
- **Perceived capabilities**. The percentage of having entrepreneurial capabilities to start a business has increased from 36.19% in 2015 to 38.11% in 2018. Nonetheless, these percentages remain lower that the EU average (43%).
- **Fear of failure**. The fear of failure among the adult population has decreased from 42.29% in 2015 to 35.06% in 2018.
- **Entrepreneurial intentions**. The entrepreneurial intentions have decreased from 7.18% in 2015 o 5.85% in 2018. In this sense, less non-entrepreneurially active adult population intends to start a business within the next three years. These percentages are below the EU average (13%).

Finally, figure we present a list of most problematic factors for doing business in Germany (The Global Competitiveness Index, 2018), according to entrepreneurs and business survey (2017). As indicated in figure 25, most problematic factors are *tax rates* (12.1%); *tax regulations* (10.7%); *restrictive labour regulations* (10.5%); and

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inefficient government bureaucracy (9). These factors are quite common for OECD countries and similar to the case of France and Finland. Entrepreneurs and business also highlight *inadequately educated workforce* (8.1%) and *insufficient capacity to innovate* (6.4). These factors are crucial for entrepreneurship. In fact, the human capital and process innovation where factors with low scores in the GEI and REDI indexes commented in section 6.2.

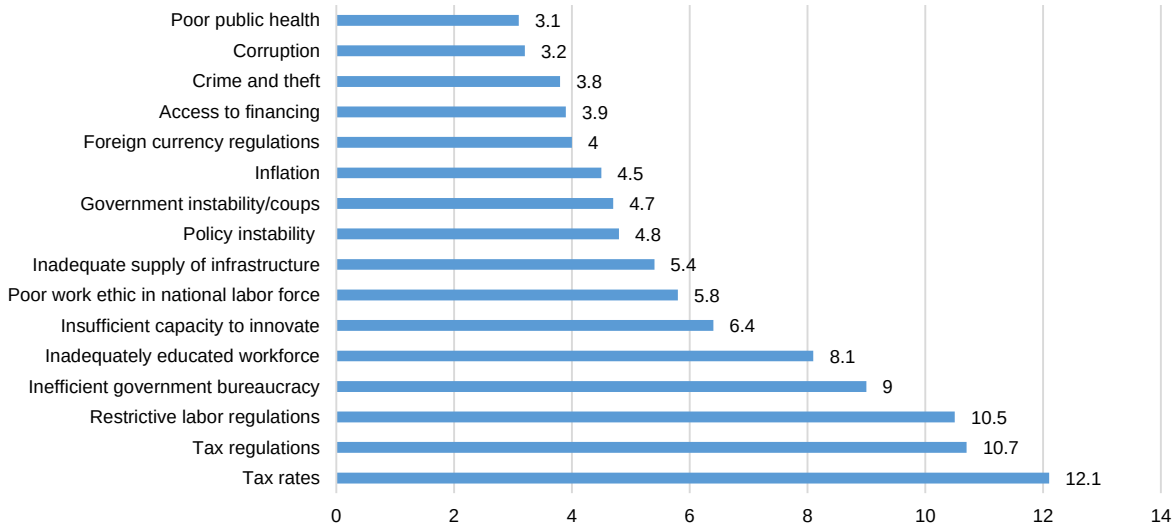

Figure 25: Most problematic factors for doing business (Germany, 2017)

6.4 Entrepreneurial activity

In this section, we use a database based on founded start-up companies for the period 2010-2018. 342 start-ups were founded during this period. This number represents 45% of all start-ups founded in the city if we take into account the complete historical record for start-ups. The percentage increases to 67% if we consider just the founded start-ups in the XXI century. These percentages are indicative given that the historical record for start-ups is incomplete.

As shown in table 21, more than 90% of start-up companies founded in Hamburg during the analysed period are still operative. In some way, we can also consider that the 8.80% of companies acquired are operative too in terms of markets. It is important to remark that we do not have information on closed companies.

Table 21: Operational status of start-ups (Hamburg, 2010-2018)

Operational status	Number of start-ups	Percentage
Acquired	30	8.80
Operational	312	91.20
Total	342	100

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As depicted in figure 26, the foundation of start-up companies in Hamburg remains quite constant between 2010 and 2016. There is a peak in 2014 with 55 new start-ups. There is a low decrease in 2017 and 2018, but we suspect that the decrease does not reflect the real foundation activity in the city of Hamburg during last two years. As mentioned before, databases not always have an up to date complete information on new start-ups.

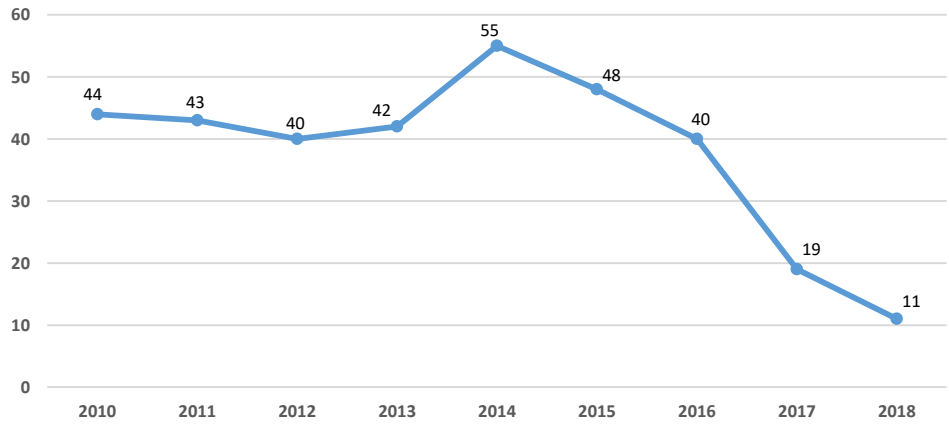

Figure 26: Number of founded start-ups by year (Hamburg, 2010-2018)

Start-up companies have a great impact on job creation. We do not have precise numbers (total number of employees by start-up), but we estimate the numbers using employees categories. As can be observed in table 22, 60% of the start-ups employ between two and ten employees, and 31% between eleven and fifty employees. Based on these data, we can estimate a range for the total direct employment in start-up companies. In this sense, by multiplying the ranges (the minimum and maximum values) of every category by its corresponding frequency, we calculate a range between 3.997 and 12.036 employees. In terms of active population for 2017 (15-74 years old), the job created by these start-ups ranges between 0.41% and 1.25% in Hamburg.

Table 22: Employment in start-ups (Hamburg, 2010-2018)

Number of employees by start-up	Number of start-ups	Percentage
1	6	2.1
2-10	168	58.1
11-50	89	30.9
51-200	21	7.2
201-500	3	1
501-1000	2	0.7
Total	**289**	**100**

[1]Cases with information. Missing values 53.

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Growth stages

One of the main variables for understanding the start-up ecosystem is the growth stage (see Annex 1, Growth stages, for descriptions) in which start-ups find themselves. Table 23 summarizes the situation for the start-ups in Hamburg in the indicated period. We can observe that most start-ups are either in the "seed" stage (45.5%) or in the "early growth" stage (4.9%), being the ones in the "late" stage a minority (13.6%).

Table 23: Growth stages of start-ups (Hamburg, 2010-2018)

Growth stages	Number of start-ups	Percentage
Seed	175	45.5
Early growth	109	40.9
Late growth	54	13.6
Total	**338**[1]	**100**

[1]Cases with information. Missing values 4.

The fact that so many companies are at the seed stage is a clear sign that the ecosystem is pushing hard to create new companies, and that it has the financial support to grow up in the next years. The growth stage is an interesting variable for characterizing a start-up ecosystem. It tells us where start-ups are placed in terms of scaling in their life cycle. The term is related to the financing cycle. The percentages indicate that almost 41% of the sample is in an early growth stage. The early stage implies different aspects. On one site, these start-ups have overcome what is called "the valley of death" and the "breakeven point". This is when forecasted revenues exactly equals the estimated costs. It is expected that beyond that point the start-up business becomes financially viable. On the other side, this stage means that the start-up has acquired enough funding - own capital or seed capital from angels, family and friends, crowdfunding, etc. - to prove their MVP, tested it in the market and start operating on it. It is a sign to capture the attention of venture capitals, have possible acquisitions/merges and strategic alliances. At the end, it is a sign of scaling in the life cycle of a company. Finally, the late growth stage represents 13.6%. This is an important percentage because it correlates with important variables such as valuation (.491**), funding (.265**), and employees (.590**).

Regarding acquisitions, 33.33% of acquisitions are made at the seed stage; 36.66% at the early growth; and 30% at the late growth. Seems that acquisitions are quite balanced among types of growth stages.

As one might expect, the valuation means differ. The valuation mean for the seed stage is EUR 6,427,292; for the early stage EUR 14,900,075; and for the late growth EUR 122,488,051. The ANOVA test to analyse differences between the growth stages regarding valuation, shows us that the means are significantly different, with a statistic F of 10.109 (sig. .000).

To sum up, the growth stage variable reflects a regular and expected tendency in the ecosystem regarding stages, valuation, funding, and number of employees.

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Industries and business models

Start-up companies operate in many different industries. Of 342 start-up companies, a sample of 289 has been analysed, as data were missing for the remaining 53 (15.49%). These 289 involve 362 industries (industry frequencies). There are more industry frequencies than start-ups. 216 (74.5%) start-ups operate in at least one industry and 73 (25.5%) in at least two industries.

Figure 27 shows that there is not an extreme concentration in any particular industry. Nonetheless, top industries are in marketing with 48 cases (13.26%), enterprise software with 43 cases (11.88%), fintech with 33 (9.12%), media with 32 (8.84%), energy with 22 (6.08%) transportation with 20 (5.52%) and health with 16 (4.42%). Regarding mySMARTLife sectors of interest, energy and transportation are relevant industries in the start-up ecosystem. This do not happens to the IoT industry. This industry has just 7 cases (1.93%). For the case of the energy industry, this is related to other industries, such as fintech (3 cases), marketing (2 cases), and enterprise software, telecom and transportation (1 case each). Start-ups also operate in different sub industries closely related to relevant areas of smart city, such as cleantech, energy efficiency, waste solution or water. For the case of the transportation industry, there is not an overlaps with energy, just in one case regarding the mobility subsector. We find the subindustries such as electric vehicle or mobility, but many of the subindustries are related to logistics and delivery, and buy and rent. It seems surprising that data does not show high entrepreneur activity in smart city sectors related to transportation. Could be argued, just as an hypothesis, that this sector and subsectors are committed by important German firms (vehicles) which already do internal innovation in subindustries such as the electrical vehicle, mobility or autonomous. This industry is already quite competitive according to five Porter's force scheme. Finally, the IoT industry, as mentioned, present very few cases. This is a complex sector overlapping many other industries. In fact, six from seven cases are related to other industries.

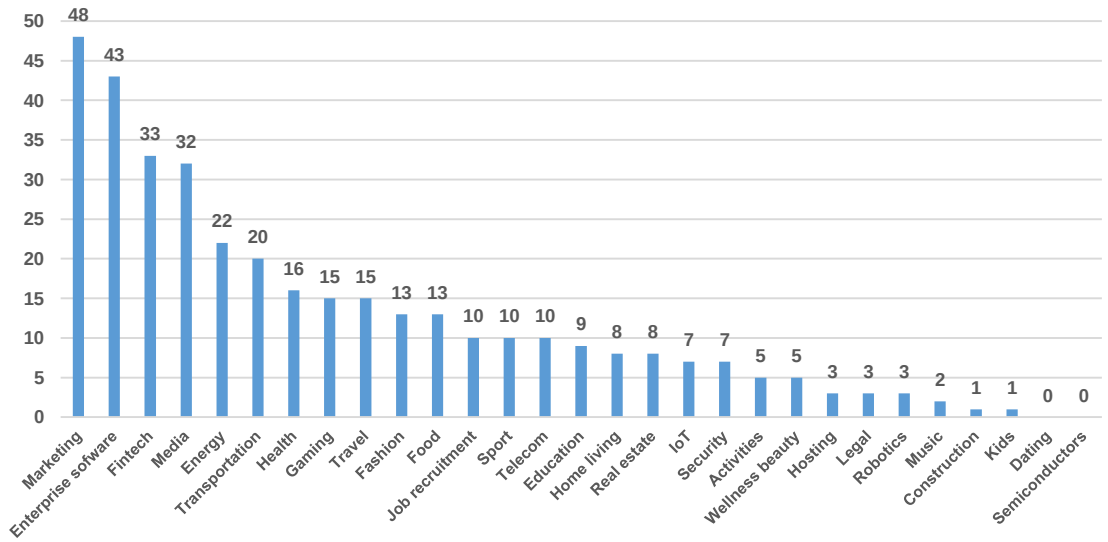

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Figure 27: Number of start-ups in industries (Hamburg, 2010-2018)

Figure 28 shows the evolution of the number of new start-ups operating in the eight industries commented above. As can be observed, the industries of marketing and enterprise software present the highest frequencies. Nonetheless, media and fintech have also experiment a growth until 2016. It is interesting also the situation of the health industry, with picks in 2014 and 2015 and a decrease in 2016. It seems that media and fintech maintain a growth path in 2016, which matches with a decrease in marketing and enterprise software.

Regarding mySMARTLife sectors of interest, the industry of energy is recovering from a decrease in 2011 and 2012 and has been growing until 2016. In fact, 2016 presents the higher number of new start-ups in the energy industry. The industry of transportation presents constants numbers for 2015, 2016 and 2017, with a pick in 2013. And the industry of IoT seems to grow during last years but its numbers are quite low.

We should be prudent to draw conclusions, as the numbers per year and industry are rather small on average. Moreover if we consider a possible lack of data for years 2017 and 2018.

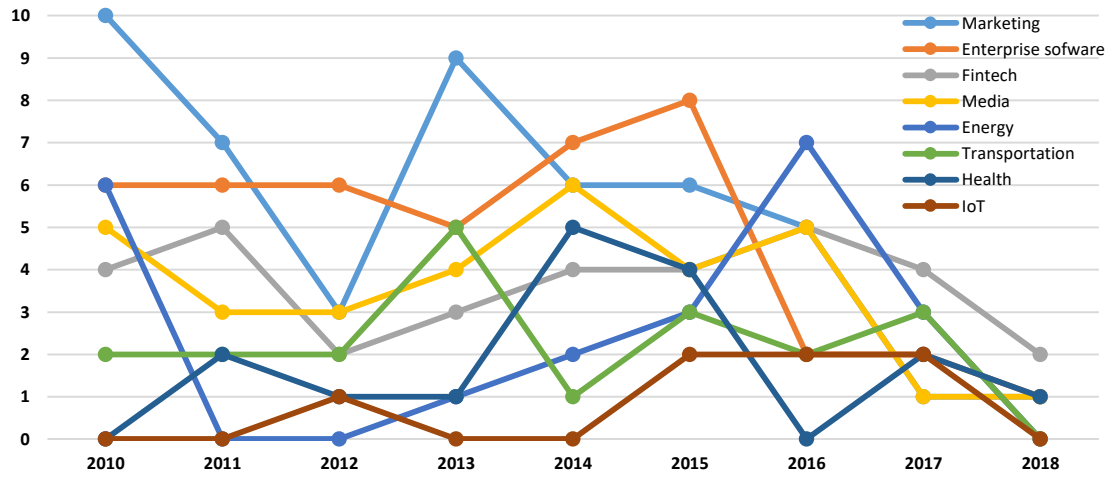

Figure 28: Number of new start-ups in the main industries by year (Hamburg, 2010-2018)

Figure 29 presents the main business models in which start-up companies are involved using to make money. Subscription business model is by far the most used. In fact, doubles in frequencies following business models such as marketplace, commission and SaaS. Presents 84 (37.67%) frequencies, while marketplace 38 (17.04%), commission 37 (16.59%) and SaaS 36 (16.14%). As we can imagine, there is a relation between subscription and SaaS, and between marketplace and commission. The first pair present a positive correlation of .181** (sig. .001), and the second pair also a positive correlation of .266** (sig. .000).

Figure 30 shows the number of new start-ups per year using business models. Subscription is leading the path and presents high ratios of growing until 2016. Next business models are quite constant, but it seems to appear a

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growing path of SaaS from 2013 to 2015. Marketplace remains quite constant in average. And commission presents a falls in 2015 comparing to 2013 and 2014.

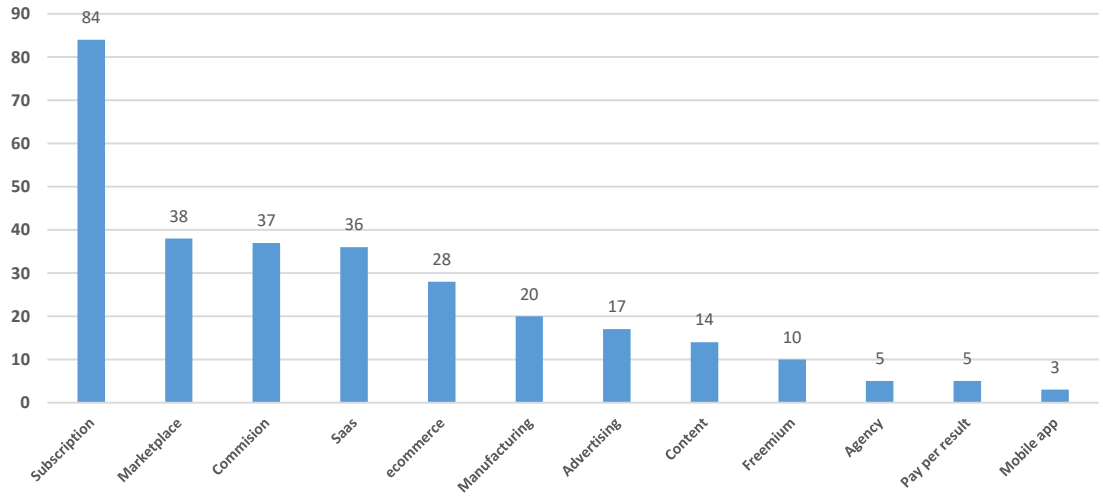

Figure 29: Number of start-ups by business models (Hamburg, 2010-2018)

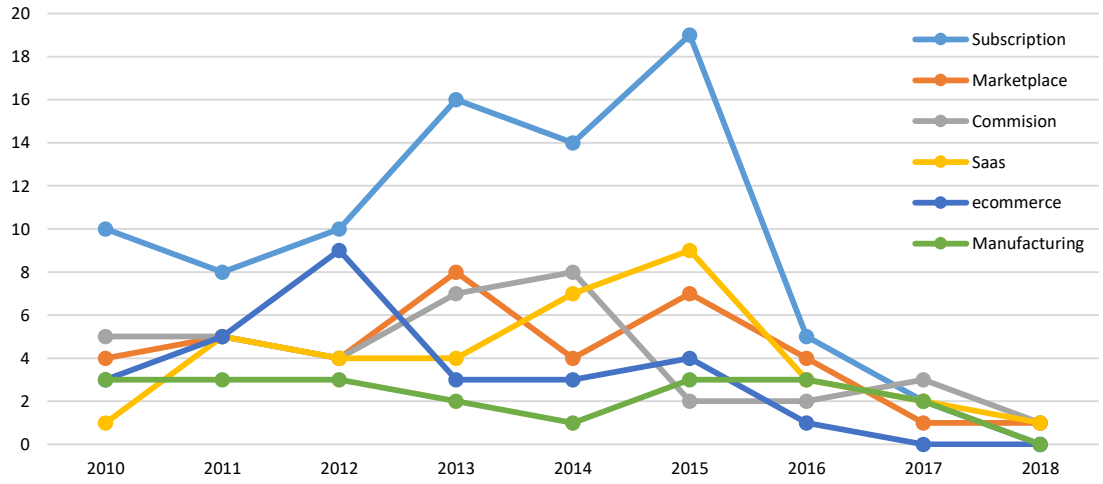

Figure 30: Number of new start-ups in the main business models by year (Hamburg, 2010-2018)

When we look at the main industries where start-ups operate, subscription has a strong presence in many of them. In general, it represents between 15% and 25% in all industries. However, there are exceptions. Subscription represents almost 40% in marketing and enterprise software. Marketing also uses advertising (16%) and commission (13%). Obviously, enterprise software shares this business model with SaaS, which represent 48%.

For the rest of the industries, different business models have much presence. In this sense, fintech's mostly used business model is commission (37%), followed by subscription (21%), SaaS and marketplace (15% respectively). Media uses content (29%), subscription (15%), advertising (13%), and the rest of business models between 5 and

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10%. Health share different business models too, manufacturing (27%), and subscription and market place (18% respectively).

Regarding mySMARTLife sectors of interest, energy mainly shares four business models, manufacturing (30%), subscription (25%), commission (20%) and marketplace (20%). Transportation shares commission and marketplace (25% respectively), subscription (20%) and manufacturing (15%).

6.5 Investment

In this section our main objective is to describe the situation of investment in the start-up companies of Hamburg, we use a database based on investment - funding rounds (see Annex 1, Investment rounds, for descriptions) - for the period 2013-2018.

During this period, there have been 253 funding rounds in 150 start-up companies with headquarters in Hamburg. As can be observed in table 24, almost 67% of start-ups have had one funding round; 19.33% two funding rounds; 3.33% three funding rounds; 4.67% four funding rounds; and 6% more than four rounds. The average is 2.50 funding rounds per start-up, with a standard deviation of 1.58. This average is quite disperse because 33% of the sample has had at least two rounds.

Table 24: Number of start-ups subject to funding rounds (Hamburg, 2013-2018)

Investment	Number of start-ups	Percentage
One round	100	66.67
Two rounds	29	19.33
Three rounds	5	3.33
Four rounds	7	4.67
More than four rounds	9	6
Total	**150**	**100**

The average to get the first funding round, taking into account the foundation year, is 2.06 years; for the second round 2.61; for the third round 3.42; and for the fourth round 4. These data are approximate since standard deviations are quite high, 2.61, 2.02, 2.1 and 1.7 respectively. Despite this lack of accuracy, the averages obtained are quite reasonable.

In figure 31, we can observe the distribution of frequencies of funded start-ups and funding rounds along the period. It is interesting to see how differences between the frequencies of start-ups and rounds increases since 2014. The ration between funding rounds and start-ups has a tendency to increase along the period. We have 1.04 rounds per start-up in 2013; 1.78 in 2014; 1.65 in 2015; 2.11 in in 2016; 1.78 in 2017; and 1.86 in 2018. In global, the ratio grows from 1.04 to 1.86, with a pick of 2.11 in 2016. Although the number of start-ups decreases in 2017 and 2018 comparing to 2013, the ratio is higher than in the previous years, except for 2016. Having said that, we

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must be careful. Probably, 2018 does not include all data about rounds. Information about funding rounds and deals takes time to be recorded given that it concerns long contractual processes.

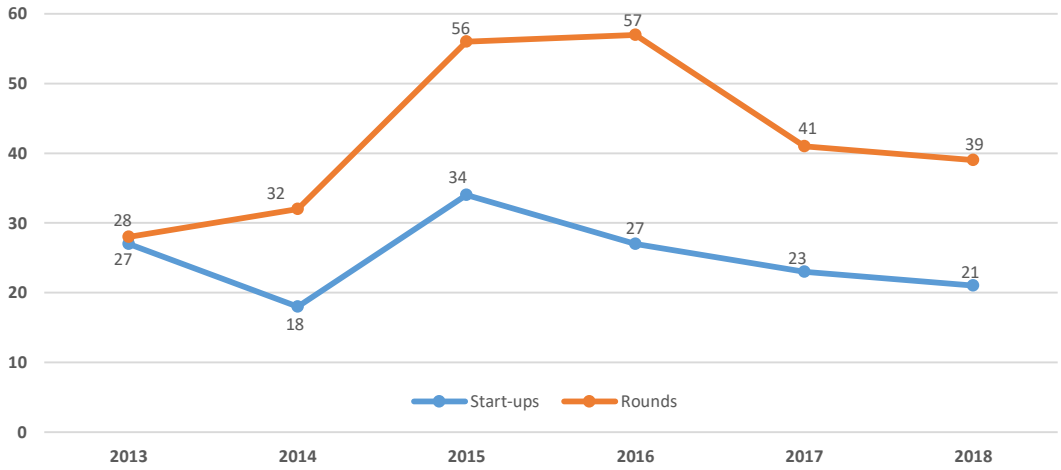

Figure 31: Number of start-ups and funding rounds by year (Hamburg, 2013-2018)

During the whole period, there was a total funding of EUR 1,487 million in Hamburg. This represents almost 9% of the total funding amount in Germany, which was EUR 17,200 million. As it comes off from table 25, Berlin's total funding represent 58% of total funding amount in Germany. An interesting aspect is that Hamburg has multiplied by eight investment from 2013 and has reached Munich in terms of funding average. In fact, Hamburg has raised EUR 100 million more than Berlin during 2018. Seems that this tendency started in 2015.

It is also important to comment that Germany has many cities, which raise money in funding rounds. In fact, besides Berlin, Munich and Hamburg, the category *Other cities* represents 25% of total funding in Germany for the period and this percentage represents 33% in 2018. As observed in the table, the percentage of other cities has multiplied itself almost by 4.5 from 2013 to 2018. Other important cities where start-ups raise money are Cologne, Düsseldorf or Frankfurt.

Table 25: Funding (in million €) of start-ups (Hamburg, 2013-2018)

	2013	**2014**	**2015**	**2016**	**2017**	**2018**
Berlin	576	1,900	2,100	1,100	2,000	2,200
Munich	147	213	267	184	228	390
Hamburg	**28**	**141**	**227**	**273**	**324**	**494**
Other cities	349	546	506	743	748	1.516
Germany	1,100	2,800	3,100	2,300	3,300	4,600

The situation about the growing amount of investment could be an indicator of the type of investors. Concretely, it could mean an entrance venture capital, which is expected in the growing and maturity stages. Hereunder, table 26 present the list of different types of funding rounds (see Annex 1, Investment rounds, for descriptions) and their

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frequencies. 43% of funding rounds are at the seed stage. Initial investment rounds, represented by angel, grant and seed rounds represent all together 54.8% of all rounds. This is a good signal for the ecosystem. These types of rounds (see Annex 2, Financing cycle, for descriptions) are crucial to cover the equity gap that most start-ups suffer when starting their business. Their importance is key since they cover the finance transition a start-up company needs to access venture capital or get partners in its projects.

Table 26: Number of funding rounds by type (Hamburg, 2013-2018)

Type of funding round	Number of rounds	Percentage
Seed	107	43.1
Early VC	39	15.7
Series A	35	14.1
Angel	16	6.5
Grant	13	5.2
Series B	11	4.4
Series C	9	3.6
Late VC	4	1.6
Growth equity	2	0.8
Series D	2	0.8
Series E	1	0.4
Others	9	3.8
Total	**248[1]**	**100**

[1]Cases with information. Missing values 5.

If we look at the average amount invested in initial investment rounds, we observe that the initial money is less than EUR 1 million in all three cases. In particular, we have an average of EUR 288,011 for angels, EUR 53,150 for grants and EUR 393,208 for seed rounds. It is important to indicate that 69% of angel rounds, 69% of grant rounds and 72% of seed rounds take place at the beginning, as a first round. These data clearly reveal that the ecosystem is quite robust and able to help start-ups to cover the initial equity gap.

For the growing stages, the early venture rounds represent 15.7% of the total rounds. This percentage is even higher if we take into account other funding rounds that are characteristic of the growing stages such as growth equity and series A. In total, growing funding rounds represent almost 30%. The average of money invested is EUR 1.478 million for early venture, EUR 181.363 million for growth equity and 3.068 million for series A. Except the case of growth equity rounds (the mean just represent two cases that have raised EUR 90 million and 272 million), these rounds are representative of a typical funding rang from growing stages between EUR 1 million and 5 EUR million. Rounds of early venture concentrate 50% in first rounds and 50% in second or more rounds; and series A, 40% in first rounds and 60 in second or more rounds. Although these types of rounds follow an investment logic, it seems that they have a strong presence at first rounds. One possible explanation to this situation could be round type valuations. For example, a seed round valuation has an average of EUR 6,234,909, while an early venture or series A have averages of EUR 23,812,500 and EUR 31,800,000 respectively. Rounds valuation highly influence round investment.

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For the maturation stages, the typical funding rounds are late venture capital and series B, C, D or E. All together, they represent 10.8% of the sample. It is an important percentage and the average of money invested is quite important. This is the reason why just a few start-ups get to these types of rounds. We find an average of EUR 34,409,090 for late venture, 9,746,280 for series B, 19,339,595 for series C, 54,454,545 for series D and 45,000,000 for series E. 50% of late venture take place in second or more rounds, 63% for series B, 66% for series C, 100% for series D and series E.

Industries and business models

As depicted in figure 32, the industry of fintech is the one which has raised more money in the period in question, with a total amount of EUR 470 million (37 rounds), followed by enterprise software with EUR 315 million (47 rounds), fashion with EUR 290 million (20 rounds), travel with 109 million (21 rounds) and gaming with 94.5 million (8 rounds). Regarding mySMARTLife sector of interest, the industry of transport has raised EUR 34 million, energy EUR 8 million and IoT less than EUR1 million.

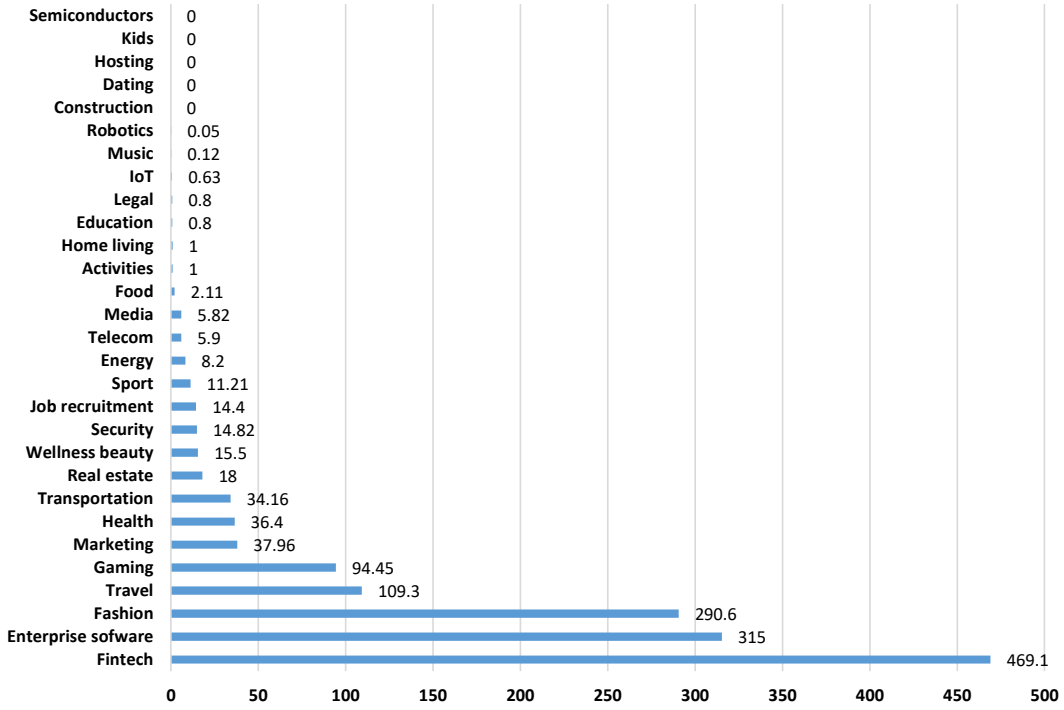

Figure 32: Funding (in million €) vs. industries (Hamburg, 2013-2018)

Figure 33 shows the amount invested by year for main industries. As observed, fintech and enterprise software are the ones that present a higher homogenous amount among the years. They present an average per year of EUR 78 million and EUR 52.5 million respectively. Both seem to have growth patterns until 2017, with an exception of enterprise software in 2017. In 2018, fintech falls almost 50% and enterprise software more than 80%. As

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mentioned before, we should be cautious with data from last year. The amount raised by the industry of fashion is clearly a sign of a unicorn. A unicorn is a start-up company valued at over $ 1 billion. This is the case for the Hamburg's start-up called "About you". According to the EU-Start-up magazine, it is one of the fastest growing e-commerce companies in Europe, offering a personalized shopping experience on your smartphone. Attending our data, "About you" was founded in 2014, has raised EUR 272 million in 2018 (second round) and has a valuation of $ 1 billion.

Regarding mySMARTLife sectors of interest, it seems that transport is doing well. The reason is that one company raised EUR 27 million in 2018. This start-up, called Wunder, is a smart mobility marketplace and tech platform providing carpooling, smart shuttles and scooter and car sharing to end customers, corporates and cities. The industry of energy raised EUR 8 million, 4 in 2014, 2 in 2016, and 1 in 2017 and 2018. For the case of IoT, the amount raised is quite low and we believe there is a lack of data.

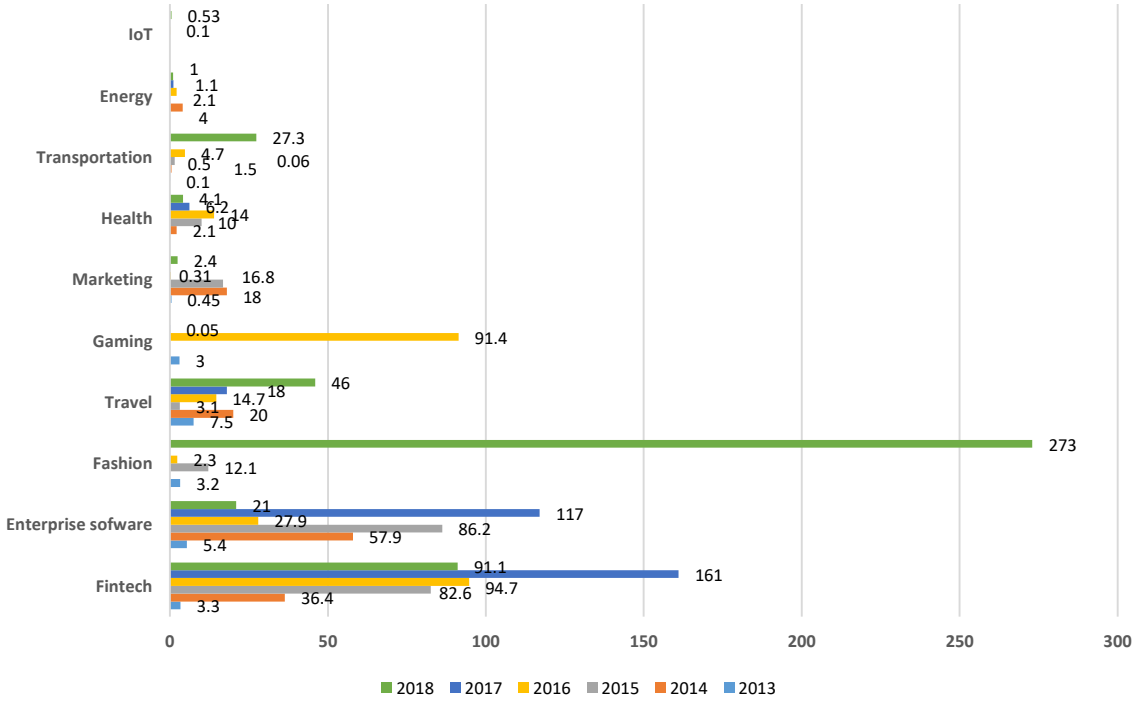

Figure 33: Funding (in million €) of selected industries (Hamburg, 2013-2018)

Figure 34, shows the investment by business models. Although subscription is the most used business model in new start-ups as we have seen in section 5.4, commission, marketplace and SaaS raised more than EUR 400 million. It is important to remark, as mentioned in section 5.4, that commission and marketplace have a positive correlation. For the case of the database on investment used in this section, the correlation is even higher .433** (sig. .000). In fact, 54% of all start-ups that operate with these business models are using both at the same time. For the case of ecommerce, as mentioned above, there is one start-up that raised alone EUR 272 million, which represent almost 94% of the investment. Finally, advertising and manufacturing are raising EUR 199 million and

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EUR 170 million respectively. In general, money invested goes to different business models. What seems obvious is that content, mobile app, agency and pay per result business models are not significant from the investment point of view.

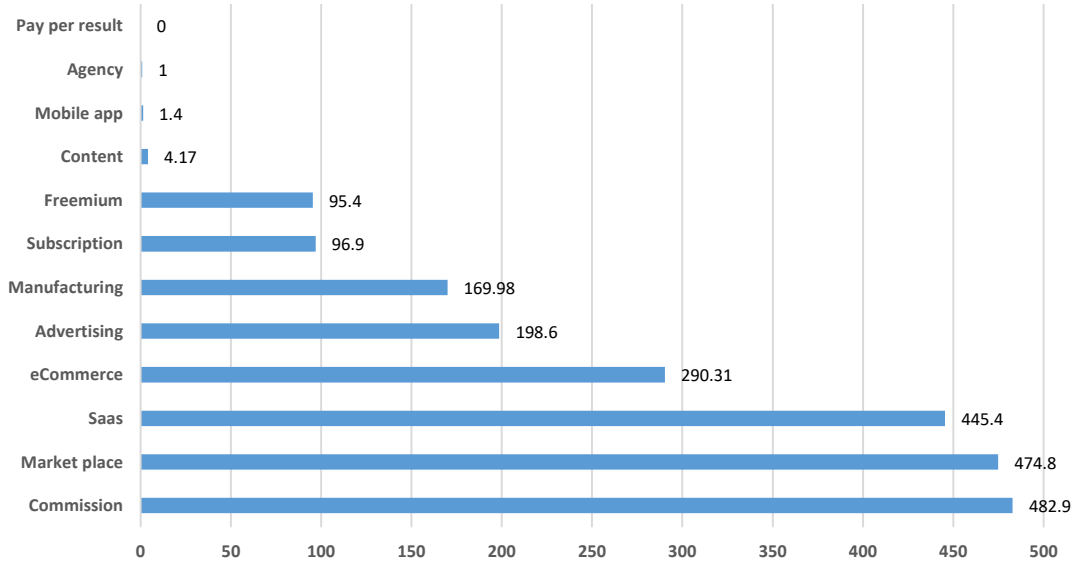

Figure 34: Funding (in million €) vs. business model (Hamburg, 2013-2018)

As can be observed in table 27, almost 53% of the rounds are carried out just by one investor and the remaining 47% by at least two or more investors. If we take into account the funding round types, the investors mean per round increases along the investment cycle. For example, the seed round has a mean of 1.53 investors with a standard deviation of .8810; the early venture a mean of 2.35 with a standard deviation of 1.7252; series A a mean of 2.7 with a standard deviation of 1.16; and late venture a mean of 2.5 with standard deviation of 1.71. The ANOVA test to analyse differences between funding stages regarding number of investors shows us that these means are significantly different, with a statistic F of 5.153 and a significance of .000.

Table 27: Investors by number of rounds (Hamburg, 2013-2018)

Number of investor	Number of rounds	Percentage of rounds
One investor	72	52.94
Two investors	25	18.38
Three investors	18	13,24
Four investors	9	6.62
More than four investors	12	8.82
Total	**136**[1]	**100**

[1]Cases with information. Missing values 117.

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Finally, we present the percentage of investors' origin. As we can see in figure 35, 60% of the sample is from Germany, 19.6% from Europe, 16% from America, 4% from Asia and 0.4% from Africa. Regarding Germany, investor come from many cities. Hamburg and Berlin share a similar percentage, around 22% respectively. Other important cities are Bonn (16.5%), Munich (13.7%), or Frankfurt (6.16%). Regarding Europe, there is a strong presence of England (London), Netherlands (Amsterdam) and Belgium (Brussels). The case of Belgium is related to grants linked to the Horizon 2020 SMEs instrument. For the case of America, all investors are from the United States of America, coming from important hubs such as Palo Alto, San Francisco, Boston or New York. For the case of Asia, most of the investor are from Israel (Tel Aviv), with some presence of China and Japan. And for the case of Africa, just one investor from South Africa (Cape Town).

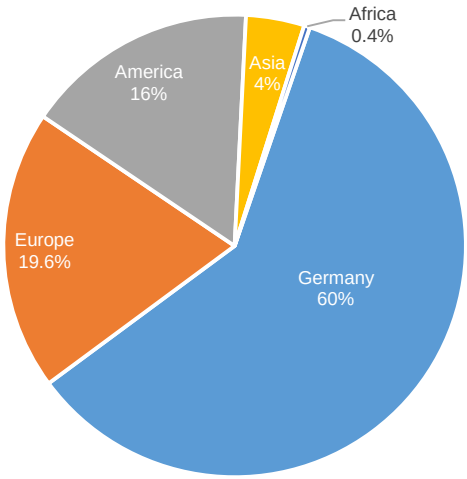

Figure 35: Percentage of investors by geography (Hamburg, 2013-2018)

6.6 Exits

In this section, we analyse the exits produced during the period 2010-2018 in the ecosystem of Hamburg. The analysis focuses on two main actors, start-ups and acquirers. It is important to identify which start-ups and industries have succeeded, but it is also important who has acquired them and where the money comes from.

During the analysed period, the ecosystem has had 83 exits from 1,083 operative start-ups. As summarized in table 28, the majority of exits are acquisitions (96.4%) and just a small percentage corresponds to IPOs (3.6%). It is true that there are other types of rounds considered exits, for example a secondary sale, where a stakeholder sales his share from the company to another buyer. Normally, this is produced by one founder, an early employee, or an early investor, and has to be considered also as an exit. The problem is that there is not enough and concrete information about these types of exits in the ecosystem of Hamburg.

Table 28: Exist by type of rounds (Hamburg, 2013-2018)

Type of rounds	Number of acquisitions	Percentage

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Acquisitions	80	96.4
IPO	3	3.6
Total	**83**	**100**

As can be observed in figure 36, it seems to be a great increase in years 2016 and 2017 comparing to previous years. Exits during these two years represent almost half of the sample. This situation is similar to other hubs, for example Helsinki, which has also an increase tendency in acquisition during recent years. The key aspect from Hamburg is that the ecosystem almost double acquisitions from 2015 to 2017. The situation of acquisition in 2018, as mentioned previously, responds to a lack of information. In fact, one month later after analysing the data 2018 had one more exit and six in 2019. This lack of information represents a normal situation.

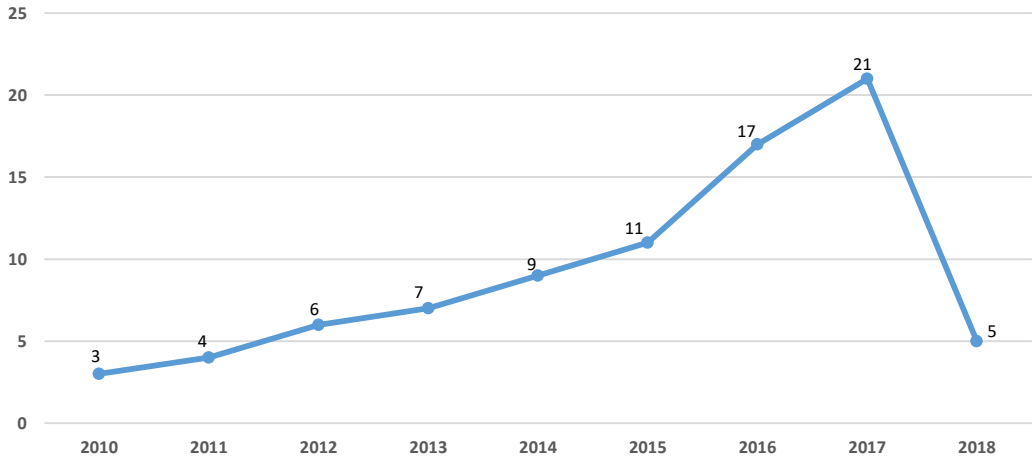

Figure 36: Number of exits by year (Hamburg, 2010-2018)

An interesting indicator for the situation of the ecosystem is the number of years elapsed before an exit. If we take the whole sample for the period, 83 exits, the average of years from foundation to exits is 14.77 with a standard deviation of 18.55. This average seems to be reasonable time, but it is not really reflecting the situation in the ecosystem of Hamburg. Such a high standard deviation is telling us that the sample is very scattered and has outliers. If we considered exits only for start-ups founded since 2000 - 57 exits (69%) of the sample -, the average decreases to 6.57 with a standard deviation of 4.40.

During 2013 and 2018, as depicted from table 29, there were acquisitions in Hamburg for an amount of EUR 2,892 million This represents almost 4% of the total amount used up for exits in Germany, EUR 85,400 million. The city of Berlin, which is the one that raises more money from investment, represents 16% of total amount, EUR 13,100 million; Munich represents 7.5% of total amount, EUR 6,384 million; and other cities represent 74%, EUR 62,276 million. It seems that exits are quite spread along German cities.

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Exits in Hamburg according the amount spent for them, have increased their rank from years 2013 and 2014. The city has jump from the position 32 position to position 16 in 2018. It has presented a very good rank in 2015, 9th position, due to the great amount - EUR 1,400 million – raised in acquisitions.

Table 29: City exists (€ million) by year (Hamburg, 2013-2018)

	2013	2014	2015	2016	2017	2018
Berlin	3,300	2,700	1,500	1,200	2,600	1,800
Munich	2,900	656	2,300	183	138	207
Hamburg	**0.175**	**83**	**1,400**	**389**	**552**	**468**
Others	899.825	4,061	3,700	13,328	27,810	13,225
Germany	7,100	7,500	8,900	15,100	31,100	15,700

Industries

Figure 37 shows that the industry of marketing tops acquisitions with 18 for the whole period, followed by enterprise software and media with 10 respectively, gaming with 7, energy, fintech, telecom and travel with 6 respectively, and transportation 5. To some extend these numbers correlate with foundation and investment rounds, but there are some exceptions. The industry of marketing tops foundations (48), but falls to sixth position regarding the total amount invested (EUR 37.96 million). Enterprise software is second regarding foundation (43) and maintains second regarding investment (EUR 315.4 million). Media is fourth regarding foundation (32) but falls to fifteenth position regarding investment (EUR 5.82 million). Gaming is eighth position regarding foundation (15) and in fifth position regarding investment (EUR 94.45 million). Fintech is in third position regarding foundation (33) and first regarding investment (EUR 469.1 million). Travel is in ninth position regarding foundation (15) and in fourth position regarding investment (EUR 109.3 million). Finally, the industry of telecom is in fifteenth position regarding foundation (10) and in fourteenth position regarding investment (EUR 5.9 million).

Regarding mySMARTLife sectors of interest, energy has had 6 exits and it is in fifth position regarding foundation (22) but falls to fourteenth position regarding investment (EUR 8.2 million). Transport has had 5 exits and it is in sixth position regarding foundation (20) and in eight position regarding investment (EUR 34.16 million). And IoT has had 3 exits and it is in eighteenth position regarding foundation (7) and twenty-eighth position regarding investment, but we believe there is not enough data regarding investment for the IoT industry.

The exits of companies can be classified by industry according to companies' status, this means *being operative*. Taking into account all operative companies by industry, the exit ratio changes the position of industries. As observed in table 30, travel coups the classification with a ratio of 4, which means an exit every four companies.

Table 30: Exit ratio by industry (Hamburg, operative companies in 2018)

Main industries	Exit ratio
Travel	4,00

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Telecom	4.17
Marketing	4.89
IoT	5.33
Gaming	5.71
Energy	6.00
Enterprise software	8.60
Media	8.90
Fintech	9.67
Transportation	10.80

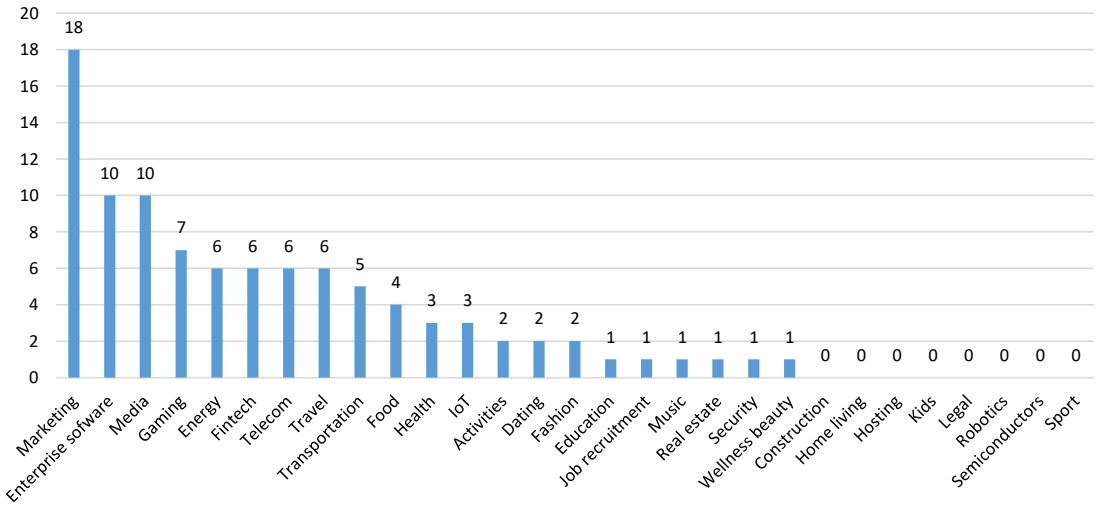

Figure 37: Number of exits by industry (Hamburg, 2010-2018)

Acquirers

In terms of acquirers, the sample shows one acquirer per acquisition. There is an average of 1.07 with a standard deviation of .34. Regarding the type of acquirers, 83% are corporates, 12% investment funds and 5% angels. Clearly, there is a strong correlation between acquisition and type of acquirer as well as with having been funded in previous rounds. In fact, the mean of funding rounds is 2.31 with a standard deviation of 1.80. The sample varies, 42% of starts-ups have had just this acquisition round, but 68% have had previous rounds.

As observed in figure 38, Europe concentrates almost 76% of all acquirers if we take into account Germany. Germany by its own represents 49%. America and Asia 21% and 3% respectively. Regarding Germany, acquirers come from many cities. The main one is Berlin with a percentage of 21%, followed by Munich with 15%, Hamburg and Köln with 14% respectively, and other cities as Bavaria, Bonn, Cologne or Essen with 2% respectively. The rest of acquirers just mention Germany as headquarters or are missing values. For the case of Europe, London (England) and Stockholm (Sweden) coped acquisitions with a percentage of 23% and 19% respectively. For the case of America, almost all acquirers are from the United States, coming from different cities such as Boston, San Francisco, Chicago, San Mateo, etc. Finally, Asia just represent 3% and acquirers come from the cities of Hangzhou and Shanghai (China).

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Although we do not have many information on investment for acquisition rounds by geography - just 17 cases -, it seems that United States copes acquisitions with a total sum of EUR 1.855 million (5 cases), followed by Europe with EUR 682 million (5 cases), Germany with EUR 531 million (6 cases), and Asia EUR 80 million (1 case).

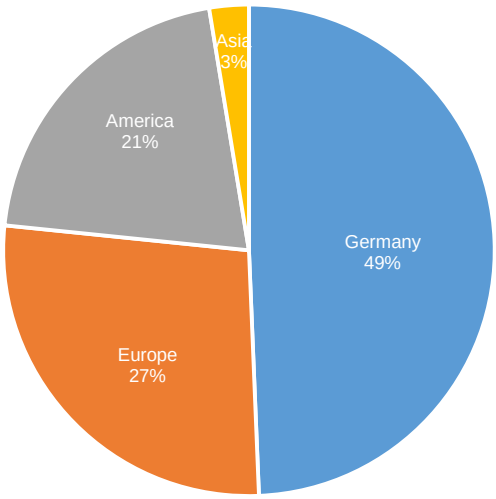

Figure 38: Acquirers by geography (Hamburg, 2010-2018)

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7. The case of Helsinki

7.1 Introduction

The start-up scene in Helsinki is well recognized in Europe and worldwide[28]. According to Startup Genome[29], Helsinki EE is unique through its connectedness and ambition level. Helsinki offers a functional and attractive platform where many world-changing solutions have taken place. In fact, Finland is among the top three European countries in gaming enterprises, which led the country to be in the top 20 global ecosystems for gaming.

The central contact point for doing businesses in Helsinki is NewCo Helsinki[30]. This public institution offers different types of services for start-ups such as funding -in partnership with The Hub[31], a platform that connects start-ups with talent, investors and best practices tools -, international strategy to growth, network contacts, mentoring or ecosystem services. In this regard, NewCo Helsinki is pushing hard to develop the start-up ecosystem in the area and in establishing international contacts to support company growth. As mentioned by Ari Seppänen, project manager for ecosystems of growth, from the Economic Development-Innovations and New Experiments Executive Office from Helsinki, they are pushing hard to internationalize the EE and help start-ups to enter global markets.

From a public perspective strategy, Helsinki is concentrating its efforts in early stages, giving support and networking. As mentioned by Ari Seppänen, around 80% of their resources are concentrated in early stages in order to support the initiation of ventures. In addition to getting main actors in contact (accelerators, incubators, entrepreneurs, universities, etc.), Helsinki is focusing on supporting entrepreneurs in business logics in order to go to market with strong business plans, as well as marketing selling attitudes.

From a country level, Business Finland[32] supports and promotes entrepreneurship. For the central government it is a policy priority. They have an “Entrepreneurship Package” as a key project on competitiveness to support business in their different life cycle stages, with the objective to remove barriers to business and entrepreneurships and improve operating conditions in national and global markets. Many of the measures focus on improving efficiency of internationalization services for business and entrepreneurs, business finance instruments, promotion of deregulation, market competition, etc. The entrepreneurship package, among its measures, includes the provision of EUR 600 million growth funding. In fact, as mentioned by Henrik Jakobsson, Chief Sourcing Officer from Salusfin, a Finish start-up company from mySMARTLife project consortium, the first funding round they received to start the business, as well as counselling, came from Business Finland.

[28] Source: http://www.goodnewsfinland.com/helsinki-startup-ecosystem-recognised-globally/
[29] Source: https://startupgenome.com/ecosystems/greater-helsinki
[30] Source: https://newcohelsinki.fi
[31] Source: https://thehub.fi/
[32] Source: https://www.businessfinland.fi/en/do-business-with-finland/home/

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Another important actor from the city of Helsinki is Helsinki Business Hub[33], which is the international trade and investment promotion agency for the region. Their goal is to help foreign companies to set up their business, grow and develop in the region. As they publicize, Helsinki has important cluster in the areas of health, ICT and smart city with a clear focus on clean solutions and smart mobility.

Regarding important components for the EE, Helsinki counts with many accelerators (Vertical health accelerator, Startup Sauna, Rising North or Avanto Ventures), workspaces (Uma, Urban Office, Minimum Viable Office, etc.), great events (Arctic15 or Slush) and many service providers. Furthermore, the city has over 200 investors. As mentioned above, Business Finland operates in start-up seed stages, but there are many other investors in seed stages such as Lifeline Ventures, Inventure, Invesdor, etc. or in early venture capital stages, such as Supercell, Loudspring, Pontos group or Capman.

7.2 Framework conditions

In this section, we use primary sources from different databases as well as secondary sources to have an overlook of main characteristics and framework conditions for the entrepreneurial ecosystem in Helsinki and in the whole country of Finland. Our main objective is to draw a picture from general (Finland) to particular (Helsinki) to identify these conditions.

Our first approach to entrepreneurship and business is at national level through the following comparable world indexes (see Annex 1, Indexes, for descriptions): the Easy of Doing Business, the Global Competitiveness Index, the Index of Economic Freedom, the Global Entrepreneurship Index and the Regional Entrepreneurship and Development Index, which scores are presented in table 31. We have chosen those that are developed by important worldwide organizations and represent a primary source to consult for doing business in Helsinki and Finland.

Table 31: Indexes (2018-2019)

	Easy of Doing Business[1]	Global Competitiveness Index[2]	Index of Economic Freedom[3]	GEI Index[4]	REDI Index[5]
Score	80,35	80	74.9	67	71
World rang	17	11	20	12	-

[1] The World Bank. Doing Business. Measuring Business Regulations. 2019. Score: 0-100.
[2] World Economic Forum. The Global Competitiveness Index. 2018. Score: 0-100.
[3] Heritage. Index of Economic Freedom. 2019. Score: 0-100.
[4] The Global Entrepreneurship and Development Institute. Global Entrepreneurship Index (GEI). 2018. Score: 0-100.
[5] The London School of Economics and Political Science. Regional Entrepreneurship and Development Index (REDI). 2018. Score: 0-100.

The first index is the Ease of Doing Business score. According to Doing Business database information (2019), Finland (Helsinki as city information covered) ranks 17 from 190 countries with a score of 80.35. This score

[33] Source: https://www.helsinkibusinesshub.fi/about-hbh/

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overcomes the regional average for the OECD high income countries (78.9) as well as many of the EU countries. Just Denmark, Norway, United Kingdom, Sweden, Lithuania and Estonia scores better in this index. As observed in figure 39, Finland scores high in many of the components that set up the Easy of Doing Business score. Finland particularly receives high marks for *Starting a business* (scores 92.43 - ranks 43), *paying taxes* (scores 90.64 - ranks 11), and *resolving insolvency* (scores 92.81 - ranks 2). However, there are three important topics that score low: *getting credit* (score 65 - ranks 60), *protecting minor investors* (scores 58.33 - ranks 72), and *enforcing contracts* (scores 66.4 - ranks 46).

Finland made efforts to make it easier to do business. Some of the reforms concentrate in *paying taxes* and in the *labour market regulation*. Regarding taxes, Finland made *paying taxes* less costly by reducing the labour contribution rates paid by employers and by introducing a new and more efficient online portal for filing corporate tax returns called “My Tax” (2019). Regarding the *labour market*, Finland increased the length of the maximum probationary period for permanent employees (2018).

One of the key components to take into account should be the *protecting of minor investors.* As mentioned, has a low score as well as ranking. This component results extremely important for entrepreneurs, who often need investment in initial and growing phases of their businesses to cover the equity gap as well as scaling. Furthermore, we also observe that getting credits has a low score as well as ranking. This is also a problem for entrepreneurs who relies on credits to start own businesses.

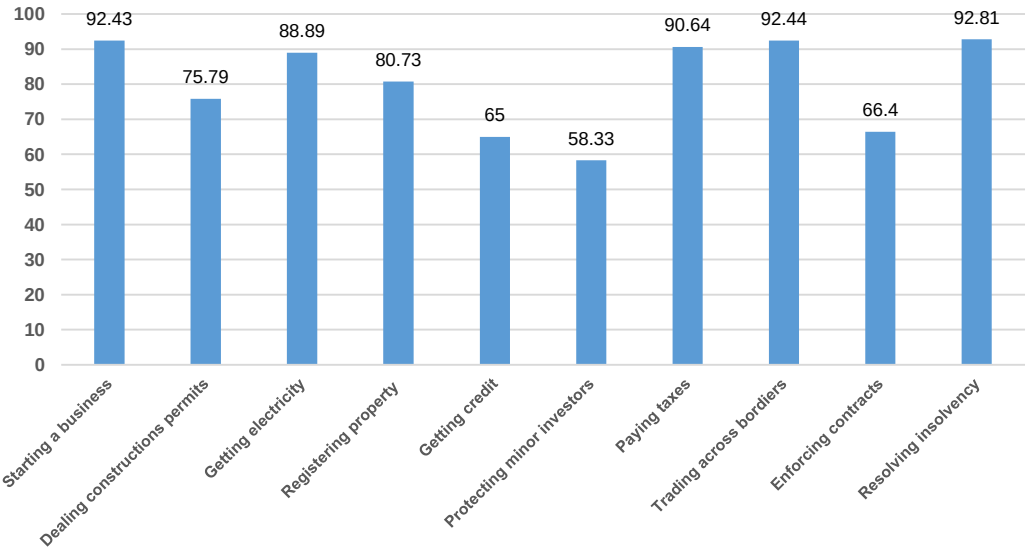

Figure 39: Scores for Easy of Doing Business Index (Finland, 2019)

The second index is the Global Competitiveness Index. According to World Economic Forum database information (2018), Finland ranks 11 from 140 countries with a score of 80. In 2017 ranked 12 from 140 countries. Compared with the first index - Easy of Doing Business -, Finland scores even better. As depicted from figure 40, there are twelve components. Finland ranks and scores high in enabling environment components for competitiveness, such

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as *institutions* (scores 81 - ranks 2), *infrastructure* (scores 82 - ranks 23) and *macroeconomic stability* (scores 100 - ranks 1). For the case of *ICT adoption*, scores less than 80, but ranks 16. Another important factor is the human capital. Finland does a good job in *health* (scores 91 - ranks 22) and *skills* (scores 88 - ranks 1).

Following we have the market factor. Finland scores high in the *financial system* (scores 89 - ranks 3), but lower in *market size* (scores 57 - ranks 61), *product market* (scores 68 - ranks 14) and *labour market* (scores 71 - ranks 19). Finally, we have the innovation ecosystem factor. In this case, Finland has good rankings comparing to other countries. For the case of *business dynamism* ranks 8 (scores 78), and for the case of *innovation capability* ranks 10 (scores 10).

Seems that market components (except the *financial system*) need to score and rank better. Components of market conditions' mean scores 71 and ranks 17. Nonetheless, the mean scored is highly influenced by the *market size*. This is a structural component delimited by demography. In this sense, Finland is a small country comparing to top countries in the ranking, such as United States, Germany, United Kingdom, etc. *Market size* strategies should focus in internationalisation to offset internal market size.

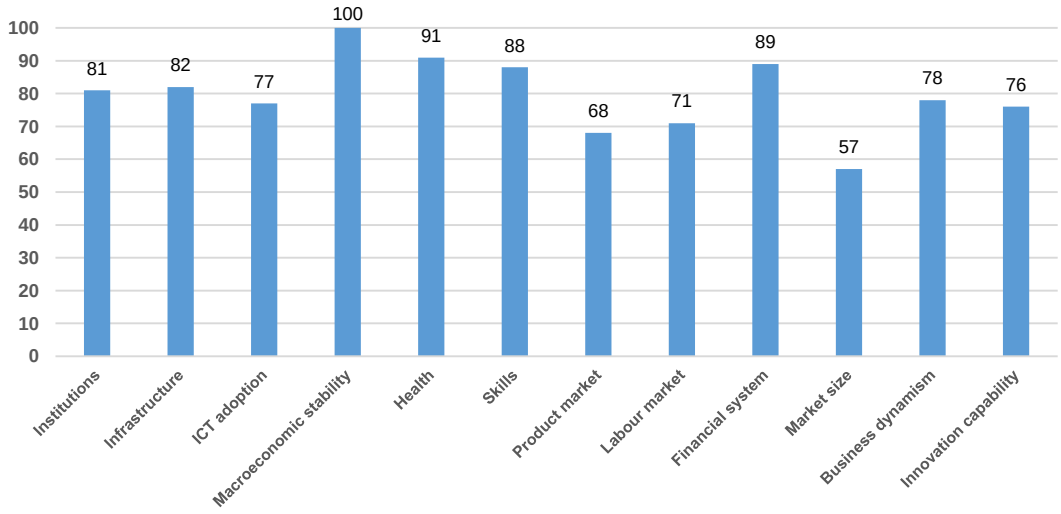

Figure 40: Scores for Global Competitiveness Index (Finland, 2018)

The third index that we present is the Index for the Economic Freedom (2019). Finland ranks 20 from 169 countries with a score of 74.9. Comparing with previous mentioned indexes, seems that Finland ranks lower, but its overall score has increased by 0.8 point from 2018; ranks 11 among 44 European regions; and its overall score is above the world average. As reflected in figure 41, rule of law components are high. Maintains one of the world's strongest *property rights* protection (89.6) and *government integrity* (92.5). Seems that the quality of the judiciary is generally high. In fact, this could be one of the reason that explains why corruption is not a problem in Finland[34]. Regarding regulatory efficiency, *business freedom* and *monetary freedom* scores high, 89.4 and 84.8 respectively.

[34] Finland scores 85 and ranks 3 in the Corruptions Perceptions Index (2018). Source: www.transparency.org

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This is not the case for *labour freedom*, which scores 50.3. This score relates to regulations and requirements in the labour market. Finland has strong policies to protect employees and entrepreneurs and businesses could see them as negative in terms of flexibility and bureaucracy processes. What seems quite low is *government spending* (7.2). This topic considers the level of government expenditure as a percentage of the GDP. The government spending has been decreasing in recent years according to historical data. In 2010 presented a percentage of 39% that has been decreasing until 2019. Finally, those components related to open market seem to score high. *Trade freedom* scores 86, *investment freedom* 85, and *financial freedom* 80. Seems that Finland welcomes foreign investment.

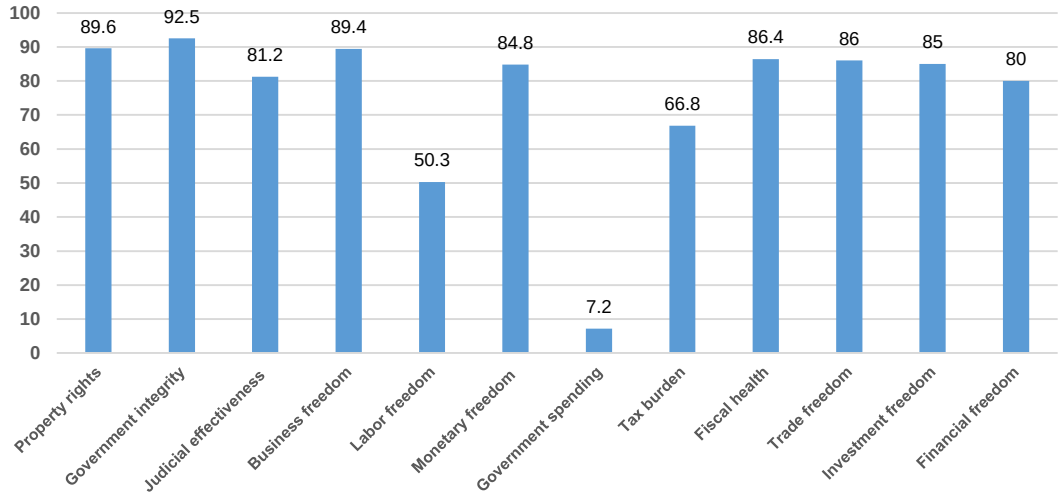

Figure 41: Scores for the Index of Economic Freedom (Finland, 2019)

In general, seems that *labour freedom* could be an obstacle for businesses. In fact, as we will see later on, the most problematic factor for doing business in Finland highlighted by entrepreneurs is the restrictiveness of the market regulation (The Global Competitiveness Index 2017-2018). On the other hand, open market scores seem to welcome foreign investment. One topic that results controversial is the governing spending, quite low and with a decrease tendency during recent years.

Finally, we present the Global and Entrepreneurial Index (GEI, 2018) for Finland and the Regional Entrepreneurship and Development Index (REDI, 2018) for Helsinki-Uusimaa region, which involve the city of Helsinki. Regarding GEI, Finland scores 67 and ranks 12 from of 137 countries and regarding REDI, Helsinki-Uusimaa scores 71. Figure 42 shows similar patterns between the country and the region. However, we find some differences. Finland scores in *high growth* (clustering and gazelle) and *internationalization* (connectivity and export), although values are not quite high for none of each. On the other site, Helsinki-Uusimaa scores top at *start-up skills* (quality of education and skill perception) and *technology absorption* (absorptive and technology level), although Finland also present high values. Helsinki-Uusimaa also scores very high in two important items for the EE, *networking* (social capital and know entrepreneurs) and *human capital* (education and training and education

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level). Finally, two important items that where Finland and Helsinki-Uusimaa score very low are *competition* (business strategy and competitors) and *financing* (financial institutions and informal investment).

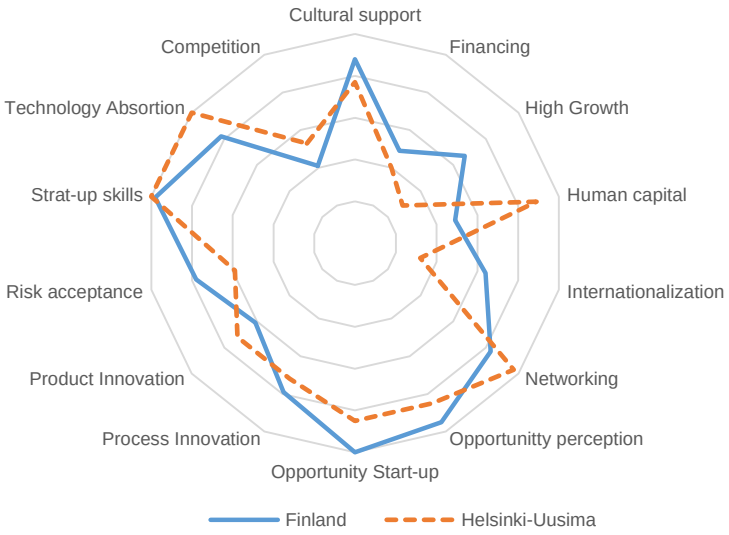

Figure 42: GEI and REDI indexes (Finland and Helsinki-Uusimaa, 2018)

After the analysis at a country and regional level, the authors, to close this section, have revised a national ranking[35] for cities, which serve to compare Helsinki with other Finnish cities. Considering just Finland, Helsinki's ecosystem ranks first in 2019, above cities such as Oulu, Tampere, Turku or Vantaa.

7.3 Entrepreneurs

In this section, we use a database based on start-ups founded during the period 2010-2018 as well as different reports to describe entrepreneur's profile and perceptions from Helsinki.

According to our database, start-ups from Helsinki have a founders' mean of 2.28 founders for every start-up with a standard deviation of 1.35. As presented in table 32, the percentages for the first three categories - one founder, two founders, and three founders - compose 86.09% of the sample, being 33.48% for one founder; 31.74% for two founders and 20.87% for three founders. It seems that entrepreneurship in Helsinki is not just an individual activity on the contrary, it is a group activity. In fact, two or more founders represent more than 65% of the sample.

Regarding founder's gender, at it is presented in table 33, start-up companies with female founders alone, represent 9.1% of the sample, while male founders alone represent 73.9%. Taking into account that the global

[35] Source: https://www.startupblink.com/startups/helsinki+uusi+finland

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average is 16% for female founders, the amount of 12% is a value to improve but is quite close to the European entrepreneurial city ecosystems, where female founder's best scores are in Barcelona (15%), London (15%) or Copenhagen (14%) (GEM, 2016/2017). On the contrary, 17% of the sample are mixed teams. This good percentage scores above the average. However, there is a strong presence of men in mixed teams.

Table 32: Start-up founders (Helsinki, 2010-2018)

Number of founders	Number of Start-ups	Percentage
One	77	33.48
Two	73	31.74
Three	48	20.87
Four	15	6.52
Five or more	17	7.39
Total	**230[1]**	**100**

[1]Cases with information. Missing values 449.

Table 33: Start-up founder gender (Helsinki, 2010-2018)

Gender of founders	Number of Start-ups	Percentage
Female	21	9.1
Male	170	73.9
Mixed team	39	17
Total	**230[1]**	**100**

[1]Cases with information. Missing values 449.

An important founders' characteristic is their previous entrepreneurial experience. As observed in table 34, 24.03% are start-up companies founded by entrepreneurs who have had prior experiences on launching start-ups and 75.97% are entrepreneurs for the first time.

Table 34: Entrepreneurial background of start-up founders (Helsinki, 2010-2018)

	Number of Start-ups	Percentage
Serial	56	24.03
No serial	177	75.97
Total	**233[1]**	**100**

[1]Cases with information. Missing values 446.

Another important aspect to highlight about entrepreneurs are perceptions. The Global Entrepreneurship Monitor (GEM) (2018), a unique global assessment of entrepreneurial activity, highlights some interesting ideas about entrepreneurs in Finland:

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- **Perceived opportunities**. The level of opportunity perception (adults 18-64 years) is relatively high compared to other EU member states. 49% of population perceived good opportunities for entrepreneurship while the EU average is 35%. On the other hand, this percentage is lower than the Nordic countries, which present an average of 69%. The report also highlights that this perception is considered highest among highly educated individuals.
- **Perceived capabilities**. The perception of having entrepreneurial capabilities to start a business has increased. 37% of adult population considers having necessary capabilities to start a business. Nonetheless, this percentage remains lower than the EU average (43%). For the case of Nordic countries, the share is equal to Sweden, but lower in comparison with Norway (31%). Unlike, the opportunity perception - consider to have capabilities - is related with gender and age. The perception is higher among men and individuals aged 35-44 years.
- **Fear of failure**. The fear of failure among the adult population is 40%, and 33% for those who have perceived entrepreneurial opportunities. For the adult population, the percentage remains equal to the EU average (40%). As for the case of capabilities, the fear of failure is higher among women and those age groups between 25 and 44, which seems to be in family formation and responsibilities.
- **Entrepreneurial intentions**. 11% of the non-entrepreneurially active adult population intends to start a business within the next three years. This percentage is below the EU average (13%). Nonetheless, both percentages are quite low. Among Nordic countries, Finland has the highest percentage comparing to Norway (5%) and to Sweden (8%).

In figure 43, we present a list of most problematic factors for doing business in Finland (The Global Competitiveness Index, 2018), according to entrepreneurs and business survey (2017). Most problematic factors are *restrictive labour regulations* (27.3%), *tax rates* (21.5%), *tax regulations* (11.7%) and *inefficient government bureaucracy* (9.8%). These factors are quite common for OECD countries and as we will present in following chapters, very similar for the cases of France and Germany.

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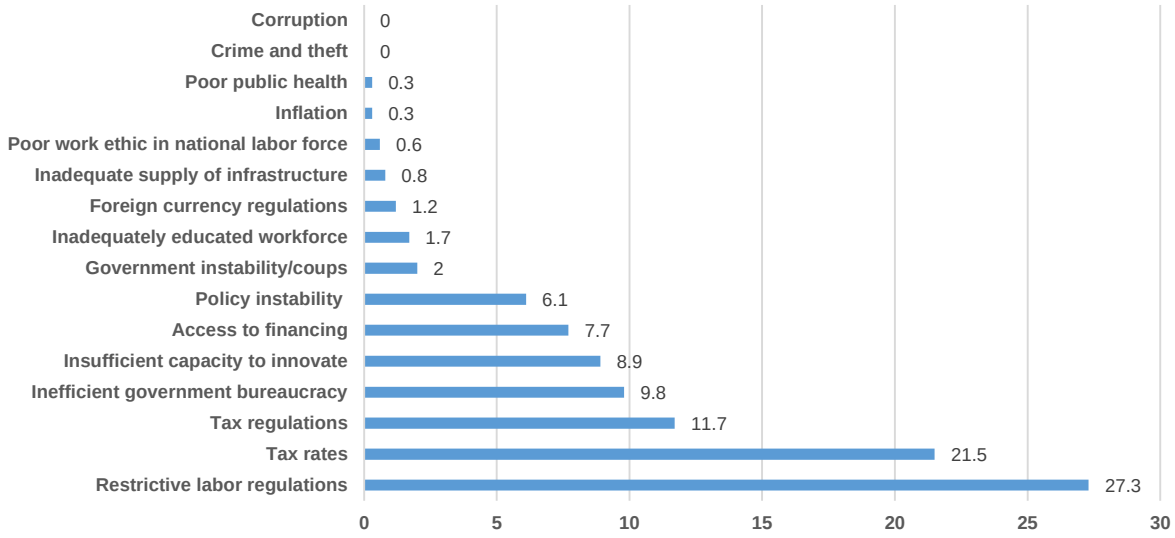

Figure 43: Most problematic factors for doing business (Finland, 2017)

7.4 Entrepreneurial activity

In this section, we use a database based on founded start-ups for the period 2010-2018. 712 start-ups were founded in Helsinki between 2010 and 2018. This number represents around 60% of all start-ups founded in the city if we take into account historical data from start-ups. This percentage raises almost to 80% if we consider just founded start-ups in the XXI century. These percentages are indicative given that the historical record for start-ups is incomplete.

As observed in table 35, more than 90% of start-ups founded during the analysed period still operative. In fact, if we take into account acquired start-ups, the percentage raises to 95%. Despite this information, the most important situation to point out is the failure percentage, which represents less than 5%. This percentage could be controversial. The analysed period seems to be quite short.

Table 35: Operational status of start-ups (Helsinki, 2010-2018)

Operational status	Number of Start-ups	Percentage
Acquired	20	2.81
Operational	659	92.56
Closed	33	4.63
Total	**712**	**100**

Figure 44 shows that the foundation of start-ups has multiply itself by three from 2010 to 2016. 2017 and 2018 present less founded start-ups. This situation is not a question of foundation activity in the city of Helsinki. It is remarkable that these years do not have an up to date complete information on new start-ups.

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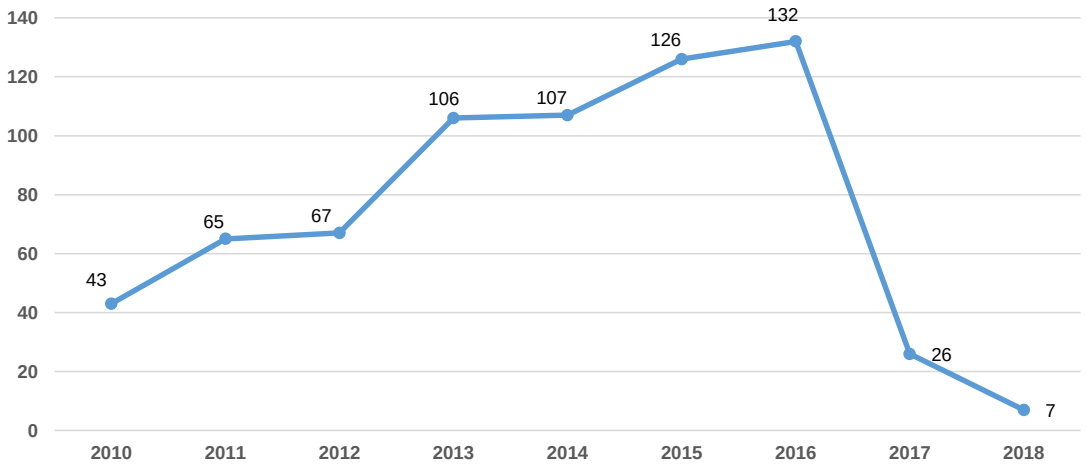

Figure 44: Number of founded start-ups by year (Helsinki, 2010-2018)

Regarding employment, we do not have precise numbers (total number of employees per start-up), but we can estimate the numbers using employees categories. As can be observed in table 36, almost 60% of the start-ups employ between two and ten employees, and 31.8% between eleven and fifty employees. Based on these data, we can estimate a range for the total direct employment in start-up companies. In this sense, by multiplying the ranges (the minimum and maximum values) of every category by its corresponding frequency, we calculate a range between 6,446 and 21,110 employees. In terms of active population for 2016 (15-64 years old), the direct job created by these start-ups ranks between 2% and 6.5% in the city of Helsinki.

Start-ups have a great impact on job creation. We do not have precise numbers on job creation (total number of employees by start-up), but we can do an estimation using employees categories. As observed in table 36, 60% of the start-ups employ between two and ten employees, and almost 32% between eleven and fifty employees.

Table 36: Employment in start-ups (Helsinki, 2010-2018)

Number of employees by start-up	Number of start-ups	Percentage
1	9	2
2-10	266	59.1
11-50	143	31.8
51-200	24	5.3
201-500	3	0.7
501-1000	5	1.1
Total	**450**[1]	**100**

[1]Cases with information. Missing values 229.

Growth stages

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One of the main variables for acknowledging the start-up ecosystem refers to the growth stage (see Annex 1, Growth stages, for descriptions) in which start-ups find themselves. As depicted from table 37, we can observe that 41.35% of start-ups are in a seed stage, followed by 46.97% in an early growth and 11.68% in late growth.

Table 37: Growth stage of start-ups (Helsinki, 2010-2018)

Growth stages	Number of start-ups	Percentage
Seed	280	41.35
Early growth	318	46.97
Late growth	79	11.68
Total	**677[1]**	**100**

[1]Cases with information. Missing values 2.

As introduced, the growth stage is an interesting variable for an ecosystem. Tells us where start-ups find themselves in terms of scaling in their life cycle. The term is related to the financing. The situation for the seed stage, around 42% of the sample, is very important for the ecosystem. Tells us that the ecosystem is pushing hard to create new companies and have the financial support to grow up in next years. In fact, taking into account the analysed period, 60% of the acquisitions are made in a seed stage.

The percentages show us that almost 50% of the sample is in an early stage. Early stage implies different aspects. On one site, these start-ups have overcome what is call the “valley of death” and have also overcome the “breakeven point”. This means when forecasted revenues exactly equals the estimated costs. In general, we can mention that many of these start-ups are at a point at which their business becomes financially viable. On the other site, this stage means that these start-ups have acquired enough funding - own capital or seed capital from angels, family and friends, crowdfunding, etc. - to prove their MVP, tested it in the market and start operating on it. It is a sign to capture the attention of venture capitals, have possible acquisitions/mergers and strategic alliances. At the end, it is a sign of scaling in the life cycle of a company.

Finally, the late growth stage just represents a percentage of 11.68%. Considering all type of growth stages, this is a significant percentage because one of every five start-ups are in a maturation stage.

An important aspect is companies’ valuation. The valuation of a company usually correlates with its stage. In this regard, the valuation media for seed stage is EUR 652,207; EUR 10,966,607 for early growth; and EUR 64,582,090 for late growth. The ANOVA test to analyse differences between the growth stages regarding valuation, shows us that the means are significantly different, with a statistic F of 23,632 (sig. .000). Obviously, the valuation has positive correlation of .424** (sig. .000) with late growth.

Besides valuation, the growth stage variable correlates with job creation. Although it seems an evidence, the analyses show the correlation by employees’ ranges of categories. Starts-ups in a seed phase have a positive correlation of .946** (sig. .000) with ten employees; early growth a positive correlation of .550** (sig. .000) with fifty employees; and late growth a positive correlation of .503** (sig. .000) with two hundred employees or more.

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Industries and business models

Start-ups operate in many different industries. Of 679 start-up companies, a sample of 600 start-ups has been analysed, as data were missing for the remaining 79 (11.6%). However, these 600 start-ups involve 804 industries (industry frequencies). There are more industry frequencies than start-ups because 396 (70%) start-ups operate in one industry while 204 (30%) operates in at least two industries.

Figure 45 shows that there is not a high concentration in any industry. Nonetheless, tops are in enterprise software with 127 cases (14.38%), media with 112 (12.68%), gaming with 68 (7.70%), fintech with 55 (6.23%), education with 54 (6.12%) and health with 41 (4.64%).

Regarding mySMARTLife sectors, IoT, energy and transportation are also great industries. The industry of IoT has 37 cases (4.19%), energy 36 (4.08%) and transportation 28 (3.17%). Smart city sectors have a great potential in the city of Helsinki. For the case of the IoT industry, this is related to many other industries such as enterprise software (six cases); energy (five cases); transportation, telecom or education (two cases for each); or fintech, health, security (1 cases for each). In this context of industry relation, IoT products and services seem to be quite transversal. For the case of the energy industry, this is related to fewer industries in comparison with IoT. The highest relation is with transportation (nine cases). These start-ups operate in different sub-industries related to concrete areas of a smart city, such as the cleantech, energy efficiency, waste solutions or water. Finally, for the case of the transportation industry - as mentioned, very related to the energy industry -, we find subindustries such as the vehicle production, mobility or autonomous and sensor tech. There is a positive correlation among energy and transport of .248** (sig. .000).

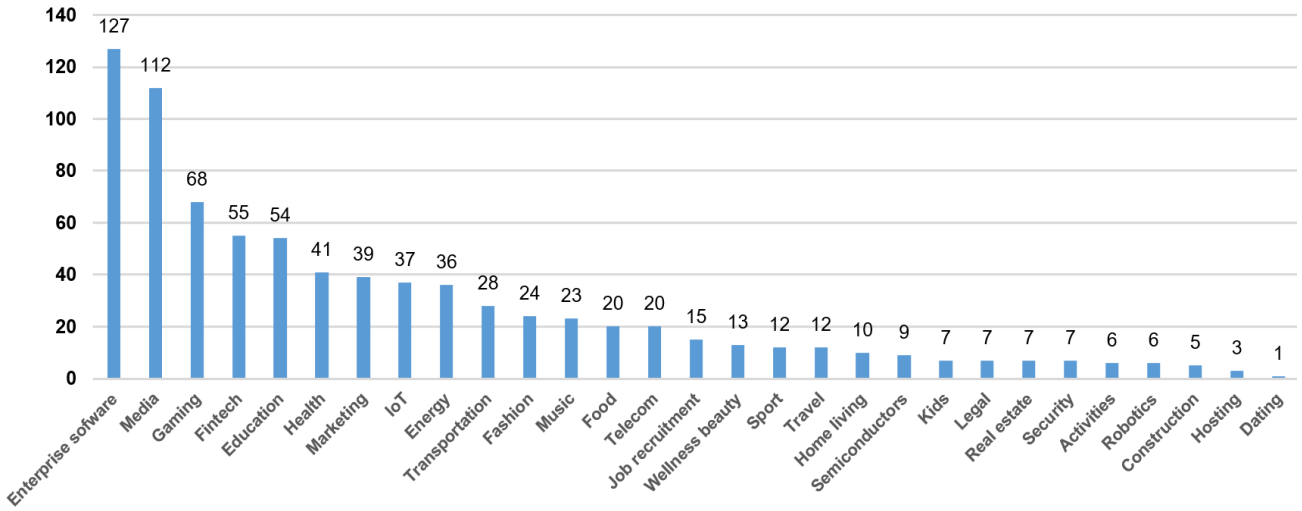

Figure 45: Number of start-ups in industries (Helsinki, 2010-2018)

Next figure shows the evolution of the number of new start-ups operating per year. As observed, there is a high growth between 2010 and 2016. Overall, the number of new start-ups has multiply by four until 2016. If we do not

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take into account 2017 and 2018, many of the industries have a growth. Seems that enterprise software and media are stabilized since 2014; gaming grows until 2015 and falls in 2016; fintech, education, IoT, energy and transportation maintain a growth path until 2016; and health seems to fall from a peak in 2013 and it is maintaining between 2014 and 2016.

Figure 48 figure presents the main business models start-up companies are using to create, deliver and capture value. Of 679 start-ups, a sample of 424 has been analysed, as data were missing for 255 cases. These start-ups present 587 business models (business models frequencies). There is an average of 1.26 business models for every start-up with a deviation standard of .04. Subscription and SaaS are most used business models. If we do not take into account missing values, they represent 50% of the business models which start-ups operate. In fact, among different business models, subscription and SaaS present a positive correlation of 493** (sig. .000). This is the highest correlation, followed by commission and marketplace with a positive correlation of .258** (sig. .000) and advertising and content with a positive correlation of .183** (sig. .000).

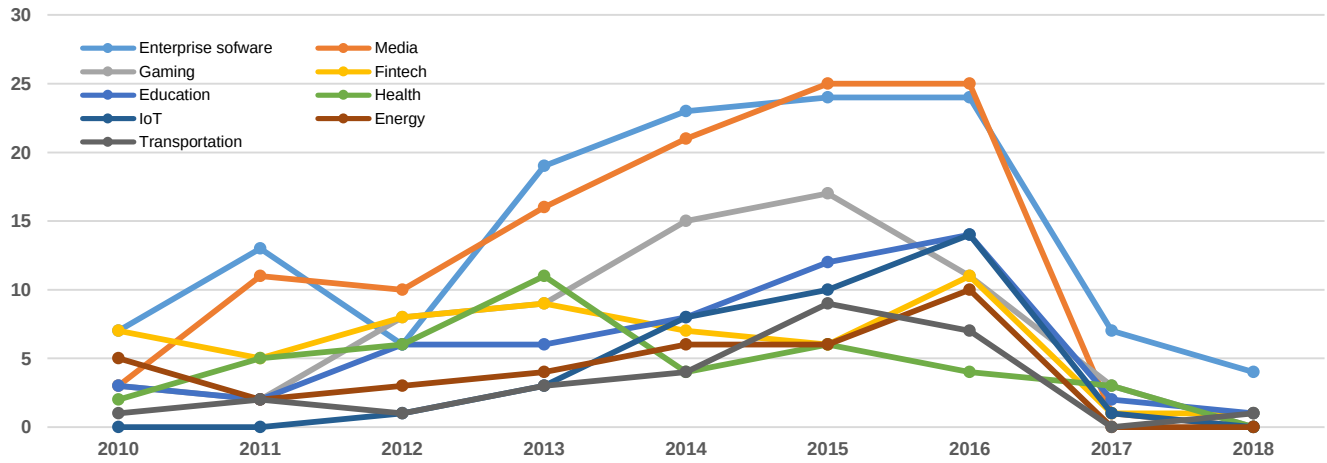

Figure 46: Number of new start-ups in the main industries by year (Helsinki, 2010-2018)

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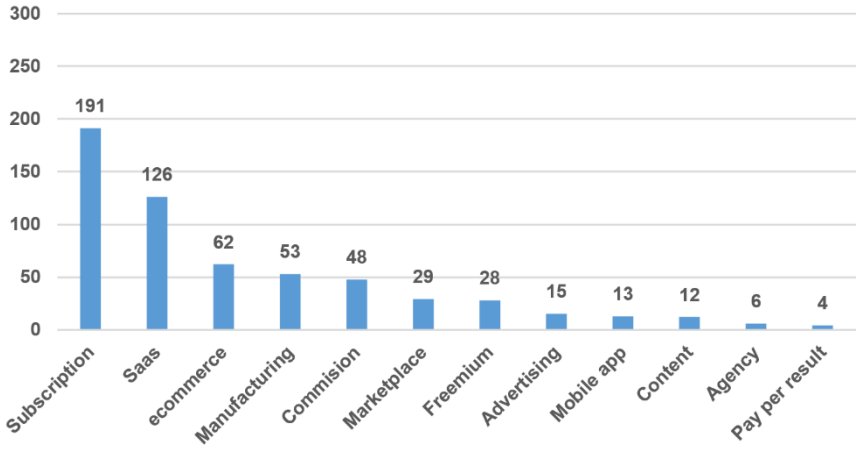

Figure 47: Number of start-ups by business models (Helsinki, 2010-2018)

Next figure 48 shows that subscription and SaaS are leading the path in terms of numbers. However, in terms of percentages, subscription is losing weight in 2015 and 2016. Subscription have a 33% and 34% in start-ups founded in 2013 and 2014, but decreases in 2015 and 2016, 19% and 21% respectively. Instead, SaaS percentages remain quite constant, around 17-18% between 2013 and 2016 with a peak in 2014. For the same period, 2013 and 2016, ecommerce increases 2% and manufacturing 3%, while commission decreases 3%. Nonetheless, the subscription business models keeps having the higher percentage, followed by SaaS. Obviously, both business models are interesting from entrepreneurs' perspective because services usually involve regular fees (by day, week, month or year).

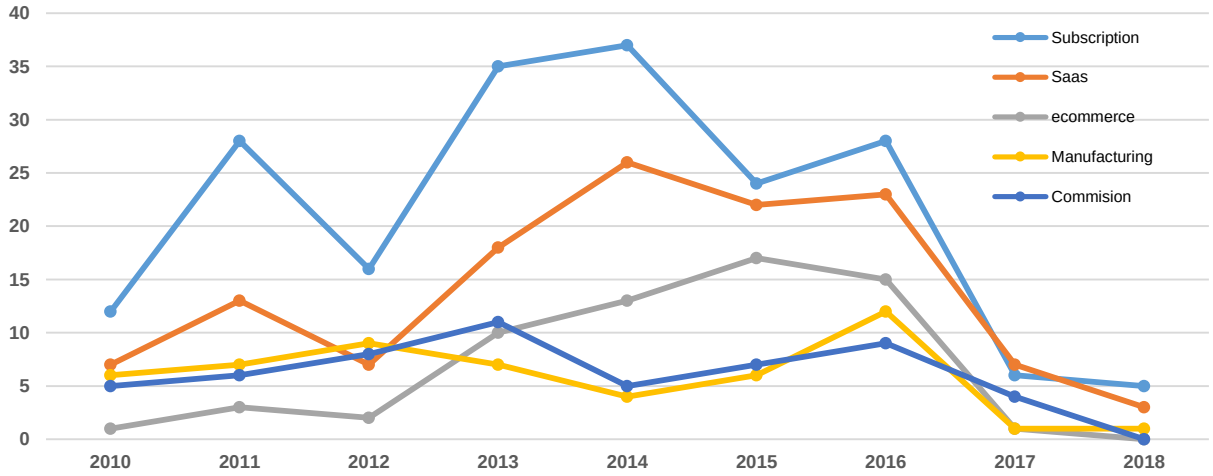

Figure 48: Number of new start-ups in the main business models by year (Helsinki, 2010-2018)

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When we look at main industries where start-ups operate, subscription and SaaS have a strong presence in many of the industries. However, some industries combine business models. Gaming most used business model is freemiun, although it is combined with mobile app, SaaS and subscription. Fintech, on the contrary, operates with commission business models in its majority.

Regarding mySMARTLife sectors, IoT, energy and transportation, seems that IoT uses the subscription business model the most, but also SaaS, manufacturing, and marketplace in same percentages. For the case of energy, almost 50% of the cases is represented by manufacturing, followed by subscription and SaaS. The situation is similar to transportation, where manufacturing is also important, but with a low percentage comparing to subscription.

The creation of start-ups by industry is a good variable for the ecosystem. Tells us where entrepreneurs are focusing their efforts and ventures. Nonetheless, we have to take into account other important variables. In this context, the creation by industry differs from investment and valuation.

7.5 Investment

In this section, where our main objective is to describe the situation of investment in the start-up companies of Helsinki, we use a database based on investment - funding rounds (see Annex 1, Investment rounds, for descriptions) - for the period 2013-2018.

During this period, there have been 635 founding rounds in 367 start-up companies with headquarters in Helsinki. As can be observed in table 38, almost 60% of the start-ups have had at least one founding round, 22.07% two funding rounds, 12% three founding rounds, 5.72% four founding rounds; and less than 2% of start-ups more than 4 rounds. There is an average of 2.46 funding rounds per start-up, with a deviation standard of 1.70.

Table 38: Number of start-ups subject to funding rounds (Helsinki, 2013-2018)

Investment	Number of start-ups	Percentage
One round	214	58.31
Two rounds	81	22.07
Three rounds	44	11.99
Four rounds	21	5.72
More than four rounds	7	1.91
Total	**367**	**100**

The average to get the first round, taking into account foundation year, is 2.72 years; for the second round 2.79; for the third round 3.52; and for the fourth round 3.88. These data is approximate because standard deviations are quite high, 2.9, 2.8, 2.87 and 3.09 respectively. Despite this lack of accuracy, the averages obtained are quite reasonable.

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In figure 49, we can observe the frequencies distribution of the funded stat-ups and funding rounds among the period. It is interesting to see how the difference between the frequencies of start-ups and rounds increases since 2014. The coefficients between rounds and start-ups indicate that the frequency of rounds per start-up increases. We have 1.08 rounds per start-up in 2013; 1.71 in 2014; 1.64 in 2015; 1.87 in 2016; 1.94 in 2017; and 2.09 in 2018. Although the frequency of start-ups and rounds decreases for year 2018, the coefficient is higher. Having said that, we must be careful. Probably, 2018 does not include all information about rounds. Information about funding rounds and deals take time to be recorded because involves long contractual processes.

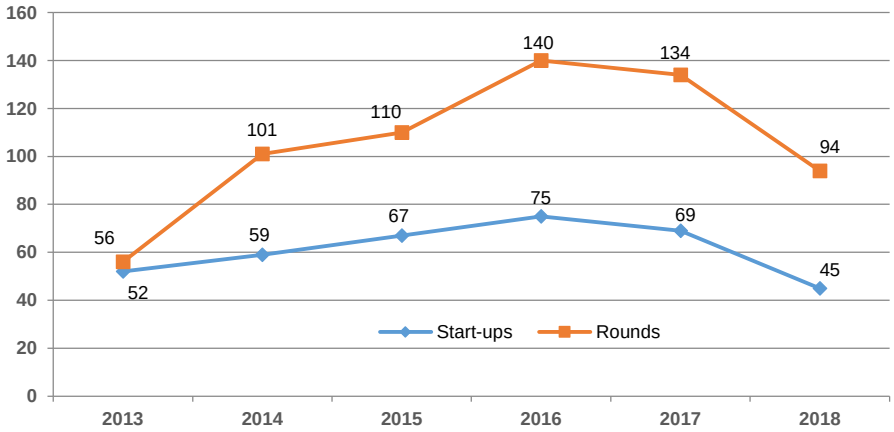

Figure 49: Number of start-ups and funding rounds by year (Helsinki, 2013-2018)

During the whole period, there has been a total funding amount of EUR 1,041 million in Helsinki. This represents almost 50% of the total funding amount in Finland, EUR 2,109 million. We do not have information on funding rounds in other large cities like Espoo, Tampere or Vantaa. Helsinki doubles in population the second largest city, Espoo, 648,042 inhabitants and 283,632 respectively for 2018. Although Helsinki represents almost 50% of the total funding amount in Finland, this percentage was 68% in 2014, decreases until 33% in 2015 and increases again until 50% in 2018. Obviously, there are other city hubs that are attracting investment, but 50% of all investment is very representative. Helsinki has recovered from a low investment in 2015. In fact, Helsinki has raised EUR 109 million more in 2018 from 2017 with less registered cases (74 for 2018 and 102 for 2017). With a maximum peak in 2016 with 75 start-ups and 140 rounds.

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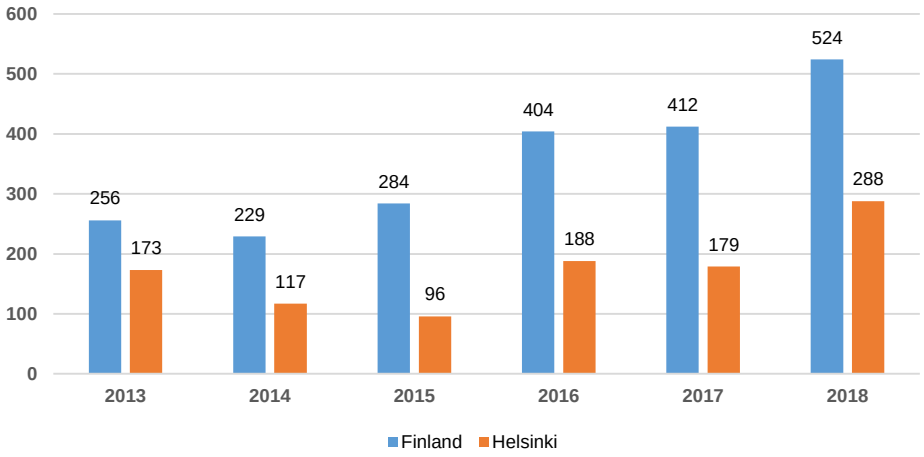

Figure 50: Funding (in million €) of start-ups (Helsinki, 2013-2018)

This situation about the growing amount of investment could be an indicator of the type of investors. Concretely, could mean an entrance of venture capital in growing and maturity stages. Hereunder, we present the list of different types of funding rounds and their frequencies.

As depicted from table 39, 50% of funding rounds (see Annex 1, Investment rounds, for descriptions) are seed. In general, the sample shows a high percentage of initial investment rounds, characterized by angel, grant and seed rounds. All together, they represent 65% of the sample. This is a good signal for the ecosystem. These types of round (see Annex 2, Financing cycle, for descriptions) are crucial to cover the equity gap most start-ups suffer when starting their businesses. Its importance is key because they cover the finance transition a start-up needs to access venture capital or get partners in their projects. In fact, if we look at the average invested in these type of rounds, we observe that the initial money is less than EUR 1 million. Taking into account the order of investment, we have an average of EUR 158,150 for angels round, EUR 445,567 for grants rounds and EUR 704,549 for seed rounds. Furthermore, it is important to indicate that 54% of angel rounds take place in first round, 61.5% in grants rounds and 63.5% in the seed rounds. As mentioned before, these data reflects a strong ecosystem to cover the equity gap of start-ups.

Table 39: Number of funding rounds by type (Helsinki, 2013-2018)

Type of funding round	Number of rounds	Percentage
Seed	323	50.87
Early VC	115	18.11
Grant	57	8.98
Angel	39	6.14
Series A	34	5.35
Series B	11	1.73
Growth equity	9	1.42
Series C	6	0.94
Late VC	3	0.47

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Convertible	1	0.16
Series D	1	0.16
Not Know/Not answer	36	5.67
Total	**635**	**100**

For the growing stages, the early venture capital rounds represents 18.11% of total rounds. This percentage also increases if we take into account other funding rounds that are characteristic of the growing stages such as growth equity and series A. In total, growing founding rounds represent 25%. The average of money invested is EUR 1.91 million for early venture rounds, EUR 1.06 million for growth equity rounds and 4.04 for series A rounds. Following the investment logic, these rounds should concentrate in second or further rounds, when start-ups show a growing path where incomes overcome expenses. In the case of Helsinki, 54% of early venture rounds is in second or further stages; 33% for growth equity; and 59% for series A. These percentages follow the logic trend of investment, but they have also a strong presence in first founding rounds. An explanation to this situation focuses in rounds valuation. For example, a seed round valuation has an average of EUR 4,864,165, while an early venture capital or series A present averages of EUR 11,200,092 and EUR 2,009,622 respectively.

For the maturation stages, the typical funding rounds are venture capital and series B, C, and D. For the case of Helsinki, they represent less than 5%. Just a few start-ups get to these rounds. Nonetheless, the average of money invested is EUR 50.45 million for late venture capital, EUR 18.02 million for series B, EUR 7.43 million for series C and EUR 12 million for series D. Obviously, these rounds focus in second and further stages. 66% of late venture capital rounds are in second or further stages; 81% for series B; 83.3% for series C; and 100% for series D.

Industries and business models

As depicted from figure 51, the industry of gaming is the one who has raised more money, with a total amount of EUR 73,822,155 (56 rounds), followed by media with EUR 172,308,218 (79 round), telecom with EUR 148,225,085 (33 rounds), health EUR 139,135,598 (68 rounds) and enterprise software EUR 101,588,622 (89 rounds). These industries, which overcome EUR 100,000,000, represent almost 60% of the total funding. Regarding mySMARTLife sectors of interest, IoT has raised EUR 20,641,357 (21 rounds), energy EUR 56,392,237 (37 rounds) and transportation EUR 64,781,516 (21 rounds).

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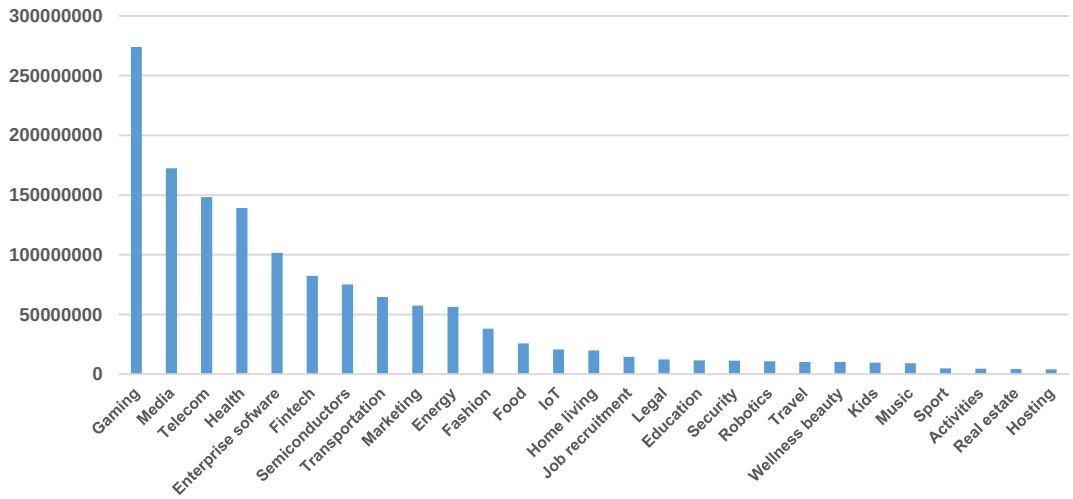

Figure 51: Funding (in €) vs. industries (Helsinki, 2013-2018)

As can be observed in table 40, 63.80% of rounds are carried out by one investor and the remaining 36.20%. This represent a mean of 1.89 investors per round, with a standard deviation of 1.49. If we take into account the funding round types, the investors mean per round increases along the investment cycle.

Table 40: Investors by number of rounds (Helsinki, 2013-2018)

Number of investor	Number of rounds	Percentage of rounds
One investor	208	63.80
Two investors	38	11.66
Three investors	35	10.74
Four investors	19	5.83
More than four investors	26	7.98
Total	**326**[1]	**100**

[1]Cases with information. Missing values 309.

Finally, we present the percentage of investors' origin. As we can see in figure 52, 55.05% of investors are from Finland, 32.53% from Europe, 9.58% from America and 2.84% from Asia. Regarding Europe, investors came from many countries, but there is a strong presence of Sweden. There are others like Germany, England (London), France (Paris) and Belgium (Brussels), which represent important countries with invertors' hubs. The case of Belgium is different. Most of the investment comes from EU grants, concretely SMEs instrument H2020. For the case of America, almost all investors are from the United States of America. In the case of the United States, there are different important investor's hubs from both east and west coasts. In addition, for the case of Asia, there is investment mainly from China and South Korea, with some representation of Twain or Arabia Saudi.

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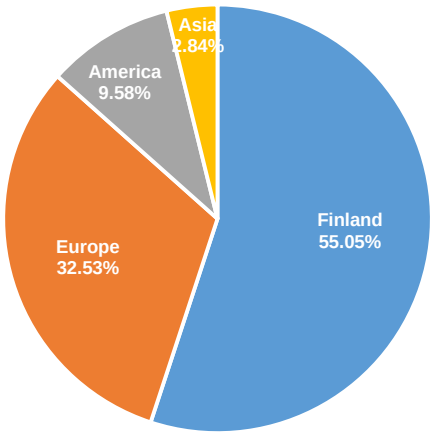

Figure 52: Percentage of investors by geography (Helsinki, 2013-2018)

7.6 Exits

In this section, we analyse the exits produced during the period 2010-2018 in the ecosystem of Helsinki. The analysis focuses on two main actors, start-ups and acquirers. It is important to identify which start-ups and industries have succeeded, but it is also important who has acquired them and where the money comes from.

During the analysed period, the ecosystem has had 47 exits from 1,043 operative start-ups. As summarized in table 41, the majority of exits are acquisitions (91.49%) and just a small percentage is represented by IPOs (8.51%). It is true that there are other types of rounds considered exits, for example a secondary sale, where a stakeholder sales his shares from the company to another buyer. Normally, this selling is produced by one founder, an early employee, or an early investor, and has to be consider also as an exit. The problem is that there is not enough and concrete information about these types of exits in the ecosystem of Helsinki.

Table 41: Exist by type of rounds (Helsinki, 2010-2018)

Type of rounds	Number of exits	Percentage
Acquisition	43	91.49
IPO	4	8.51
Total	**47**	**100**

As can be observed in figure 55, the majority of exits have taken place during the last five years, from 2014 to 2018, representing 91.50% of total exits during the analysed period. We find a peak in 2017 with 13 exits (27.7%), which represents the best year. This situation is quite similar to principal European hubs who have also a similar tendency for the same period.

An interesting indicator for the situation of the ecosystem is the number of years this needs elapsed before an exit. If we take the whole sample for the period, 47 exits, the average of years from foundation to exits is 12.06 years with a standard deviation of 11.01. 12 years seems to be a reasonable time, but it is not really reflecting the

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situation in the ecosystem of Helsinki. Such a high standard deviation is telling us that the sample has outliers. If we considered exits just from start-ups founded since 2000 - 38 exits (80.9%) of the sample -, the average decreases until 7.63 with a standard deviation of 4.84.

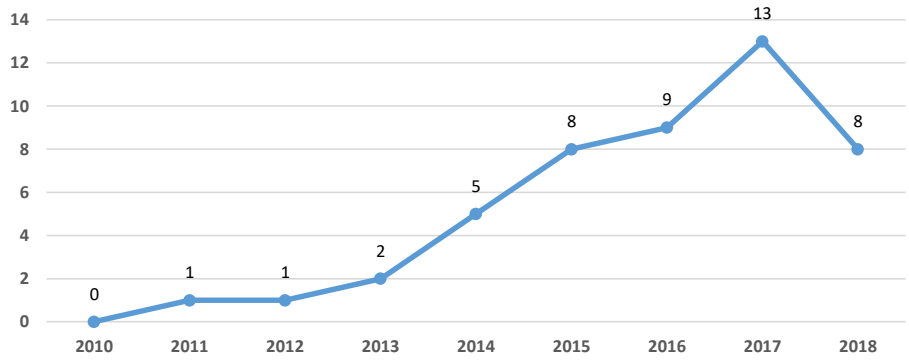

Figure 53: Number of exits by year (Helsinki, 2010-2018)

During the period 2013 and 2018, as can be observed in figure 54, there has been an amount exited for acquisitions of EUR 13,225 billion in Helsinki. This represents almost 38% of the total amount exited in Finland, EUR 62,306 billion. Helsinki sweeps the board almost for every year in Finland, except for 2014 and 2017. We must mentioned that these amounts correspond to few cases (17) because we do not have complete information for the rest of the cases. Nonetheless, the amount exited in ranked top in Europe for 2013 (in for place, just below London, Berlin and Munich) and for 2016 (third place, just below Cambridge and London).

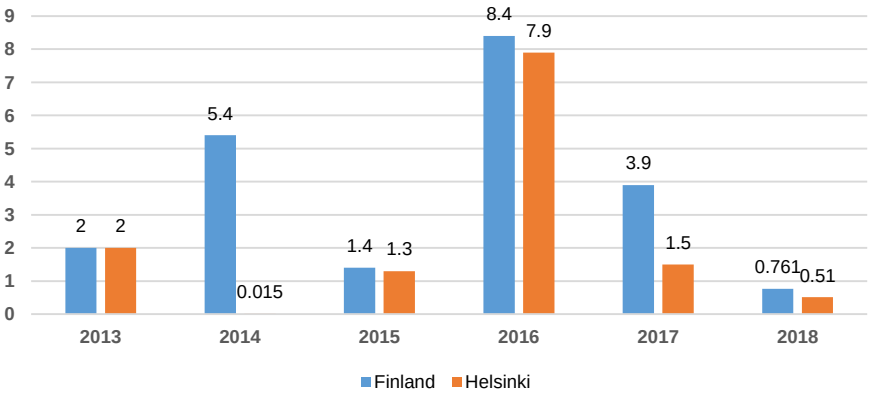

Figure 54: Exits (in billion €) (Finland and Helsinki, 2013-2018)

Industries

Figure 55 shows that the industry of gaming tops the acquisitions with 13, followed by fintech and health with 8, and enterprise software, security and telecom with 5. To some extent, these numbers correlates with foundation

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and investment rounds. Gaming is in third position regarding foundation of start-ups and in first position regarding investment; fintech is in third and six position; health is in six and fourth; and enterprise software is in first and fifth. For the case of telecom, this industry rest at the middle in terms of foundation but third in terms of investment. Seems surprising the case of security, which is in tail regarding foundation as well as investment but has acquisitions. A possible reason for the case of security is that the market is quite mature and this industry had a great development in the first decade of the century.

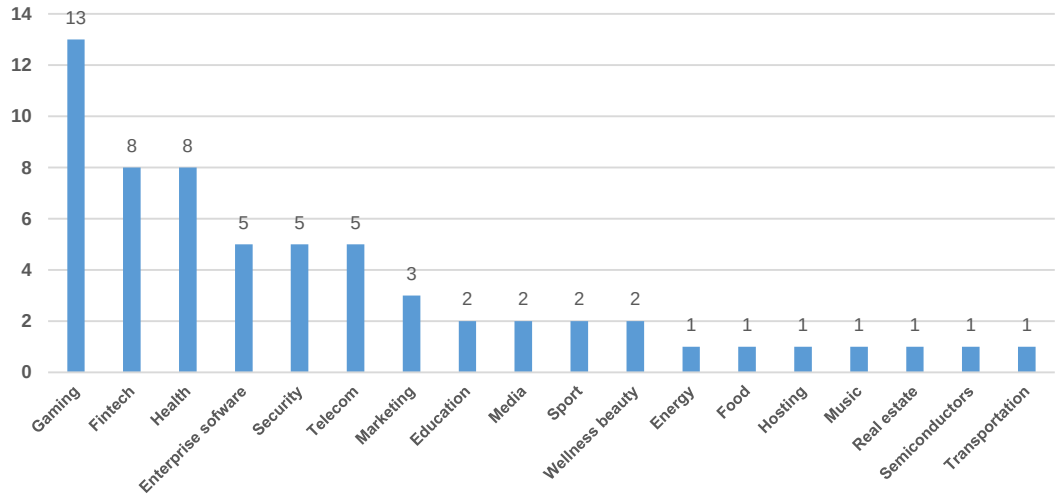

Figure 55: Number of exits by industry (Helsinki, 2010-2018)

Acquirers

In terms of acquirers, the sample shows one acquirer per acquisition. Regarding the type of acquirers, 80.9% are corporate and just 6.45% investment funds. Clearly, there is a strong correlation between acquisition and type of acquirer as well as with having been funded in previous rounds. As observed in figure 56, Europe concentrates acquisitions with an important 43.90%. The percentage increases if we take into account Finland acquisitions, which represent almost 25%. America 21.95% and Asia 9.76%. Regarding Finland, acquirers come from Helsinki, Espoo and Helsinfors.

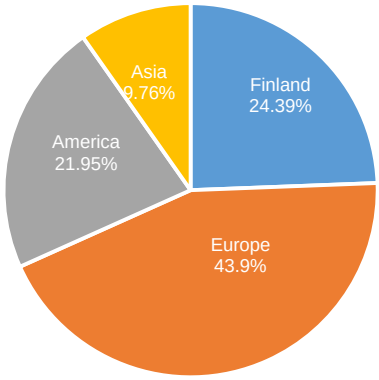

Figure 56: Acquirers by geography (Helsinki, 2010-2018)

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8. Discussion

Mrs Von der Leyen, new President-elect of the European Commission EU, on her Opening Statement in the European Parliament said:

> "Our small and medium-sized businesses are innovative, flexible and agile. They create jobs. But they can only do all this if they have access to capital everywhere in this huge single market".

The terms innovative, flexible and agile seems to appeal, in great measure, without forgetting the traditional enterprises, to start-ups, a new type of SMEs that has been the centre of this deliverable. Nowadays, it is clear that they are essential for local economies, being an important source of employment, which will be sustained if they are able to get financing for materializing their growth strategies and reach new markets, both national and international.

This deliverable, going from the general to the specific, has analysed the situation of each lighthouse city trying to understand and illustrate where profit comes from and how it flows, and to identify a business model portfolio eligible for entrepreneurs in the urban field. The results have to be taken cautiously. The authors have analysed different samples per city due based on the available data, which were not always sufficient. It makes difficult to present fully comparable and precise results, but it offers an interesting first approach.

As a starting point and after being established a theoretical framework, this deliverable has analysed the framework conditions of each of our lighthouse cities reviewing the score got by France, Germany and Finland in four different international indexes. On average, the three countries score high in each of them. However, it is important to highlight some numbers that would be interesting to correct. Concerning the *Easy of Doing Business* index score, it is remarkable that the three countries present low scores in two important indicators for companies, the *getting credit* and *protecting minor investors*. Regarding the Global Competitiveness Index, a common component to highlight is the score in *labour market*. This indicator presents a low score in all three countries. Regarding Index of Economic Freedom, again, the indicator *labour freedom* scores low in the three countries, similar to the *labour market*. Finally, the *GEI* and *REDI* indexes, which are strongly related to EEs, show important ideas per region. The *Ouest* region of Frances, where Nantes is located, needs to improve the following items: *start-ups skills, opportunity perception, human capital, internationalization, high growth and finance*. The Hamburg region needs to improve *high growth, process innovation, internationalisation and finance*. Finally, Helsinki-Uusimaa region needs to improve *internationalisation, high growth, financing and competition*.

The entrepreneurs' analysis has reveal two important aspects. On one side, it seems that the EEs have to push hard to incorporate female entrepreneurs. All cities are below the global average (16%) if we take into account female founders alone. There are mixed teams of founders, but the presence of female is low compared to male. On the other side, it seems that main barriers for doing business are very similar in France, Germany and Finland. In all cases, tax rates, restrictive labour regulations, tax regulations and inefficient government bureaucracy are the

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most problematic factors for doing business. For the case of France and Finland, financing is also a problem. Some of these factors (labour market, labour freedom and finance) were also detected in the framework conditions analysis. Regarding labour market, although it is very important to preserve workers' rights, it seems that it is very important to adapt the current national regulations to the needs of entrepreneurs. On a similar way, tax rates and regulations should be more flexible and adaptive to them. Finally, the financial aspect seems to be also a claim from entrepreneurs. Considering the speech of Mrs. President-elect of EU Commission, we are sure this issue will be attended in coming years. Regarding tax rates and regulations, the authors would like to highlight the fact that they obtained similar responses in explorative interviews done to entrepreneurs during the Mobile World Congress event at the 4YFN held in Barcelona in 2019. Many entrepreneurs highlight these aspects as problematic to start and operate a business. Another important trouble for them was the difficulty or even impossibility to find and retain talent. On one side, there are abilities and professional profiles that are not found in local markets. On the other side, it seems to be problematic to retain talent in companies because of disparity between pay scales in Europe.

Regarding entrepreneurial activity, it is important to highlight some ideas. One of the most important characteristics is the capacity of start-up companies to generate employment. In this regard, the deliverable has just presented an approximation to direct employment generated by start-up companies, but it would be very interesting to analyse the impact on indirect employment. In terms of entrepreneurial activity, growth stages is another important aspect to remark. Approximately, between 40% and 50% of the start-up companies are in a seed stage, between 40% and 45% in early stage and around 10% in late stage. The three cities present quite equilibrate stages, although it would be desirable to increase the number of companies in late stage. The reason is that this stage uses to correlate positively with valuations, funding and job creation.

The entrepreneurial activity, as an output of the EE, presents similarities and differences in terms of operational industries. The software enterprises, as it happens around the world, lead the path in all three EE, followed by marketing companies for the cases of Nantes and Hamburg. Nantes, just after the marketing sector, has a wide variety of industries with a same rate of enterprises creation, such as health, energy, fintech, food, IoT and media. In Hamburg, after the marketing sector, we can find fintech and media companies. In Helsinki, following the software industry, they have media and gaming industries. Regarding mySMARTLife sectors of interest, although they are not the most important ones in our lighthouse cities; energy, transportation and IoT present quite good numbers in all three EEs. Considering how these sectors are right now in Nantes, Hamburg and Helsinki, and taking into account how important they are in the transition from a traditional city to a smart and sustainable one, authors believe that, offering institutional support, would be possible to make them much more relevant, building clusters that could be European references. In that sense, Helsinki already has a strong policy strategy for developing clusters around different industries related to smart cities. This is probably why the Finnish capital presents more start-ups focusing on cleantech, energy efficiency, waste solutions, water, vehicle production or mobility solutions than Nantes and Hamburg.

Regarding business models, it seems that subscription leads the path in every EE. Obviously, it is an interesting business model because services usually involve regular fees. The same happens with SaaS (Software as a

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Service), which is related to the subscription business model. On a second level, Nantes balances different business models such as manufacturing, commission and SaaS. Hamburg balances marketplace, commission and SaaS too. Helsinki mostly concentrates its economic activity through subscriptions and SaaS, although it also has a significant presence of ecommerce, manufacturing and commission.

Capital is crucial for start-up companies. As we have stressed in from framework conditions, finance is an important barrier and influences processes of high growth and internationalization, and, according to GEDI index, the three cities need to improve their performance. The percentage of rounds per start-up is an indicator of this issue. For the case of Nantes, almost 74% of start-ups have had just one round. For the case of Hamburg the percentage decreases down to 67%, while for the case of Helsinki, the percentage decreases even more to 59%. In this regard, Helsinki is the EE with more rounds per start-up, around 41% of start-up companies have had two or more rounds, which indicates the strength of its EE. On the other side, it is also important to mention that many start-ups do not grow on funding rounds and depend on founder's capital or traditional loans.

Regarding the invested amount in start-up companies, Hamburg is the EE, which raised more money between 2013 and 2018, followed closely by Helsinki. The money invested got higher during last years in the three cities. This is a good signal for the EEs. Hamburg almost doubled the invested amount from 2016 to 2018 and Helsinki increased by 40%. In terms of round types, percentages are quite similar for the three EEs. In average, there is a 60% of seed rounds, 30% of growing rounds and 10% of late rounds. Hamburg and Helsinki are the EEs that present more types of rounds for every stage, while Nantes lacks from some late rounds such as late venture. These are normal performances if we take into account that Nantes has an ecosystem that is in an initial stage, while Hamburg and Helsinki are in growing phases.

The money invested differs quite a bit among industries. For the case of Nantes, top industries are marketing and software enterprise, followed by industries such as energy, home living, IoT and transportation. For the case of Hamburg, top industries are fintech, software enterprise and fashion, followed by industries such as travel, gaming, marketing, health and transportation. For the case of Helsinki, top industries are gaming, media, telecom and health, followed by software enterprise, fintech, semiconductors, transportation, marketing and energy. It is noteworthy that mySMARTLife sectors of interest, particularly energy and transportation, have a relevant presence in investors' portfolio. Regarding business models, most invested start-up companies use subscription, SaaS, marketplace and ecommerce, followed by manufacturing and commission. Other business models such as content, agency or pay per result have a low presence in invested start-up companies.

Regarding investment by geography, Europe represents more than 80% in all three EEs, but there are some differences at country level. For the case of Nantes, more than 90% of the investment comes from Europe, but 79% comes from French investors. In Hamburg, 60% comes from German investors, while in Helsinki, 55% of the investment comes from Finish investors. It is clear that Finland, compared to France and Germany is getting investment from other European countries, particularly from hubs from Stockholm, London and Berlin. Obviously, variables like the size of the country, economy and market force Helsinki's start-up companies to raise money

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outside the country. Moreover, Helsinki is building bridges with the USA market and the Asia market, taking advantages of its geographical position. The most evident result of it is that its start-ups are rising 22% of the money form USA and near 10% from Asia. Further, Germany has a strong economy with many important investment hubs, which make easier for start-ups from Hamburg to raise money in their own country. The case of France is similar, but EE of Nantes, as it is nascent, is still raising rounds near home.

Finally, this deliverable has analysed the start-ups success focusing on exits. As shown by the data, all three EEs are increasing their exits during last years. For the case of Nantes, health is the industry with more exits, followed by a second group of industries including software enterprise, marketing and semiconductors, and a third group of industries involving energy, transport and IoT, which are the three industries related to mySMARTLife project. In Hamburg, marketing is the industry with more exits, almost doubling the second group of industries composed by software enterprise and media. Transportation and energy are inside the third group. In Helsinki, gaming tops exits, followed by a second group of industries including fintech and health, and a third group comprising software enterprise, security and telecom. It is remarkable that no industries related to mySMARTLife are highlighted in this city concerning exits.

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9. Conclusions

The analysis carried out in this deliverable has served to reach the following general conclusions:

- The entrepreneurial activity and entrepreneurial ecosystems are pushing hard in Europe, and particularly in the lighthouse cities involved in mySMARTLife project. Although there are many differences among them, local public authorities are giving priority to the topic in their economic policy strategies.
- Although the topic is a priority, there is a need to align strategies among different policy administrative levels in each country, from local to state level, to enforce entrepreneurial activity, enrich entrepreneurial ecosystems and overcome barriers to do businesses.
- Furthermore, new businesses such as start-up companies, based on innovation, flexibility, agility and high growth, require new policy frameworks far away from the traditional ones on SMEs.
- In order to approach the reality of start-up companies, there is a need to establish common methodologies and data gathering sources to reach this reality at a city level. On one side, the study of entrepreneurial activity and entrepreneurial ecosystems in order to do comparison is a difficult task. The majority of reports focus on a country level and it is hard to get enough data at city level. On the other side, the quantity and quality of information and data is clearly linked to the importance of the EEs as a main hub. In this regard, there is a need to approach small and medium city hubs with a common research framework to get information. Attending this situation, the authors believe that the reality and potential of entrepreneurial activity and entrepreneurial ecosystems, as well as value created, are higher than presented here. In this sense, the REDI index, a project promoted by the European Commission is a clear example to get a common framework for regions and have more information.
- Although there are differences among cities and countries, all entrepreneurs mention similar barriers to do business. These are related to tax rates, tax regulations, restrictive labour regulations and inefficient government bureaucracy. A common denominator from these barriers clearly involves public policy stakeholders.
- In addition, entrepreneurs also indicate as main problems getting credit and finance. These clearly correlate with two difficulties that all three EEs present: internationalization and high growth of entrepreneurial activity. In fact, although there are differences among the EEs, all have mentioned these aspects as something to tackle in their strategies.
- The investment analysed in all three cases present a clear picture of the situation. In general, the system acts locally, nationally or with geographically near countries. There is still a lot of room to search for capital across Europe and internationally. Regarding Europe, start-up companies raised from main hubs such as Stockholm, Berlin, London and Paris.
- Finally, according to entrepreneurial inclusive policies from the European Commission, we must underline the urgency to incorporate gender policies in EEs. The female presence is too low.

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The main conclusions for each Entrepreneurial Ecosystem are:

Nantes:

- The Nantes EE is a nascent phase. Nantes Métropole is giving priority to the topic. It has included the start-up scene in its new innovation strategy.
- The strategy focuses on establishing good links and relation between components of the EE, but it needs to increase the number of start-up companies.
- Obviously, as a nascent EE, Nantes needs to boost the amount invested in seed rounds in order to help companies on its initial phase of the investment cycle. To this end, the EE needs to set the path for connecting start-ups with important European hubs beyond France.

Hamburg:

- The Hamburg EE is in a growth phase. Hamburg has given priority to the start-up scene in the city and set up the Startup Unit in 2018.
- Although the unit has been created recently, the start-up scene in Hamburg is strong. A key aspect for this success is related to its cluster policy and the presence of eight important clusters in Hamburg.
- Hamburg strategy focuses on a quantitative growth of the entrepreneurial activity, dismissing bureaucracy barriers and establishing national and international networks with main worldwide hubs.
- The success of the entrepreneurial activity in Hamburg is clearly linked to investment. Germany has many important hubs inside the country, especially when compared to other countries. Nonetheless, should improve the access to other European hubs.

Helsinki:

- The Helsinki EE is also in a growth stage but coming near a sustaining phase. Compared with Nantes and Hamburg, Helsinki has a long track in the start-up scene.
- The strategy of Helsinki focuses on initial stages. They are giving support to entrepreneurs in business logics and marketing selling, in order to prepare them to consolidate their businesses and facilitate their growth internationally.
- Due to framework conditions, such as population or market size, Helsinki presents higher percentages of foreign investment. Furthermore, Finland Business has a programme to promote the travelling of entrepreneurs outside the country.
- Finally, the entrepreneurial activity is quite linked to its cluster policy and local strategy regarding smart city objectives. In energy and transportation sectors, Helsinki presents important sub industries, such as cleantech, energy efficiency, mobility, etc.

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11. Annexes

11.1 Annex 1: Glossary

Growth stages

- **Seed.** The seed stage refers to the period just after a company has launched and is working on their proof of concept. During this period, a company is also looking to gain initial transaction and receive feedback from early adopters so that they can refine what they offer before looking to move into the growth stage. Source: https://www.syndicateroom.com/learn/glossary/seed-stage
- **Early growth.** The term growth stage refers to the stage a business is in when it has moved beyond the initial seed stage. Companies are often considered to be in growth stage when they have completed their proof of concept, have an initial form of traction, and are looking to accelerate the growth of the business. Source: https://www.syndicateroom.com/learn/glossary/seed-stage
- **Late growth:** The growth stage of a new business generally begins late in the "Early Stage" and proceeds well into the VC financing stages. Late in the early stage, aspects of the company begin to become more complete and there is clear evidence of progress in the company's development. Typically, the management team is complete and the product or service has gone to market on a commercialized basis. Enough revenues are being generated and the company is beginning to obtain market validation for their product. Source: https://fundingsage.com/startup-funding-rounds-and-the-funding-life-cycle/growth-stage/

Indexes

- **Ease of Doing Business Index**. Annually, the World Bank launches the Ease of Doing Business Index which assesses regulations affecting domestic firms in 189 economies and ranks the economies in 11 areas of business regulation, such as starting a business, resolving insolvency and trading across borders. The index is based on the study of laws and regulations, with the input and verification by more than 11,400 government officials, lawyers, business consultants, accountants and other professionals in 189 economies who routinely advise on or administer legal and regulatory requirements. (GEM, 2015). Easy of doing business. Source: https://www.doingbusiness.org/en/rankings
- **Global Competitiveness Index**. The World Economic Forum has ranked world's nations according to their Global Competitiveness Index. The index comprises 12 institutional pillars (from basic infrastructure to innovation receptivity) values of which are calculated or estimated by 38 key indicators and over 100 variables. Data for the Index is gathered partially from the Executive Opinion Survey, a survey of a representative sample of business leaders in respective countries. (GEM, 2015). Global Competitiveness Index. Source: https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018

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- **Index of Economic Freedom**. Is also an annual index created by The Heritage Foundation and The Wall Street Journal. It is to measure the degree of economic freedom across 186 countries. The index scores nations on 10 dimensions of economic freedom, such as business freedom, financial freedom, freedom from corruption, by using statistics from organizations like the World Bank, the International Monetary Fund and the Economist Intelligence Unit. (GEM, 2015). Index of Economic freedom. Source: https://www.heritage.org/index/

- **Global Entrepreneurship Index (GEI)**. The GEI index is a breakthrough advance in measuring the quality and dynamics of entrepreneurship ecosystems at a national, regional and local level. The GEI index methodology has been developed by The Global Entrepreneurship and Development Institute. Is a non-profit organisation that advances research on links between entrepreneurship, economic development and prosperity. The institute was founded by world-leading entrepreneurship scholars from the LSE, George Mason University, University of Pécs and Imperial College London. GEI. Source: https://thegedi.org/global-entrepreneurship-and-development-index/

- **Entrepreneurship and Development Index (REDI)**. The index takes into account both individual attitudes and characteristics and the regional context and, accordingly, not only whether people are willing to start a business but whether the conditions to do so are in place in the region concerned. The index is composed of three sub-indices covering entrepreneurial attitudes, abilities and aspirations. Each of the sub-indexes has an individual component (relating to the individual decision making behaviour) and an institutional component (relating to the context). REDI. Source: https://ec.europa.eu/regional_policy/en/information/publications/studies/2014/redi-the-regional-entrepreneurship-and-development-index-measuring-regional-entrepreneurship

Investment rounds

- **Angel**. An angel round is typically a small round designed to get a new company off the ground. Investors in an angel round include individual angel investors, angel investor groups, friends, and family. Source: https://support.crunchbase.com/hc/en-us/articles/115010458467-Glossary-of-Funding-Types

- **Early / Late Venture Capital.** Venture funding refers to an investment that comes from a venture capital firm and describes Series A, Series B, and later rounds. This funding type is used for any funding round that is clearly a venture round but where the series has not been specified. Source: https://support.crunchbase.com/hc/en-us/articles/115010458467-Glossary-of-Funding-Types

- **Grant.** Is a quantity of money, i.e., financial assistance, given by a government, organization, or person for a specific purpose. Unlike a loan, you do not have to pay back the money. In some cases, the receivers of study grants who abandoned their courses have to pay back the money. Source: https://marketbusinessnews.com/financial-glossary/grant-definition-meaning/

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- **Growth equity.** Is a type of private equity investment, usually a minority investment, in relatively mature companies that are looking for capital to expand or restructure operations, enter new markets or finance a significant acquisition without a change of control of the business. Source: https://en.wikipedia.org/wiki/Growth_capital
- **Seed**. Seed rounds are among the first rounds of funding a company will receive, generally while the company is young and working to gain traction. Round sizes range between $10k–$2M, though larger seed rounds have become more common in recent years. A seed round typically comes after an angel round (if applicable) and before a company's Series A round. Source: https://support.crunchbase.com/hc/en-us/articles/115010458467-Glossary-of-Funding-Types
- **Series.** In Series A funding, investors are looking for companies with great ideas as well as a strong strategy for turning that idea into a successful, money-making business. For this reason, it's common for firms going through Series A funding rounds to be valued at up to $15 million. The investors involved in the Series A round come from more traditional venture capital firms. Series B rounds are all about taking businesses to the next level, past the development stage. Investors help startups get there by expanding market reach. Companies that have gone through seed and Series A funding rounds have already developed substantial user bases and have proven to investors that they are prepared for success on a larger scale. Series B funding is used to grow the company so that it can meet these levels of demand. Businesses that make it to Series C funding sessions are already quite successful. These companies look for additional funding in order to help them develop new products, expand into new markets, or even to acquire other companies. In Series C rounds, investors inject capital into the meat of successful businesses, in an effort to receive more than double that amount back. Series C funding is focused on scaling the company, growing as quickly and as successfully as possible. Source: https://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp

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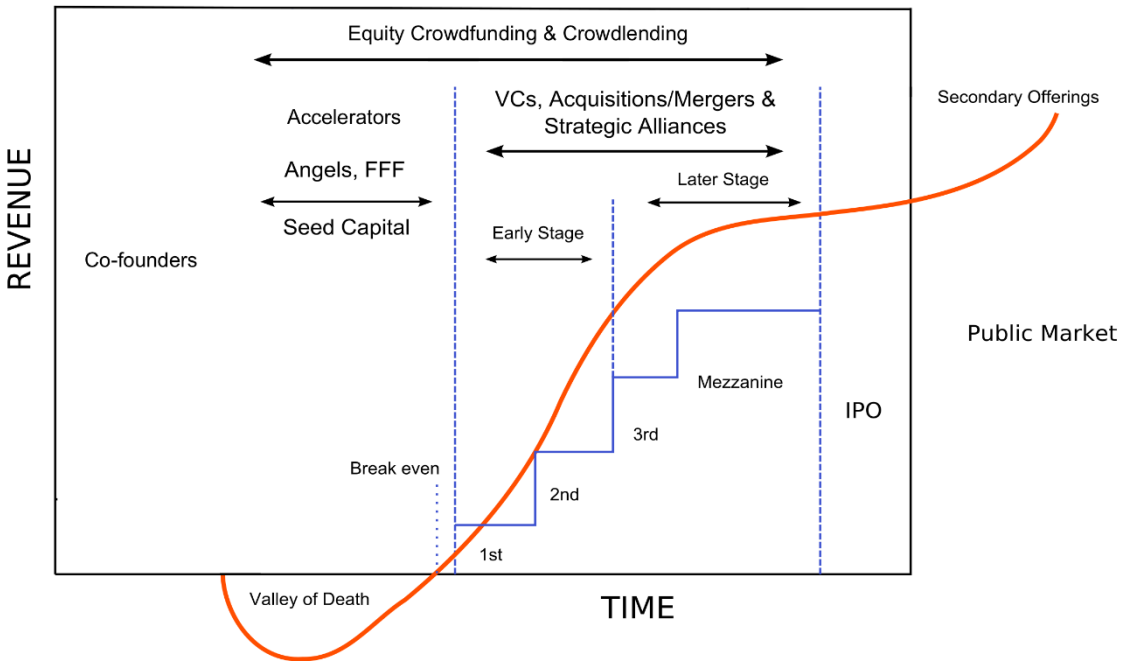
11.2 Annex 2: Start-up financing cycle

The following figure presents different type of investors according revenue and time from the start-up financing cycle.



Source: https://startupxplore.com/en/blog/types-startup-investing/

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