

博士論文

**The Role of Startups and the Entrepreneurial Ecosystem in
Innovation: a Multi-Method Study and its Policy
Implications**

(イノベーションにおける起業家と起業エコシステムの役割：諸
解析手法の適用と政策的含意)

ズリアガ カルダ アルバ

Author: Alba Zurriaga Carda

Supervisor: Professor Kazuo Furuta, and Professor Kazuro Kageyama, Department of
Technology Management for Innovation, School of Engineering, The University of Tokyo

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Executive Summary

Background, Purpose and Research Questions

The positive socio-economic effects that entrepreneurship can have in a country's economy are well recognized and documented. Entrepreneurship can be a generator of employment, wealth, innovative products and services. Entrepreneurship can improve the quality of life and economic freedom, increase productivity and have spillover effects that have a cascading positive effect in the economy. This research is motivated by this belief and aims to understand how to better support entrepreneurs and value creation within a region.

The purpose of this thesis is threefold. Firstly, the thesis aims to gain deeper insights into the *figure of the entrepreneur* as the center of startup creation. The thesis explores their profile, motivations, intentions and needs, in an attempt to better understand and thus support them. It does so by finding answers to the research questions: “What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?”, “Is there a new and easier way to detect entrepreneurial intention, even before individuals have realized it?”, and “What are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)?”.

Secondly, it explores the system in which entrepreneurs operate, the *entrepreneurial ecosystem*, and what are the environmental requirements and support mechanisms that affect an entrepreneur's ability to create, grow and exit a company. It does so by responding to the questions: “Is the Entrepreneurial Ecosystem a good conceptual design to study entrepreneurship?” and if so “which are the key factors necessary for startup's success, and thus for the development of the Entrepreneurial Ecosystem?”. Understanding the dynamic development and value creation of an entrepreneurial ecosystem, is a necessary first step in order to develop targeted support mechanisms to encourage its development. Therefore this thesis explores the questions: “What are the reinforcing and diminishing mechanisms that affect the

development of the ecosystem over time?”, “Which stage of firms are the main contributors to value creation within a region?”, “How does this change over time?”.

Thirdly, it aims to apply the better understanding of entrepreneurs and the Entrepreneurial Ecosystem to help *guide the policy-making efforts* of ecosystem stakeholders and thus elicit the positive socio-economic consequences outlined before.

Research Methodology

The study of entrepreneurship is part of the social sciences. As such, this research utilizes a variety of **mixed methods**, both **qualitative and quantitative**, to explore the different dimensions of the role and figure of the entrepreneur and that of the Entrepreneurial Ecosystem.

In the first part, exploring the figure of the entrepreneur, the thesis focuses on how and why people make (or not) the decision to become entrepreneurs. It utilizes primary data gathered via a **questionnaire** (in English, Spanish and Japanese) to students and young workers, and explores their entrepreneurial intention via **Structure Equation Modelling** it also proposes a new measure to assess the intention to become an entrepreneur, the **Entrepreneurial Distance**, by using cross-tabulation analysis of the distribution of responses.

To analyze the Entrepreneurial Ecosystem, this study uses **Systems Thinking** and **System Dynamics** methodologies to capture the development of the ecosystem over time, and the relations and connections between its components. Finally offering insights into designing Public Policy support measures to effectively support the development of the Entrepreneurial Ecosystem.

The thesis, includes insights and learnings from >100 first-hand **qualitative semi-structured interviews and conversations** with entrepreneurs, Venture Capitalists, Accelerators/Incubators, Government Officials, corporates and other ecosystem stakeholders in Entrepreneurial Ecosystems all around the world (Silicon Valley, New York, Boston, London, Cambridge, Paris, Lyon, Berlin, Munich, Madrid, Barcelona, Amsterdam, Rotterdam, Zurich, Tel Aviv, Jerusalem, Seoul, Taipei, Beijing, Shanghai, Myanmar, Vietnam and Tokyo). These were held during the course of the author’s Doctoral Course, and personal experience founding and running a software startup in Japan, and working within a Support Organization (Deloitte

Tohatsu Venture Support) supporting Startups, Corporates and Innovation Policy makers in collaborating and further developing the Entrepreneurial Ecosystem.

Findings

This thesis provides insights into the motivations of prospective entrepreneurs and the dynamic development as well as value generation of the Entrepreneurial Ecosystem.

Based on the primary data collected and its analysis via Structure Equation Modeling, the study finds that: self-efficiency and entrepreneurship education positively affect entrepreneurial intention whereas fear of failure negatively affects entrepreneurial intention.

The study also provided a new tool to easily assess the Entrepreneurial Intention of students with a very simple questionnaire, by calculating the “Entrepreneurial Distance”.

The proposed Entrepreneurial Ecosystem System Dynamics model allows ecosystem stakeholders to understand the dynamic development of the ecosystem over time, the distribution of value generation according to firm stage, and reinforcing and diminishing mechanisms affecting the development of the Entrepreneurial Ecosystem.

Conclusions and Significance

This study has helped to better understand which are some of the factors that affect the entrepreneurial intention and its decision making process. Being able to identify prospective entrepreneurs and providing them with the resources and support mechanisms necessary for them to realize that intention and be successful in the future, could enhance the positive spillover mechanisms that entrepreneurship can have.

A better understanding of the dynamic development and value generation within an entrepreneurial ecosystem is necessary in order to influence and support their development, as well as to align the resources and efforts of different stakeholders. An interesting question that the study proposes is that of the “capacity limit” of a particular Entrepreneurial Ecosystem, or number of firms that can be supported according to the availability of resources (funding, human capital or customers). Once the model is applied to a region, and historical data is gathered, it can serve as a tool for stakeholders to identify if and which is the limiting factor that might be

preventing the Entrepreneurial Ecosystem's growth. Ultimately, this may support innovation policy-makers by providing them with a tool to identify the most efficient resource allocation to expand the capacity limit of a Regional Entrepreneurial Ecosystem, by understanding and addressing existing gaps.

Recommendations

The proposed ecosystem analysis methodology can help ecosystem stakeholders better understand their collective responsibility and contribution to the ecosystem, as well as support a more sophisticated approach towards innovation policy-making, rather than the “create our own regional Silicon Valley” approach. Understanding the dynamics behind the development and value creation of an ecosystem, as well as the status and resources available can bring invaluable insights concerning resource allocation.

Keywords: Entrepreneurship, Entrepreneurial Intention, Entrepreneurial Ecosystem, System Dynamics, Systems Thinking, Capacity, Planning, Innovation Policy-making.

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Chapter 1: Introduction and Motivation

Chapter 1: Introduction and Motivation

This chapter explores the concept of the entrepreneur and that of entrepreneurship and outlines the socio economic benefits that they may trigger. In addition it defines what are the motivations and objectives behind the work and which are the research questions that we aim to answer. It also outlines how the thesis is organized and the research methods that have been employed.

1.1. Definition of Entrepreneurship

Since the introduction of the term, scholars have come up with varied definitions of the term entrepreneur. For Schumpeter, entrepreneurs were innovators, introducing change via “creative destruction” (Schumpeter, 1961, 2013) On the other hand, Kirzner considered entrepreneurs to excel at perceiving profit opportunities (Kirzner, 2015). Furthermore, Knight believed that entrepreneurs tend to focus on assuming the risks and uncertainties associated with running a business (Carree & Thurik, 2005). In reality, entrepreneurs face all of these issues, leading to a definition of entrepreneurship as “a person who is continually pursuing economic value through growth and as a result is always dissatisfied with the status quo” (D. Isenberg, 2011). Entrepreneurs are aspirational, risk-taking, contrarian and have a profit-seeking ambition.

However as important as it is to define what entrepreneurship is, it is also necessary to clarify what it is not. Across the world, the concepts of self-employment, small business ownership and entrepreneurship are confused (D. Isenberg, 2011). In this way, business ownership, is not necessarily entrepreneurial per se. It is possible for someone to be self-employed and own a small and medium enterprise (SME), yet he isn’t necessarily an entrepreneur. The big difference between these concepts relies in the innovation and growth potential. An **SME is organized to operate and remain a small sized business throughout its lifetime**. On the other hand, a **startup**, although in its initial stages it might be of a comparable size to an SME, has plans of future expansion. In this way for startups the small size of the company is **temporary; it is a transitional state before, hopefully, achieving fast growth** (D. Isenberg, 2011).

Another interesting consideration is the two different types of entrepreneurs defined via the Global Entrepreneurship Monitor (GEM) project (P. Reynolds et al., 2005), which differ both in the reasoning behind becoming entrepreneurs as well as their effect on economic development.

“**Opportunity**” entrepreneurs, are those who make an active choice to start a new project, because they perceive there is an underexploited business opportunity. This type of entrepreneurship has a positive and significant effect on economic development because it creates new businesses that generate jobs as well as introducing innovations into the market in the form of novel products and services.

However individuals may become entrepreneurs because other work options are absent or unsatisfactory. These individuals are known as “**necessity**” entrepreneurs and may be becoming entrepreneurs because the economy is not generating sufficient traditional wage-earning job opportunities. Therefore high rates of “necessity” entrepreneurship may lead to slow economic growth and lagging development (Z. Acs, 2006).

As well as the abovementioned “necessity” entrepreneurs, there may be other negative outcomes associated to entrepreneurship. Baumol described entrepreneurs to be “persons who are ingenious and creative in finding ways that add to their own wealth, power and prestige”(Baumol, 1996). Therefore, it may be possible that entrepreneurs bring unproductive or even destructive activities, apart from the positive social outcomes mentioned before. These activities would include corruption, crime, speculation, and financial trouble. Institutions will therefore be responsible in acting both as regulators and gatekeepers, to prevent these undesirable outcomes from occurring (Naudé, 2013).

In our work, when speaking about entrepreneurship, we will be referring to this **high-growth potential, opportunity-seeking entrepreneurship**.

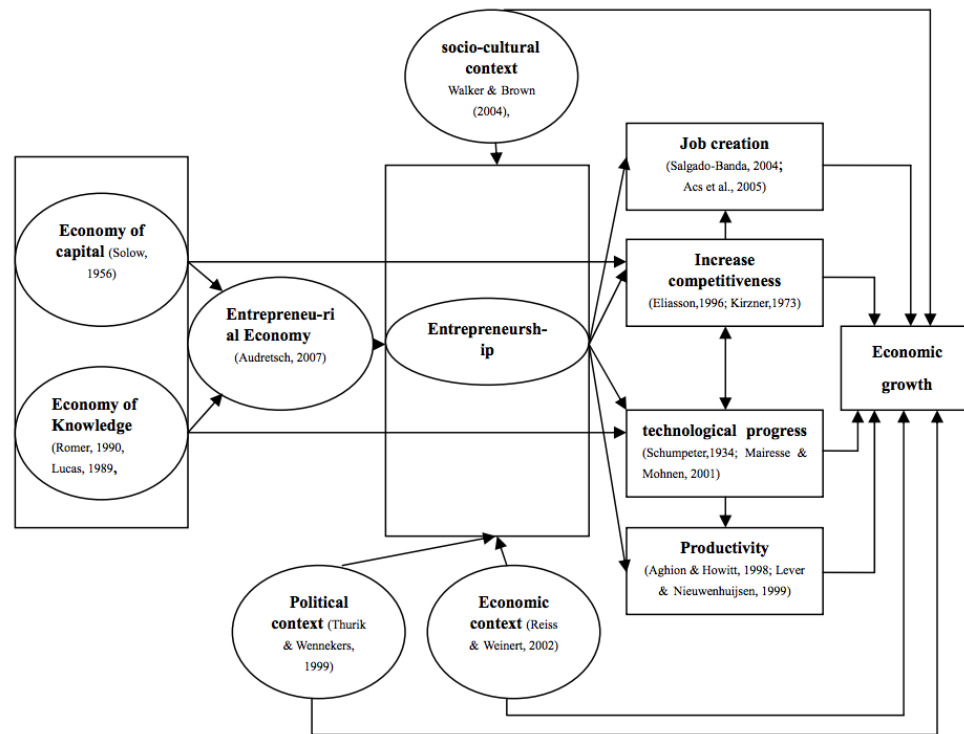
1.2. Importance of Entrepreneurship

Entrepreneurship has been found to be a key factor for **economic growth and development** (Z. Acs, 2006). Entrepreneurs create new businesses that lead to the generation of employment. Young, growing companies, have been found to be the **main contributors to new jobs**, in Europe and the United States (D. Isenberg, 2011, Foster et al., 2013).

Secondly, these new companies drive innovation by creating **innovative products** and **services**. This improves the productivity by the use of new technologies, and reduces the dependency on obsolete systems and technologies, improving the **quality of life and economic freedom** (Dhaliwal, 2016) As subsequent players enter the market, competition is intensified. This competition may lead to faster technological change and thus will translate into an increase in **productivity and efficiency**. If this is the case, high degrees of entrepreneurship will render in high levels of economic growth (Z. J. Acs & Varga, 2005) In this way, entrepreneurship can be an engine for growth and development, for the present and the future, by building the businesses of tomorrow that will improve the national income in the form of **higher tax revenue in the future**.

Most importantly, entrepreneurship generates **spillover** effects that transcend outside the new businesses generated into associated industries. These spillovers contribute to social and economic prosperity. Due to this positive and cascading effect that entrepreneurship can have in the regional and national economies, policy-makers are placing the promotion of entrepreneurship high in their agendas. Amaghous and Ibourk have done an excellent job connecting entrepreneurial activities with economic growth in 19 OECD countries (Amaghous, J., & Ibourk, A. (2012).

Figure 1.1: Entrepreneurship and Economic Growth: the Transmission Channels
(Amaghouss, J., & Ibourk, A. (2012))



1.3. Motivation, Objectives and Research Questions

The motivation of my work is threefold. Firstly, I aim to gain deeper insights into the *figure of the entrepreneur*; their motivations, intentions and needs, in an attempt to better understand and thus support them. As we have seen, entrepreneurs are the source of positive spillover effects in the economy, and as such it is important to understand them, to be able to better support them.

- Research question 1: What are the factors that affect entrepreneurial intention?
 - H₁: Fear of failure negatively affects entrepreneurial intention
 - H₂: Self-efficiency positively affects entrepreneurial intention
 - H₃: Entrepreneurship education positively affects entrepreneurial intention

Secondly, I would like to explore the *environmental requirements* and support mechanisms needed by the entrepreneurs to succeed. There are many considerations that affect

an entrepreneur's ability to create, grow and exit a company. These considerations therefore will affect the creation of value, and as such need to be better understood.

- Research question 2: Is the Entrepreneurial Ecosystem a good conceptual design to study entrepreneurship? If so which are the key factors necessary for startup's success, and thus for the development of the Entrepreneurial Ecosystem?
 - H4: The Entrepreneurial Ecosystem is a good conceptual design to study entrepreneurship
 - H5: The availability of capital, human capital and customers are they key factors for entrepreneur's success.

Thirdly, I would like to then be able to to apply the better understanding of entrepreneurs and the Entrepreneurial Ecosystem to help *guide the policy-making efforts* of governments around the world and thus elicit the positive socio economic consequences of entrepreneurship outlined before. Currently there is no clear definition or guidance towards the role that the government or other public organizations should play in the development of the Entrepreneurial Ecosystem. As well as resources to support entrepreneurs and their missions are limited, therefore how to best allocate resources is a very significant question that I aim to answer.

- Research question 3: Is it possible to expand the carrying capacity of the Entrepreneurial Ecosystem and thus the positive effects?
 - H6: By identifying the bottlenecks in the Entrepreneurial Ecosystem development, we will be able to allocate resources to alleviate those bottlenecks, this will help the development of the Entrepreneurial Ecosystem and the positive socio economic spillover effects.

The current Entrepreneurial Ecosystem literature has been led by and is aimed at practitioners, who themselves are stakeholders of the Entrepreneurial Ecosystem (either policy makers, entrepreneurs themselves or supporters/mentors/investors in startups), not directed towards an academic audience (Stam & Spiegel, 2016). Therefore the causal depth and evidence base is limited (Stam, 2015). My goal with this thesis is to bridge this gap, and to advance the academic literature by connecting it with the practitioner insights.

Therefore in the next chapters, this thesis will explore what are the key components of the Entrepreneurial Ecosystem, which are the enablers and inhibitors for entrepreneurship, and how do we create a supportive environment that maximises innovation and entrepreneurship regionally.

1.4. Organization of Thesis

The dissertation starts by taking a closer look at the key component for entrepreneurship to take place; the figure of the entrepreneur. In **Chapter 2** we will explore the **figure and role of the entrepreneur** as the center for startup creation. Much of the traditional literature has focused around the entrepreneur and firm level, looking at what is necessary for them to grow and succeed.

Although it is vital to understand the internal factors for success (within the firm or the entrepreneur him or herself), there is evidence that the immediate business environment plays an essential role too and that a company's chances of success depend on its geographical location (Porter, 2000). This is why our thesis continues by studying the larger dynamic relations between **firms and support organizations that compose the Entrepreneurial Ecosystem in Chapter 3**, from a theoretical perspective. Intuitively, as the world becomes globally connected and markets, transportation and connectedness allow to do business across countries, you would expect the role of local competition to diminish. Yet what Porter found was exactly the opposite, paradoxically, in a global economy, competitive advantages were emerging from local competitiveness and relationship.

"...therein lies a paradox: the enduring competitive advantages in a global economy lie increasingly in local things—knowledge, relationships, motivation—that distant rivals cannot match." - Porter, 1998

Similarly, an entrepreneur's chances of success, and thus positive socioeconomic influences, depend not only on his own actions and activities within the firm, but also on the external conditions and relations with other stakeholders around him. Therefore the thesis continues by exploring different influencing forces for startups. To do this, we will build upon the existing literature defining the Entrepreneurial Ecosystem and propose a **novel System Dynamics model** that can help gain a deeper understanding on the Entrepreneurial Ecosystem, in **Chapter 4 & 5**.

Entrepreneurship can stimulate economic growth, development and prosperity, and our goal is to better comprehend this phenomenon and provide a tool for policymakers and stakeholders to play a more efficient and supportive role towards entrepreneurs.

Finally, **Chapter 6**, summarizes the **conclusions, discussion, implications and limitations of this thesis, and points towards future research to advance the domain.**

1.5. Research Methods and Approaches

Throughout this thesis we have employed a variety of **mixed methods**, both **qualitative and quantitative** to explore the different dimensions of the role and figure of the entrepreneur and that of the Entrepreneurial Ecosystem.

The study of entrepreneurship falls within the social sciences. In the first part, exploring the figure of the entrepreneur we have focused on how and why people make (or not) the decision to become an entrepreneur. We gather primary data via of students and their career choices via a **questionnaire** (in English, Spanish and Japanese), and explored their entrepreneurial intention via a **Structure Equation Modelling and the Entrepreneurial Distance** (a new measure that we created to assess the intention to become an entrepreneur).

To analyse the Entrepreneurial Ecosystem, this study uses qualitative and quantitative analysis, and the **Systems Thinking** and **System Dynamics** methodologies to capture the development of the ecosystem over time, and the relations and connexions between its components. Finally offering insights into designing Public Policy support measures to effectively use the limited resources available to help the development of the Entrepreneurial Ecosystem.

Throughout the thesis, we have included insights and learnings from >100 first-hand **interviews (qualitative semi-structured interviews) and conversations** with entrepreneurs, Venture Capitalists, Accelerators/Incubators, Government Officials, corporates and other ecosystem stakeholders in Entrepreneurial Ecosystems all around the world (Silicon Valley, New York, Boston, London, Cambridge, Paris, Lyon, Berlin, Munich, Madrid, Barcelona, Amsterdam, Rotterdam, Zurich, Tel Aviv, Jerusalem, Seoul, Taipei, Beijing, Shanghai, Myanmar, Vietnam and Tokyo) held during the course of my PhD. This has been possible as concurrently to this thesis I have co-founded my own startup (AnchorUp, a software app for travellers), which helped me understand the first-hand realities (and challenges!) of being an entrepreneur. As well as

supported other startups through my work at Deloitte Tohmatsu Venture Support (a support agency connecting startups, corporations and government agencies to foster innovation, especially in Japan).

Chapter 2: The Entrepreneur as the Center of Startup Creation

Chapter 2: The Entrepreneur as the Center of Startup Creation

This chapter explores the role of the entrepreneur as the center of startup and value creation. The work aims to understand what are the intricacies behind the decision-making process that makes people want to become entrepreneurs. We do so by researching about what are the factors that influence the entrepreneurial intention and thus point out at potential targets for intervention. We also introduce a new measure, the entrepreneurial distance, to try to identify prospective entrepreneurs even before they themselves have realized this, and thus be able to target with support mechanisms that can encourage this decision in the future. The chapter ends with the realization that entrepreneurs are an important component, but their presence alone does not explain value creation in the region.

2.1. Importance of Entrepreneurship for Socioeconomic Development

Throughout the literature it has been found that entrepreneurship significantly affects socioeconomic growth and development via a variety of mechanisms. It can generate new employment (Foster et al., 2013), generate novel products and services (Acs, Zoltan, 2006), increase national prosperity and competitiveness (Dhaliwal, 2016), introduce future tax revenues (Z. J. Acs & Varga, 2005), and overall have a cascading effect in the economy and spillover effects to other industries (Amaghouss, J., & Ibourk, A. (2012). Nonetheless, some literature has also pointed at the unproductive and even destructive effect that entrepreneurship may have in existing industries (Baumol, 1996).

2.2. Research Questions

Therefore, given the socioeconomic impact that entrepreneurship can have, this thesis aims to develop the understanding necessary to better support entrepreneurs and increase the numbers of innovative firms. Chapter 2 responds to the following questions:

1. What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?

2. Is there a new and easier way to detect entrepreneurial intention, even before individuals have realized it?
3. What are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)?

2.3. Research Methods

This thesis falls into the category of social sciences, but throughout the work we have tried to design multi-method approaches, that combine qualitative insights and quantitative methods to better understand entrepreneurs and the environment they work in.

To answer the first and second research questions we used statistical analysis of primary responses gathered by our survey instrument (description follows), and cross-tabulation analysis by using SPSS AMOS software. To answer the third research question we developed a Structural Equation Model exploring Entrepreneurial Intention, as well as the leading steps towards it, Exploratory Factor Analysis and Confirmatory Factor Analysis.

2.4. Survey Instrument

In order to answer our research questions, explore, and test our hypotheses, we developed a survey instrument, by combining research items that had been previously used throughout the entrepreneurial literature, as well as our own proposed items to complement these. The full questionnaire was composed of 90 items and can be found in the Annex.

Our survey instrument measured the degree of agreement of respondents to certain statements using a five point Likert scale (1: strongly disagree to 5: strongly agree). The items measured which are the aspects that characterize entrepreneurs, by using Veciana's articles that define entrepreneurs, (example: "Please evaluate which attributes you believe characterize entrepreneurs")(Veciana, 2005). Secondly, we modified these items from the third to the first person and asked the respondents to "Please evaluate which attributes you believe you possess". The questionnaire then asked about the intention to behave entrepreneurially (Franke & Luthje, 2003) (example: "I'd rather be my own boss than have a secure job", "I'd rather found a new company than be the manager of an existing one", "Do you plan to be self-employed in the

foreseeable future after graduation?”), the perceived educational support (Turker et al. 2009), risk taking behavior and entrepreneurial self-efficacy characteristics (Bosma, Coduras, Litovsky, & Seaman, 2012). We also employed Gasse’s items regarding feasibility conditions regarding entrepreneurship (Gasse et al. 2009, 2011). Additionally to survey for entrepreneurial attitudes, we followed the GEM (GEM, 2012) survey items “Do you know someone personally who started a business in the past 2 years?”, “In the next six months, will there be good opportunities for starting a business in the area where you live?”, “Do you have the knowledge, skill and experience required to start a new business?” and “Would fear of failure prevent you from starting a business?”. In order to analyze country aspects we asked the respondents if they agreed with some statements, measured through a five-point Likert scale, following the GEM (GEM, 2012) survey items, “In your country, most people would prefer that everyone had a similar standard of living”, “In your country, most people consider starting a new business a desirable career choice”, “In your country, those successful at starting a new business have a high level of status and respect”, “In your country, you will often see stories in the public media about successful new businesses”.

Finally, the constructs were analyzed by using multi-item probe questions to increase reliability and reduce errors (Chen et al. 1998; Van Gelderen et al. 2008).

2.4.1. Translation of the Questionnaire

The original questionnaire was created in English following existing literature, and this version was available for our whole population of study. Additionally, the survey instrument was translated into Japanese by a bilingual Japanese-English speaker, and was distributed amongst Japanese students. Furthermore, a bilingual Spanish-English speaker, from the original English version, translated the survey instrument into Spanish. This Spanish version was distributed amongst Spanish and Latin American students. All three versions can be found in the Annex.

2.4.2. Sampling

When researching intentionality, it is very important to carefully select the sample population. Through meta-analyzing previous studies, it was proved that intentional processes are highly sensitive to initial conditions (Kim et al. 1993). Therefore, it becomes necessary to study entrepreneurial phenomena before they occur as well as including non-entrepreneurial intending subjects, so that our proposed theory can be properly tested and that our results are not biased. We therefore systematically compared respondents with and without an interest in entrepreneurship, to include subjects with a broad spectrum of intentions and attitudes toward entrepreneurship (Krueger et al. 2000).

With this in mind, University students were selected, because they represent a significant share of the pool of potential entrepreneurs and the cross-national comparability is enhanced by controlling for important variables such as literacy, work experience, age, and education. Additionally, as a matter of practicality, student subjects are generally convenient and accessible. It is important to note that the questionnaire was distributed through opportunity sampling, reaching out to those with and interest in responding and available at the time. Therefore, conclusions should be taken with care.

2.4.3. Limitations

Some of the limitations of prior research were due to the sample population chosen. When analyzing current entrepreneurs, the answers given to the reasons why they decided to become entrepreneurs are retrospective in nature, and tend to differ as time goes by from the original reasoning behind their actions. Additionally, the sample population tends to present a left-censored bias towards successful entrepreneurs, as only those remain after a certain period after the entrepreneurial action was pursued. Therefore, unsuccessful entrepreneurs or those that decide to quit are not considered in such retrospective studies, and thus the reasons or opinions might not capture the initial diversity.

To overcome these two limitations, the current study is focusing in current students which are about to enter the labor market. Such population is able to give their current views on entrepreneurship and their intent to undertake such profession with a concurrent logic. The

answers we collected are therefore based on prospective reasons, making our conclusions unbiased in terms or not of entrepreneurial success.

The empirical part of the study has a number of limitations associated to the opportunity sampling used for collecting responses; those that were willing and able to respond to the questionnaire were contacted.

Additionally, as the data was collected using questionnaires, it is subject to self-reporting bias. This is a situation in which individuals might not recognize their “true” characteristics or reasons behind becoming an entrepreneur. In addition, it is possible that they reply with reasons that are perceived as socially desirable rather than their true undesired ones. This is a difficult limitation to overcome, as so is being able to measure the difference between individuals in the strength of their responses. Larger sample numbers may help even out self-reporting bias due to the larger sample.

Furthermore, the cross-sectional nature of the data in combination with the low number of responses from individual countries has not allowed us to make country-specific assertions, except for the case of Japan, Spain and the United States.

In light of these limitations, the results presented need to be interpreted with caution.

2.4.4. Data Collection

The study was pre-tested on 10 individuals to finalize the research questions and delete unnecessary items. The respondents were selected through opportunity sampling, reaching out to the population available and willing to take part at the time, therefore the sample may not be representative of the population as a whole and could be biased, or not show all the variation present in the population. The conclusions will be extracted keeping these limitations in mind.

The response rate is difficult to assess, as the questionnaire was published in several notice boards around the University of Tokyo, as well as emailed to previous students who might not use their university email account regularly. To the best of our knowledge, the questionnaire was distributed to around 820 people, and we gathered 268 responses, obtaining a response rate of 32,6%. However, the overall response rate is likely to be an overestimation, as others might have come across the questionnaire but are not possible to account for.

The IRB exempt status was granted due to the non-recollection of personal information and the anonymous results.

The data was collected by means of a Google Sheets document, available between April 2015 and June 2015 (a copy of the questionnaire can be found in the Annex). The qualitative answers were then transformed into quantitative answers following a 5-point Likert scale. Answers ranging from: completely disagree, disagree, neither disagree nor agree, agree and completely agree were given a value of 1, 2, 3, 4 and 5, respectively.

The data was then screened before further statistical analyses were performed. First, we explored missing data as this may present a problem for the Structural Equation Modeling Analysis. Respondents lacking more than 10% of responses were eliminated from the study, as well as variables lacking 10% of responses were not employed. For the rest of the missing items, those measured through five point Likert-scales were replaced using the Median Replacement Method. Whilst categorical data were left untouched. Additionally, unengaged respondents were also removed by deleting those that presented no variation in their responses. In our case, 2 respondents had a standard deviation of 0.15, therefore exhibiting no variance and being useless to our study.

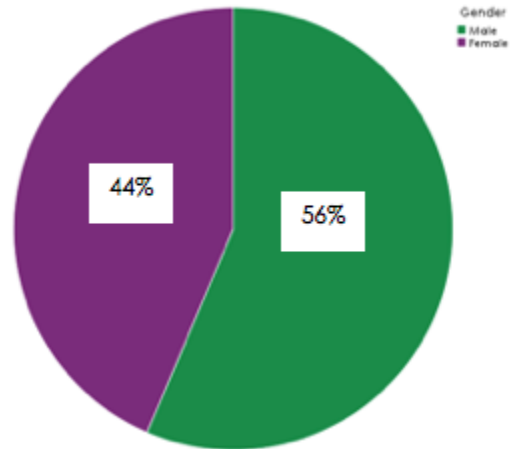
2.4.5. Sample Composition

The total number of respondents was 268, after deleting unengaged respondents and responses missing over 10% of items, the total number was of 264.

2.4.5.1. Distribution of Respondents by Gender

The distribution by gender was about 56% male and 44% female (Figure 2.1).

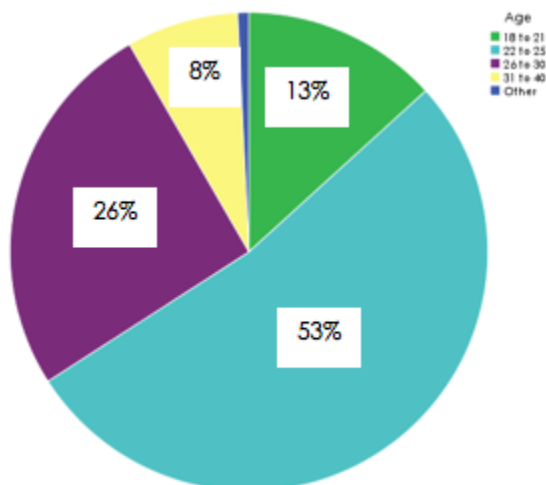
Figure 2.1: Breakdown of Respondents by Gender



2.4.5.2. Breakdown of Respondents by Age

The distribution by age was of 13% 18 to 21, 53% 22 to 25, 26% 26 to 30 and 8% 31 to 40. Other age distributions are negligible (Figure 2.2).

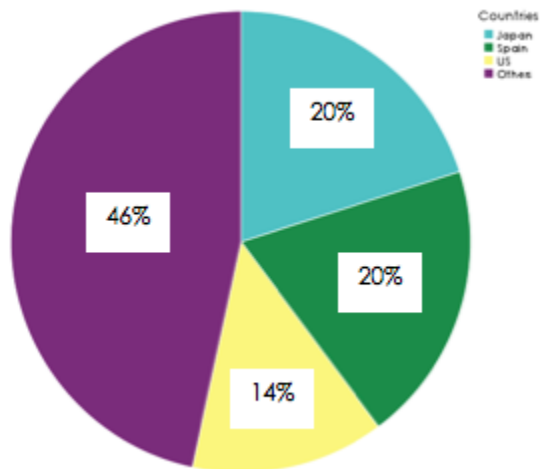
Figure 2.2: Breakdown of Respondents by Age



2.4.5.3. Breakdown of Respondents by Country

Respondents are originally from 39 different countries, across five continents. With regards to the distribution per country: Japan and Spain each accounted for 20% of respondents, whereas responses from the United States comprised 14%. The rest of the countries had lower percentage responses per country, and we considered them in conjunction, as a multinational pool of respondents (46%), as there were not sufficient responses per country to explore statistically significant differences within the sample (Figure 2.3).

Figure 2.3: Breakdown of Respondents by Country



The distribution of responses by country can be found in alphabetical order below.

Table 2.1: Breakdown of Respondents by Country

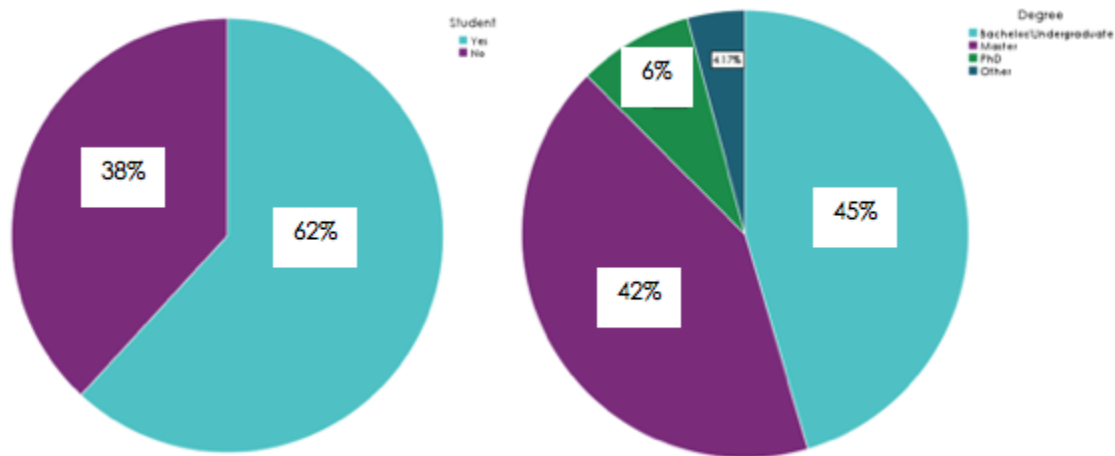
Country	Respondents	Country	Respondents
Algeria	2	Kosovo	1
Argentina	1	Malaysia	3
Australia	14	Mexico	1
Austria	4	Netherlands	1
Bangladesh	1	New Zealand	5
Belgium	1	Norway	1
Brazil	2	Pakistan	1
Canada	2	Philippines	3
China	4	Poland	1
Denmark	1	Portugal	1
England	1	South Africa	1
France	10	Spain	52
Germany	5	Sweden	7
India	8	Switzerland	2
Indonesia	9	Taiwan	2
Israel	2	Thailand	6
Italy	1	UK	5
Japan	55	US	36
Kazakhstan	1	Vietnam	2
Kenya	1	TOTAL	256

2.4.5.4. Distribution of Respondents by Profession and Degree

The survey was distributed to both students (62%) and non-students (38%). Of the student responses, 45% were of undergraduate/bachelor level, whilst 42% were master/graduate

students and 8% were PhD candidates. The share of students of other studies is negligibly small (Figure 2.4).

Figure 2.4: Distribution of Respondents by Profession and Degree



2.5. Cross-Country Perspective

The purpose of the first part of this chapter aims to respond to the research question: “What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?”. We wanted to understand if entrepreneurs around the world are viewed as having mutual characteristics that define them, or if contrarily, entrepreneurs differ by country. Additionally we were interested to see how the image of entrepreneurs varied across the countries studied: Japan, Spain, United States (US) and the multi-national sample (composed by grouping 28 other countries’ responses), and if this perception could be related to the conduciveness of the cultural towards entrepreneurship.

According to the Global Entrepreneurship Monitor (GEM consortium, 2014), conducive entrepreneurial cultures tend to have weak uncertainty avoidance, low power distance, tend to be masculine, individualistic, achievement-oriented, and universalistic (Hofstede, 2001). The three primary countries we are considering in our study: United States, Japan and Spain, show different levels in the key indicators considered conducive to entrepreneurship (GEM consortium, 2014). According to GEM (GEM consortium, 2014), United States shows the most conducive

indicators whilst Japan appears to have the least conducive characteristics and Spain shows an intermediate position (Figure 2.5).

Figure 2.5: Country comparison based on the Global Entrepreneurship Monitor (GEM consortium, 2013).

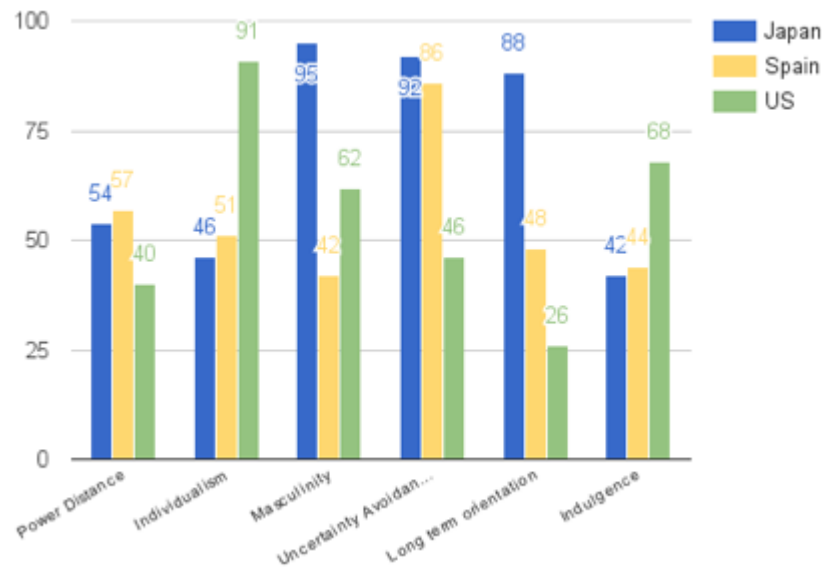


Table 2.2: Country comparison based on the Global Entrepreneurship Monitor (GEM consortium, 2013).

	United States	Japan	Spain
Total Entrepreneurship Activity (TEA)	13.8%	3.8%	5.5%
Established Business Ownership	6.9%	7.2%	7%
Perceived Opportunities	51%	7%	23%
Perceived Capabilities	53%	12%	48%
Entrepreneurial Intention	12%	3%	7.1%
Fear of Failure	30%	55%	38%

Therefore our first hypothesis is that: Hypothesis 1 (**H₁**): Countries with more conducive entrepreneurial culture will have a more positive perception of entrepreneurs.

Additionally, we wanted to know if this profile of entrepreneurs is the same across countries, or if differences exist. Our survey instrument measured the degree of agreement of respondents to statements related to the image of entrepreneurs using a five point Likert scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, and 5: strongly agree), for it we used Veciana's items of attributes related to the image of entrepreneurs (Veciana et al., 2005). We grouped responses agree with strongly agree and disagree with strongly disagree and compared the distribution of the two groups.

For the data analysis, we used the Statistical Software SPSS. Through cross-tabulation analysis, we compared differences across groups and performed chi-square tests to see if the differences were statistically significant. For all cases, the null hypothesis (H_0) was that there is no statistically significant difference across groups, whilst the alternative hypothesis (H_A) was that there is statistically a significant difference across groups. If the chi-square test value was lower than 0.05, we rejected the H_0 and accept with a 95% confidence interval the H_A . Additionally, we evaluated the size of the significant effects as being small, medium or large, depending on the degrees of freedom and the size of the Cramer's V (Cohen, 1988) (Table 2.3).

Table 2.3. Effect size according to Cramer's V (Cohen, 1988).

Degrees of Freedom (df*)	Effect		
	Small	Medium	Large
1	.10	.30	.50
2	.07	.21	.35
3	.06	.17	.29

2.5.1. General Image of Entrepreneurs

We asked respondents if they personally knew someone that had started their own business in the past five years, and 85% responded affirmatively. This shows that entrepreneurs are present in all of the populations of our study.

Five items showed no significant differences after the cross-tabulation between the entrepreneur's characteristics and the different countries, meaning they showed similar levels of support across the countries studied (Table 2.4). These items are important across all countries, and show a high level of agreement, making them robust and reliable characteristics of entrepreneurs in our sample (Table 2.4). These items are: "Entrepreneurs are able and willing to take risks" (92%, 4.38), "Entrepreneurs are dynamic people" (83%, 4.15), "Entrepreneurs help the economic development of the country" (81%, 4.11), "Entrepreneurs create jobs" (80%, 4.05), "Entrepreneurs have a good entrepreneurial vision" (70%, 3.84) and "Entrepreneurs are very innovative" (70%, 3.71) (Table 2.4).

Whilst the item that the respondents disagreed or completely disagreed with was: "Entrepreneurs can accomplish every task successfully" (60%), (Table 2.4). This is significant, as it seems that the image of the entrepreneur is not being idealized. Entrepreneurs are not being considered capable of doing every task well, but appear to have characteristics that are more realistic.

Table 2.4 Items Defining Entrepreneurs Throughout our Sample

Statement	Chi-square alpha	Agree
"Entrepreneurs are dynamic people"	0.956	83%
"Entrepreneurs are very innovative"	0.805	70%
"Entrepreneurs are able and willing to take risks"	0.072	92%
"Entrepreneurs have a good entrepreneurial vision"	0.652	70%
"Entrepreneurs create jobs"	0.088	80%
"Entrepreneurs can accomplish every task successfully"	0.329	15%

2.5.2. Image of Entrepreneurs by Country

The results of the cross-tabulation analysis can be found in Table 2.5. Our results show that the image of the entrepreneurs in Spain was the most positive with the highest agreement with the items: "Entrepreneurs have good organizational skills", "Entrepreneurs have good financial and management skills", "Entrepreneurs are professionally well prepared" and

“Entrepreneurs can manage a company successfully”. However, they showed the least agreeance, from the countries studied with the item: “Entrepreneurs earn a high income”. We found there to be less support to the entrepreneur characteristic items in Japan, and US respondents had intermediate values. Interestingly 50% of Japanese respondents believed “entrepreneurs earn a high income”, whilst only 14% of Spanish respondents believed so, despite the positive image previously shown in Spain. It appears that the perspectives of income are very different across the countries studied. Lastly, we found significant differences in the agreement of “Entrepreneurs help the economic development of the country”. Although, the majority of respondents supported this statement, the proportion that did so in Japan (84%) was lower than in the rest of countries, (above 94%).

Table 2.5: Cross-Tabulation Analysis of Statistically Significant Differences between Countries
in our Sample

Statement	Chi-square alpha	Kramer's V	Countries (% agree)			
			Japan	Spain	US	Other
“Entrepreneurs have good organizational skills”	0.002	0.305 (3df) = large	63%	94%	71%	84%
“Entrepreneurs have good financial and management skills”	0.029	0.244 (3df) = medium	43%	74%	60%	70%
“Entrepreneurs are professionally well prepared”	0.029	0.251 (3df) = medium	59%	83%	33%	55%
“Entrepreneurs can manage a company successfully”	0.015	0.270 (3df) = medium	41%	75%	67%	64%
“Entrepreneurs earn a high income”	0.010	0.283 (3df) = medium	50%	14%	27%	44%
“Entrepreneurs help the economic development of the country”	0.006	0.234 (3df) = medium	83%	98%	100%	94%

We found that across our sample, there is a very positive general image of entrepreneurs across all countries studied; as them being dynamic, innovative, willing to take risks, having a good entrepreneurial vision and being able to create jobs.

However some differences also exist between countries, and these seem to be related, at least in part, to how conducive the culture of the country is, with those being less conducive supporting the least positive image of entrepreneurs.

Therefore, our first hypothesis was only partly supported, as the Japanese culture being considered the least conducive towards entrepreneurship (GEM consortium, 2014) and the less agreement with the items relating to the image of entrepreneurs. However, we expected the US respondents to have the most positive view of entrepreneurial characteristics, as the US culture is the most conducive towards entrepreneurship of those studied, but in our study, Spanish respondents appeared to have a more positive image of entrepreneurs than any other country.

In the future, it would be important to study the image of entrepreneurs across different countries with varying conducive cultures towards entrepreneurship to find a conclusive relation between both variables.

2.6. Entrepreneurial Distance: A Novel Evaluation Tool of Entrepreneurial Intention

Secondly, we aimed to respond to the research question: “Is there a new and easier way to detect entrepreneurial intention, even before individuals have realized it?”. If this is the case, it can allow us to detect entrepreneurs as early as possible, in order to give them the support they might need for them to start a business.

To address this, we proposed a new evaluation tool that we called the “Entrepreneurial Distance”, in which we compared the respondents’ own perception of the qualities they possess as a “stakeholder” (in first person). As well as the qualities they thought are important traits of entrepreneurs, as a “spectator” (in third person). Our goal was to see if their responses have statistically significant differences on the respondent’s entrepreneurial intention. The results of this work were published in the Journal of Economics and International Finance on November, 2016, under the title “Entrepreneurial distance: A novel evaluation tool of entrepreneurial intention” (Carda, A. Z et al. 2016).

To measure the difference between the “spectator” and “stakeholder” roles, for each of the respondents we calculated what we coined the Entrepreneurial Distance. The items used can be found on Table 2.6. All answers were measured in a 5-point Likert Scale, from Completely Disagree = 1, Disagree = 2, Neither Disagree nor Agree = 3, Agree = 4, Completely Agree = 5. It is then possible to calculate the difference between both corresponding responses, for each respondent.

Table 2.6. Spectator and Stakeholder items used to calculate the Entrepreneurial Distance.

Entrepreneur Characteristics (Spectator role – 3rd person)	Respondent's own abilities (Stakeholder role – 1st person)
“Entrepreneurs are dynamic people”	“I am a dynamic person”
“Entrepreneurs are very innovative”	“I am very innovative”
“Entrepreneurs are able and willing to take risks”	“I am able and willing to take risks”
“Entrepreneurs have a good entrepreneurial vision”	“I have a good entrepreneurial vision”

It is important to note that throughout our sample, four factors were found to be representative of entrepreneurs with >70% of the overall population agreeing with them, and no significant differences to be found between different countries in our sample. Therefore, we used these robust items found to describe entrepreneurs' characteristics (Table 2.7) and modified them to refer to the first person (Table 2.6).

Table 2.7. Items found to be characteristic of entrepreneurs throughout our sample.

Statement	Chi-square alpha	Agree
“Entrepreneurs are dynamic people”	0.956	83%
“Entrepreneurs are very innovative”	0.805	70%
“Entrepreneurs are able and willing to take risks”	0.072	92%
“Entrepreneurs have a good entrepreneurial vision”	0.652	70%

We defined the Entrepreneurial Distance as being the sum of the differences between each of the four pairs of items.

$$\text{Entrepreneurial Distance} = \sum \text{Entrepreneur's characteristic} - \text{Self characteristic}$$

$$\text{Entrepreneurial Distance} = (\text{Entrepreneurs are dynamic people} - \text{I am a dynamic person}) + (\text{Entrepreneurs are very innovative} - \text{I am very innovative}) + (\text{Entrepreneurs are able and willing}$$

to take risks - I am able and willing to take risks) + (Entrepreneurs have a good entrepreneurial vision - I have a good entrepreneurial vision)

Following the example above, this distance could be positive, negative or match, with different implications.

- Match distance: there is a “match” between the characteristics that the respondents believe are necessary or not to become an entrepreneur with their own self-reported abilities (>70% of the population agreed that the selected items were characteristic of entrepreneurs). In a sense, if a respondent strongly agrees with the item: “entrepreneurs are dynamic people” (value: 5), and strongly agrees with the item: “I am a dynamic person” (value: 5), the difference between the two items will be 0 ($5 - 5 = 0$). Respondents with a “matching” entrepreneurial distance will possess the same characteristics, as they believe are important for entrepreneurs and thus, our hypothesis is that they will have a higher tendency to become entrepreneurs. The opposite may also be true, a respondent may strongly disagree with the item: “Entrepreneurs are very innovative” (value: 1), and strongly disagrees with the item: “I am very innovative” (value: 1), the difference between the two items will be 0 ($1 - 1 = 0$). In this case, respondents believe certain attribute is not characteristic of entrepreneurs, and they themselves do not possess that attribute, therefore it should not influence their decision to become entrepreneurs in the future. We will consider a “match” case to occur, when the distance (sum of four differences) is between -1 and 1.

➤ Hypothesis 2 (**H₂**): There will be a positive correlation between a match in entrepreneurial distance and entrepreneurial intention.

- Positive distance: In case of a positive or negative entrepreneurial distance, we can argue that there is a mismatch between the traits that the respondents believe are necessary or not to become an entrepreneur with their own self-reported abilities, with different implication in each case. If the “entrepreneurial distance” is positive, the respondent will believe a characteristic is important to become an entrepreneur, but he does not possess it. As an example, if a

respondent strongly agrees with the item: “Entrepreneurs are dynamic people” (value: 5), and strongly disagrees with the item: “I am a dynamic person” (value: 1), the difference between the two items will be 4 ($5 - 1 = 4$). The respondent then lacks, in his opinion, a characteristic necessary to become an entrepreneur. A “positive distance” case will occur, when the sum of the four differences is 2 or above.

- Hypothesis 3 (**H₃**): There will be a negative correlation between a positive entrepreneurial distance and entrepreneurial intention.
- Negative distance: In the opposite case, if the entrepreneurial distance is negative, the respondent will believe a characteristic is not important to become an entrepreneur, but he does possess it. As an example, if a respondent strongly disagrees with the item: “Entrepreneurs are dynamic people” (value: 1), and strongly agrees with the item: “I am a dynamic person” (value: 5), the difference between the two items will be -4 ($1 - 5 = -4$). All items used have a positive connotation, being all desirable qualities to have. Therefore, we can argue that respondents with a negative distance will have high self-esteem and self-confidence and our hypothesis is that they may be more likely to become an entrepreneur. A “negative distance” case will occur, when the sum of the four distances is -2 or below.
- Hypothesis 4 (**H₄**): There will be a positive correlation between a negative entrepreneurial distance and entrepreneurial intention.

We cross tabulated the three different categories with the respondent’s intention to become an entrepreneur, to find out if the intention to become an entrepreneur had any relation to the image respondents have of entrepreneurs and their own perception of themselves. For each of the respondents we plotted the relationship between the distance and intention and saw the three different distance groups (negative, match and positive) have different intention distributions (Table 2.8).

Table 2.8 Cross-tabulation analysis between the entrepreneurial distance and entrepreneurial intention.

		Entrepreneurial Intention		
		Disagree	Neither	Agree
Distance	Negative	14.8%	29.6%	55.6%
	Match	21.8%	24.8%	53.5%
	Positive	35.9%	28.1%	35.9%

Results: Chi-square = .028 (4df), 0% cases have expected count < 5. Cramer's V = 0.146

We found significant differences between the three distance categories (negative, match and positive) and the entrepreneurial intention of the respondents, with the chi square test being $0.028 < 0.05$. Therefore, we can say with a 95% confidence interval that the H_0 (no significant differences between groups) can be rejected, and we accept the alternative hypothesis H_A (there are significant differences between groups).

For the “negative” and “match” distances, as our hypothesis predicted, there are a higher number of respondents that intend to “establish my own business or be self-employed in the foreseeable future”, 55.6 and 53.5% respectively, and a lower number of respondents that disagree with this statement, 14.8 and 21.8%, respectively.

This supports our hypothesis 2 and 4 that stated that there would be a “positive correlation between a match (H_2) negative (H_3) entrepreneurial distance and entrepreneurial intention” and a “positive correlation between a negative entrepreneurial distance and entrepreneurial intention”. H_3 shows the importance of self-confidence in a respondent's own abilities whilst H_2 highlights the importance of possessing the traits that they believe are important to succeed as an entrepreneur.

With regards to the “positive” distance, the respondents showed a lower level of entrepreneurial intention (35.9%) and a higher level of disagreement with this statement (35.9%), supporting H_4 that stated that there would be a “negative correlation between a positive entrepreneurial distance and entrepreneurial intention”. Therefore, a mismatch between the characteristics that the respondents consider to be important to become an entrepreneur and their

own abilities, is detrimental for entrepreneurial intention, as respondents believe they do not have the skill sets necessary to become one.

Additionally, we found a new way to assess entrepreneurial intention, by understanding how close to the entrepreneurial profile the respondents feel they are. This new method could be used to detect future entrepreneurial behaviour even before a person had made up their mind about deciding a career choice, and thus target support mechanism to encourage the decision-making and thus rate of entrepreneurship over time.

In addition, this “spectator” and “stakeholder” comparative model could be applicable to other fields by comparing the qualities that are considered important for the profession being considered and the respondent’s own abilities and intention to take on that career. In the future, we hope to apply this methodology to other fields in which the stakeholder spectator relationship can be interesting.

2.7. Entrepreneurial Intention Structure Equation Model

The third part of this chapter aims to respond to the question: “What are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)? “. As was previously described, entrepreneurship can have significant socioeconomic consequences. Therefore, researchers have tried to predict future entrepreneurial behavior and have tried to better understand the decision-making process in order to encourage entrepreneurship. Findings from this type of research can be used for the effective promotion of entrepreneurship by focusing on the factors that have the biggest effect on entrepreneurial intentions. The results of this work were published in the International Review of Management and Business Research on December, 2016, under the title “Effects of Risk Attitude, Entrepreneurship Education and Self-Efficacy on Entrepreneurial Intentions: A Structure Equation Model Approach to Entrepreneurship” (Zurriaga-Carda, A. et al. 2016).

2.7.1. Study of Intention

Entrepreneurial intentions research is quite mature, as it started in the 1980s by exploring an individual's intention and personal attitudes on their entrepreneurship behavior. This line of research was found to be more effective and have a higher explanatory ability to predict entrepreneurial behavior (Ajzen, 1987) than previous studies that focused on differentiating personality characteristics of entrepreneurs. Since then it has become a popular tool in the social and behavioral sciences (Reis & Stiller, 1992), being a powerful and robust quantitative methodology with higher predictive validity (Krueger et al. 2000).

The initial intentions models explored the Entrepreneurial Event Model (Shapero & Sokol, 1982), or the Theory of Planned Behavior (Ajzen, 1991). Overall, intentions have proven to be the best predictor of planned behavior and new businesses require considerable planning, making intentions models ideally suited for the study of entrepreneurship (Krueger et al. 2000).

Intention models are versatile and robust and allow for the development of theory-driven testable models for entrepreneurial research (MacMillan et al. 1992). In this way, it is possible to explore about entrepreneurship and new business creation, even before it has taken place.

The basis of this research is that intentions are able to predict a particular behaviour, whereas attitudes affect intentions, and thus future behaviour. According to Krueger (Krueger et al. 1993, 2000), attitudes and intentions depend on both the person and the situation. Therefore the study of intentions, predicts behavior better than either individual or situational variables by themselves with a greater predictive power (Krueger et al. 2000). Additionally, Shane believed that "entrepreneurial activity depends on the decisions that people make, suggesting that the attributes of decision makers should influence the entrepreneurial process" (Shane et al. 2003).

The intention modeling has been adopted by a numerous academics becoming a "common and reliable approach" to study entrepreneurship (Zellweger et al. 2012). Some of the researchers have added additional attitudes or factors influencing intention.

Since the initial models other researchers have contributed to the field by analyzing the influence of a number of factors on entrepreneurial intentions such as individual attitudes (Ajzen, 1991), the subjective norms and perceived expectations (Krueger & Carsrud, 1993), and the effect of self-efficacy (Chen et al. 1998). Additionally, the effect of social and environmental

factors (Stephen et al. 2005), such as legal rules or government support have been found to have both supporting and hindering effects on entrepreneurial intentions (Franke & Luthje, 2003).

Following existing literature, we will integrate both individual as well as contextual factors into the structural model of entrepreneurial intention.

New business creation is considered to be a risky endeavor, as there is a high level of uncertainty regarding the chances of success. Risk propensity is a personality trait that assesses the willingness to take courses of action or make decisions that are uncertain in their outcome (Jackson 1994). Results until now are inconclusive about the effect of risk propensity in entrepreneurial intentions. Some researchers have found that risk taking behaviors influence the interest and motivation to start a new business (Gerry et al. 2008), as well as the entrepreneurial intentions (Gurel et al. 2010). Hofstede pointed out the importance of the level of uncertainty avoidance in the society with relation to entrepreneurship: entrepreneurship is by no means a certain career choice, thus risk-averse individuals might have less entrepreneurial intentions (Hofstede, G. 2001). Whilst other researchers have found that risk taking does not relate to the entrepreneurial intentions (Busenitz & Barney, 1997; Douglas & Fitzsimmons, 2008). Our first hypothesis is:

- H₅: Risk aversion will **negatively** affect the entrepreneurial intention of the respondents.

Entrepreneurial self-efficacy is based on an individuals' self-perception of their skills and abilities to accomplish a specific course of action or to achieve a desired outcome (Bandura, 1997). It is this perception, rather than the objective ability of individuals, that motivates individuals to behave entrepreneurially (Markman, Balkin, & Baron, 2002). Numerous studies have shown a positive impact of entrepreneurial self-efficacy on the entrepreneurial intentions (Boyd and Vozikis 1994; Krueger et al. 2000; Zhao et al. 2005). Therefore, following existing literature, our second hypothesis is:

- H₆: Entrepreneurial self-efficacy will positively influence entrepreneurial intention

It is also important to consider contextual factors such as education, which are amongst the most important elements in the development of human resources (Turker et al. 2009). A number of authors have linked education and entrepreneurship (Galloway and Brown 2002;

Gorman et al. 1997). *Autio* (*Autio et al. 1997*) pointed out that career preferences and entrepreneurial convictions are influenced by the support received from the university environment. Whereas Chen found out that the number of management courses the students had taken were positively related to entrepreneurial intention (Chen et al. 1998). Therefore, following existing literature, our third hypothesis will therefore be:

- H₇: Entrepreneurial education will positively influence entrepreneurial intention.

Our purpose is to understand how risk adversity, entrepreneurship education and entrepreneurial self-efficacy affect entrepreneurial intentions. In particular, the effect of risk averseness on entrepreneurial intention has been inconclusive until now, having mixed results. Our paper aims to fill this gap by gathering empirical data and testing a new Structure Equation Model that explains the effect of risk averseness on entrepreneurial intentions

2.7.2. Research Methodology

Structure Equation Modeling (SEM) is one of the most widely used methods for analyzing data in the social and behavioral sciences (Rengiah & Sentosa, 2014). It allows for the study of theoretical constructs that cannot be observed or measured directly and allows for the testing of the effect of a set of variables that may be interdependent (Blaikie, 2003). The aim of our study is to find which variables have an effect on the entrepreneurial intention of the respondents and what weight do these variables impose on the final decision of becoming an entrepreneur.

2.7.3. Research Sample

Studies of intention require a systematic comparison of respondents with a broad spectrum of intentions and attitudes towards entrepreneurship (Krueger et al. 2000). Additionally, intentional processes are highly sensitive to initial conditions (Kim & Hunter, 1993), therefore it becomes necessary to study entrepreneurial phenomena before they occur, as if we study the phenomenon in retrospective it may be biased towards the opinion of successful entrepreneurs or may show self-justification bias (Carter, Gartner, Shaver, & Gatewood, 2003). With this in mind, University students (62%) with and without interest in entrepreneurship were selected before

entering the labor market. Furthermore, the sample also included recent graduates (38%) early in careers other than entrepreneurship and explored their entrepreneurial intention prospectively.

As explained previously, the respondents came from 31 countries, with around 54% being from Japan (20%), Spain (20%) and the United States (14%). These three countries show different levels in the key indicators considered conducive to entrepreneurship (GEM consortium, 2014). The United States shows the most conducive indicators whilst Japan appears to have the least conducive characteristics and Spain shows an intermediate position. The respondents have different backgrounds, cultures, and attitudes towards entrepreneurship. Conducive entrepreneurial cultures have been found to have weak uncertainty avoidance, low power distance, tend to be masculine, individualistic, achievement-oriented, and universalistic (Hofstede, 2001). We are interested to see if despite these differences, we can find a model that fits the entrepreneurial intentions of the respondents.

2.7.4. Research Instrument

Our survey instrument was designed to study entrepreneurial intentions as the dependent variable as well as measure entrepreneurship education, entrepreneurial self-efficacy and risk averseness as the independent variables. We used a combination of research items that had been previously used and validated throughout entrepreneurial literature.

The quantitative nature of the data we gathered allows for the validation of a model of entrepreneurial intentions by analyzing how the empirical data fit the proposed model. The hypothesized model was empirically tested via Structure Equation Modeling with the Statistical Software SPSS AMOS 22.0.

2.7.5. Analysis and Results

2.7.5.1. Exploratory Factor Analysis

As a first step, we performed an Exploratory Factor Analysis (EFA). EFA is performed to interpret self-reporting questionnaires, in order to reduce a large number of variables into a smaller and more manageable set of underlying factors. In EFA no a priori theory about which items belong to which constructs is applied, following a more exploratory approach. We used the Maximum Likelihood extraction method, as AMOS SPSS software uses this method to test and estimate the derived model. We used the Kaiser Mayer-Olkin (KMO) measure of sampling adequacy (0.789) and Bartlett test of sphericity (chi-square: 1238.048; Significance: $p < 0.000$) to measure if the data were adequate and suitable for conducting EFA (Field, 2009). We found both tests to be significant, Table 2.9 details the results from the EFA.

2.7.5.2. Reliability Analysis

Reliability refers to the consistency of item-level errors within a single factor. This means a reliable variable would consistently load on the same factor every time, making the measurement scales stable and consistent (Hair, Black, Babin, Anderson, & Tatham, 2006). The Cronbach's alpha value for each construct is shown in Table 2.9. The alpha value for three of the factors was above the 0.70 threshold and for the remaining one, it was relatively close (0,653). The factor "Entrepreneurial Self-efficacy" was initially composed of three items but in the posterior Confirmatory Factor Analysis (CFA) we deleted an item due to problems with reliability and validity. The deletion fixed the above-mentioned problems but consequently, the Chronbach's alpha value was reduced.

Table 2.9: Item description and EFA results.

Factor Name	Items	Eigenvalue	% of Variance	Cronbach Alpha
Entrepreneurial Intention	<ul style="list-style-type: none"> - I would rather be my own boss than have a secure job (EI1) - I would rather found a new company than be a manager of an existing one (EI2) - Starting my own business is an attractive idea to me (EI3) - I plan to establish my own business or be self-employed in the foreseeable future (EI4) 	3.820	29.383	0.829
Entrepreneurship Education (University)	<ul style="list-style-type: none"> - My university develops my entrepreneurial skills and abilities (U1) - My university provides the necessary knowledge about entrepreneurship (U2) - My university encourages me to develop creative ideas for being an entrepreneur (U3) 	2.599	19.995	0.847
Risk averseness (Risk)	<ul style="list-style-type: none"> - I don't like facing uncertainty (R1) - Fear of failure would prevent me from starting my own business (R2) - I tend to be risk averse (R3) - I am unable and unwilling to take risks (R4) 	1.375	10.578	0.753
Entrepreneurial Self-efficacy (Self)	<ul style="list-style-type: none"> - I can manage a company successfully (S1) - I have good financial and management skills (S2) 	1.102	8.479	0.653

2.7.5.3. Validity Analysis

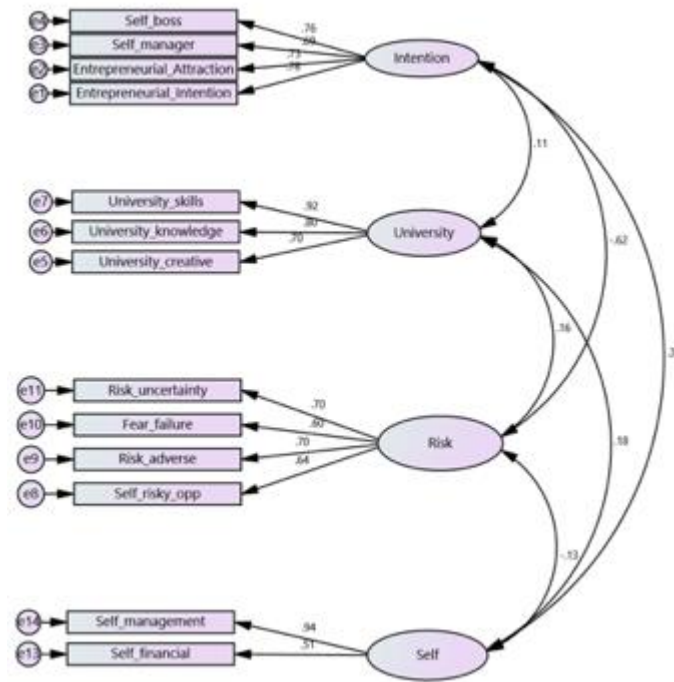
Convergent validity is achieved when the variables within a single factor are highly correlated. The four selected factors demonstrate sufficient convergent validity, as their loadings were all above the recommended minimum threshold of 0.350 for a sample size of 250 (Hair et al., 2006). Discriminant validity refers to the extent to which the factors are distinct and uncorrelated. The factors also demonstrate sufficient discriminant validity, as the correlation matrix shows no correlations above 0.700 between factors, and there are no problematic cross-loadings, as all items loaded in a single factor (Table 2.10). Additionally, the factors present face validity, meaning that factors that are similar in nature are loading together on the same factor.

Table 2.10: Pattern Matrix:

Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.^a

	Factor			
	1	2	3	4
EI1	.784			
EI2	.752			
EI3	.700			
EI4	.699			
U1		.912		
U2		.804		
U3		.699		
R1			.823	
R2			.637	
R3			.594	
R4			.489	
S2				.894
S1				.546

Figure 2.6: Confirmatory Factor Analysis Estimation



2.7.5.4. Measurement and Structural Equation Modeling

We followed (Hair et al., 2006) recommendation and used a two-step approach to Structural Equation Modeling (SEM). The first step tests the reliability and construct validity of the proposed measurement model, using Confirmatory Factor Analysis (CFA) (Figure 2.6). CFA allows for the determination of the factor structure of a dataset that has been extracted through EFA. The second step is to test the hypothesis by using structural theory and the structural model that best fits our data (Saeid et al. 2011).

2.7.5.5. Model fit of the Measurement Model

The model fit assesses how well the proposed model accounts for the correlations between variables in a dataset. The model fit can be evaluated by various goodness of fit indices. As shown in Table 2.11, the goodness of fit for our measurement model is reasonably high, thus the hypothesized model of four constructs is a suitable measurement model for this study.

Figure 2.7: Structure Equation Model

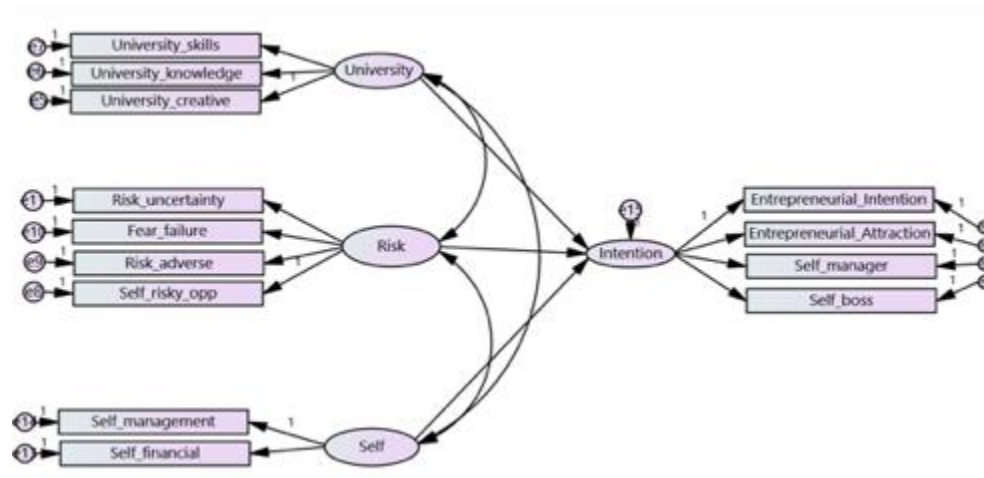


Table 2.11: Goodness-of-Fit Indices for the Measurement Model

Model	cmin/df	CFI	RMSEA	PCLOSE	SRMR
Measurement Model	1.897	0.955	0.058	0.192	0.063

2.7.5.6. Construct Validity and Reliability

The construct reliability (Table 2.12) assesses the degree of consistency of an instrument whilst the validity assesses its accuracy. To test for reliability, we analyzed the Composite Reliability (CR), and found it to be above the 0.7 threshold for all factors, indicating that the selected factors are reliable. To test for convergent validity we calculated the Average Variance Extracted (AVE). The AVE for all factors was above 0.50 except in the case of the factor “Risk Averseness”, which had a value of 0.437. We tried to increase the AVE of this construct by deleting each of the component items sequentially and re-testing to see if the convergent validity was improved. Despite these attempts, the AVE was never above the 0.5 threshold. We therefore decided to keep all constructs and as the reliability score (0.756) is above 0.700, we felt it was an admissible solution (whilst this construct is not especially strong internally, it is a reliable and distinct construct within our model) (Gaskin, 2013).

Table 2.12: Construct validity and reliability

	CR	AVE	Risk	Intentions	Education	Self-efficacy
Risk	0.756	0.437	0.661			
Intentions	0.829	0.549	-0.624	0.741		
Education	0.852	0.660	0.159	0.112	0.813	
Self-efficacy	0.716	0.578	-0.127	0.338	0.180	0.760

2.7.5.7. Structural Model Assessment

We tested the Structural model and found that it fits the empirical data well (Table 2.13). The proposed model is therefore an acceptable Structure Equation Model. We then tested each of our null hypotheses with the path coefficient and corresponding t-value (Table 2.14). The three factors were found to statistically significantly affect entrepreneurial intentions.

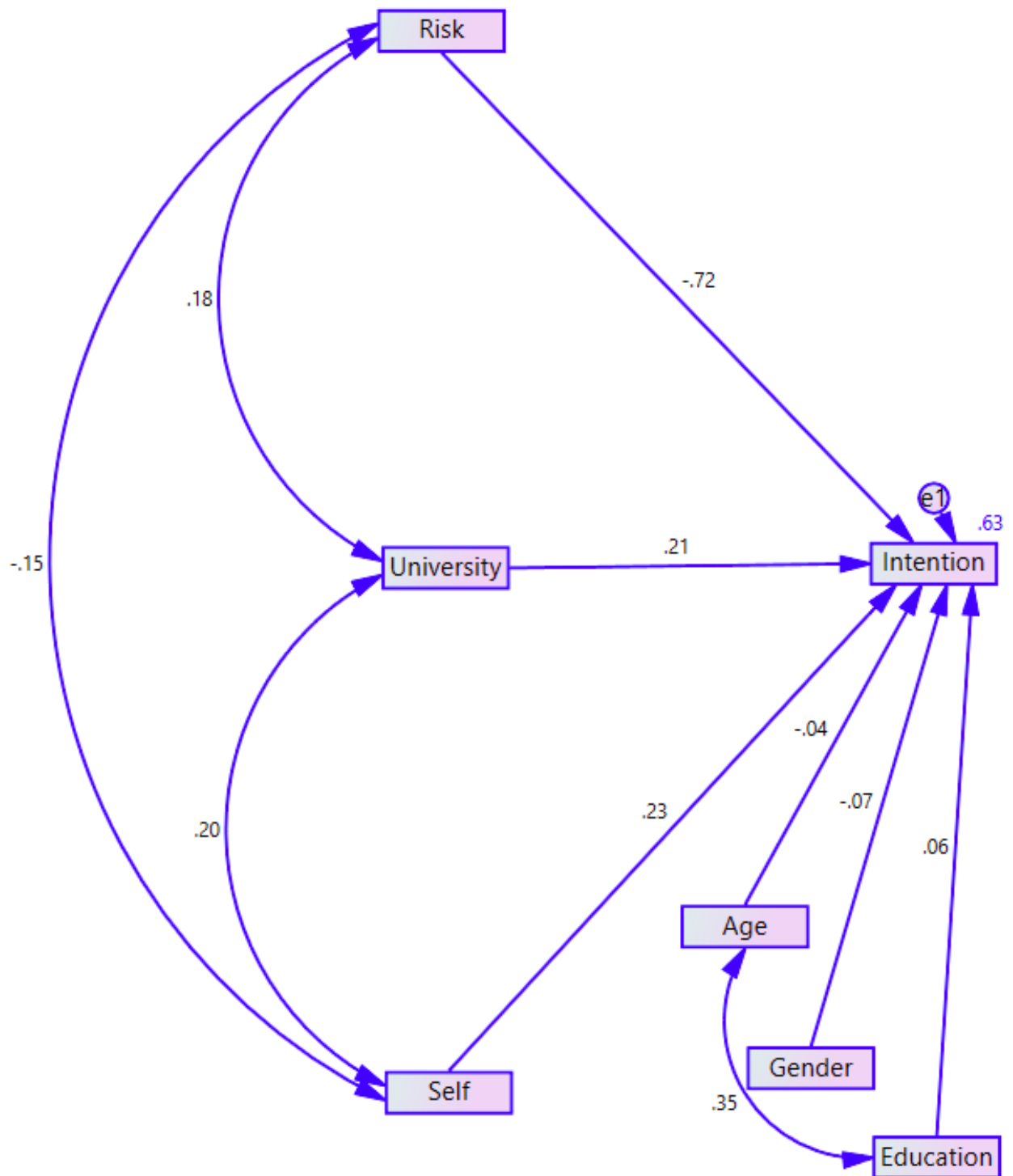
Table 2.13: Goodness-of-Fit Indices for the Structural Equation Model

Model	cmin/df	CFI	RMSEA	PCLOSE	SRMR
			A		
Measurement Model	2.624	0.948	0.035	1.000	0.045
Recommended	1 – 3	>0.950	<0.060	>0.050	<0.090

Table 2.14: Structure Equation Modeling results

			Estimate	S.E.	C.R.	P
Entrepreneurial Intention	<---	Risk Averseness	-1.079	.059	-18.409	***
Entrepreneurial Intention	<---	Entrepreneurship Education	.238	.045	5.296	***
Entrepreneurial Intention	<---	Entrepreneurial Self-efficacy	.218	.037	5.818	***
Entrepreneurial Intention	<---	Age	-.046	.041	-1.100	.271
Entrepreneurial Intention	<---	Studies	.071	.045	1.568	.117
Entrepreneurial Intention	<---	Gender	-.125	.064	-1.957	.050

Figure 2.8: Structural Model



Our fifth hypothesis (H₅), that risk averseness will have a negative effect on entrepreneurial intentions has been supported (-1.08, $p < 0.001$).

Our sixth hypothesis (H₆) has also been proven, thus entrepreneurial self-efficacy positively influences the entrepreneurial intentions (0.22, $p < 0.001$).

Our seventh hypothesis (H₇) is also supported; entrepreneurial education positively influences the entrepreneurial intentions (0.24, $p < 0.001$).

These three factors, entrepreneurship education, entrepreneurial self-efficacy and risk propensity, account for 63% of the total variance in our sample in terms of entrepreneurial intention.

2.8. Discussion and Conclusions

Chapter 2 aimed at responding at three research questions. Firstly, we were able to understand: “What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?”. We found that across our sample, there is a very positive general image of entrepreneurs across all countries studied; as them being dynamic, innovative, willing to take risks, having a good entrepreneurial vision and being able to create jobs. However some differences also exist between countries, and these seem to be related, at least in part, to how conducive the culture of the country is, with those being less conducive supporting the least positive image of entrepreneurs. Therefore, our first hypothesis was only partly supported, as the Japanese culture being considered the least conducive towards entrepreneurship (GEM consortium, 2014) and the less agreement with the items relating to the image of entrepreneurs. However, we expected the US respondents to have the most positive view of entrepreneurial characteristics, as the US culture is the most conducive towards entrepreneurship of those studied, but in our study, Spanish respondents appeared to have a more positive image of entrepreneurs than any other country. In the future, it would be important to study the image of entrepreneurs across different countries with varying conducive cultures towards entrepreneurship to find a conclusive relation between both variables.

Secondly, we found “a new and easier way to detect entrepreneurial intention”, by looking at their opinion towards entrepreneurs and their own self-reported abilities, through what we have coined as the “Entrepreneurial Distance”. This new method could be used to detect

future entrepreneurial behaviour even before a person had made up their mind about deciding a career choice, and thus target support mechanism to encourage the decision-making and thus rate of entrepreneurship over time. In addition, this “spectator” and “stakeholder” comparative model could be applicable to other fields by comparing the qualities that are considered important for the profession being considered and the respondent’s own abilities and intention to take on that career. In the future, we hope to apply this methodology to other fields in which the stakeholder spectator relationship can be interesting.

Thirdly, we aimed to understand “what are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)”, in order to understand the decision-making and influencing factors (supporting and hindering) affecting the decision to become an entrepreneur, and thus identifying potential targets to influence entrepreneurial behaviour. Our results indicate that entrepreneurial intentions are positively influenced by entrepreneurship education and entrepreneurial self-efficacy, whilst the fear of failure has a strong negative impact on the decision to become an entrepreneur. Additionally, age, gender and education were found to have no significant impact on entrepreneurial intention or its influencing factors. In the future, we would like to include a larger sample to achieve higher statistical power and to examine if different countries show different entrepreneurial intention patterns according to the differing culture. We hope that our research will help in the allocation of resources to promote entrepreneurship in a more effective manner, towards the factors that have a greater effect on entrepreneurial intentions, and detecting and supporting individuals with entrepreneurial intentions even before they have made this decision (by using the entrepreneurial distance). Particularly, encouraging entrepreneurship education to students from a variety of backgrounds can increase the rate of entrepreneurship. Additionally, we have provided empirical proof of the negative effect risk aversion can have in entrepreneurial intentions. Countries that present higher fear of failure and risk aversion will inherently have lower rates of entrepreneurship and thus competitiveness. Addressing this mindset is a challenging task that must be addressed at a societal level to achieve an increased level of entrepreneurship.

2.9. Expansion of Scope from the Entrepreneur to the Entrepreneurial Ecosystem

Through our work, we realized that even though entrepreneurs are at the center innovation and new company creation, they themselves are **not alone responsible** for the cascading socioeconomic effects that startups can have in an economy.

In actuality, an entrepreneur's **chances of success are highly dependent on the conditions and environment around them**. Startup success can only be achieved when entrepreneurs have access to human capital, investment, support organizations, service providers, customers, or mentors, just to name a few. Numerous things, outside of the entrepreneur's own actions or control, can affect the survival and success of a startup. Therefore studying exclusively the figure of the entrepreneur, ignoring the environment and multiple actors that influence their success or failure, would have limited value.

The notion of the entrepreneur as a brave, heroic, visionary individual that single-handedly creates new companies is misguided. Startups are created not only by the hard-work of entrepreneurs, which is undoubtable, but also because of a supportive environment composed of a multitude of other stakeholders that facilitate and support the entrepreneur's work. We, as other researchers before us, have understood that entrepreneurs still play a vital role for entrepreneurship to occur (Van de Ven, 1993), yet it is necessary to widen the scope of our research to understand how the environment and other stakeholders can influence entrepreneurship (D. Isenberg, 2011). It is therefore vital to study the broader system where the startups are located, and the multiple stakeholders that influence a startup's success. Only then will we be able to support effectively and benefit from the positive socio economic consequences entrepreneurship can have.

The Entrepreneurial Ecosystem is, as other complex and adaptive systems, composed of numerous actors and actions, interlinked and connected via complex feedback mechanisms. Entrepreneurs are at the core of such system, and are a key for a vibrant ecosystem to develop, however, more than the individual, it is the complex interplay of stakeholders and resources that can explain the development and thus value creation that entrepreneurship creates. Therefore, in the next chapters, we will be exploring what are the key components of the Entrepreneurial

Ecosystem, which are the enablers and inhibitors for entrepreneurship, and how do we create a supportive environment that maximizes innovation and entrepreneurship regionally.

Chapter 3: The Entrepreneurial Ecosystem as a Conceptual Design to Study Entrepreneurship

Chapter 3: The Entrepreneurial Ecosystem as a Conceptual Design to Study Entrepreneurship

The following chapter starts by reflecting back on the existing literature upon which the concept of the Entrepreneurial Ecosystem is built, particularly that of: agglomeration, industrial districts, clusters, innovation systems and business ecosystems. It then reviews the existing Entrepreneurial Ecosystem literature, and describes in detail what are the components of the Entrepreneurial Ecosystem. The chapter ends by performing a necessary simplification exercise, aimed at identifying which are the key components that affect the survival and success of a startup, that will be necessary to model the development of the Entrepreneurial Ecosystem in subsequent chapters.

3.1. Definition of the Entrepreneurial Ecosystem

The Entrepreneurial Ecosystem, is as other complex and adaptive systems, composed of numerous actors and actions, interlinked and connected via complex feedback mechanisms. Entrepreneurs are at the core of such system, and are a key for a vibrant ecosystem to develop, however, more than the individual, it is the complex interplay of stakeholders and resources that can explain the development and thus value creation that entrepreneurship creates. Following Peter Vogel's definition and based on prior literature, (Iansiti & Levien, 2004; Mason & Brown, 2014; Van de Ven, 1993) we follow the Entrepreneurial Ecosystem definition of:

*“a **dynamic and interactive** community, **within** a **geographic** region, composed of varied and **interdependent actors** (e.g. entrepreneurs, institutions and organizations) and **factors** (e.g. markets, regulatory framework, support setting, entrepreneurial culture), which **coexist, interact and evolve** over time to **promote new venture creation**.”* (Vogel, 2013)

Whereas for Roundy, the entrepreneurial ecosystem is:

*“a **self-organized, adaptive, and geographically bounded** community of **complex agents** operating at multiple, aggregated levels, whose **non-linear interactions** result in the patterns of activities through which **new ventures form and dissolve** over time”.* (P.T Roundy, 2018)

The application of the term ecosystem to the business environment started with James F. Moore, who was fond of ecological metaphors, and applied the concept to the business environment in the 1990s (Moore, 1997). Since then, the term has become popular between both academics and practitioners. Despite this, some researchers are skeptical about the application of the term ecosystem to the business and innovation literature, such as Deog-Seon Oh, arguing that it is a faulty analogy and has a poor basis to it, and considering it more of “metaphor, not a rigorous construct” (Oh, Phillips, Park, & Lee, 2016). Nonetheless, as we will further explore, the use of this analogy allows us to achieve a more comprehensive understanding of the phenomenon occurring in the Entrepreneurial Ecosystem (Smorodinskaya, Russell, Katukov, & Still, 2017).

There is not yet a consensus in the naming of the ecosystem, between academics, practitioners and other stakeholders. The terms “Entrepreneurial Ecosystem”, “Startup Ecosystem” and “Entrepreneurship Ecosystem” seem to be used **indistinctively**. In terms of their definitions, there seems to be no distinction between these concepts, and they are used **interchangeably**. In our case we will primarily use the term Entrepreneurial Ecosystem although the term “Startup Ecosystem” is more popular amongst practitioners. This is due to the more inclusive definition of entrepreneurial activities that we are considering (startups are part of the ecosystem, as are scale-ups, unicorns, spinoffs from research universities, spinouts from a corporation...). We hope that our research adds to the practitioner literature, yet this is a necessary clarification to avoid misunderstanding, as the “startup” stage is just a transient status that the firms are experiencing. Recently, Stam and Spigel, have defined the entrepreneurial ecosystems as “a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship” (Stam & Spigel, 2016). Here, **productive** entrepreneurship is referring to the concept introduced by Baumol back in 1996 (Baumol, 1996) whereby the scope is placed on any entrepreneurial activity that “**contributes directly or indirectly to net output of the economy**”. In our research we will follow the same inclusive scope.

Today, governments across the world, as well as international economic development organizations (like the International Monetary Fund, the United Nations or the World Bank), have recognized that in the current economic context, characterized by high levels of unemployment and lower growth, entrepreneurs can be the **critical drivers for employment**

and innovation generation. Recently, the support of Entrepreneurial Ecosystems has become a main point in the political agenda of governments and international organizations worldwide, due to the positive effects that entrepreneurship can have in the economy [For more information, refer to Chapter 2]

The Entrepreneurial Ecosystem literature is still in its infancy, and is constantly developing. The **academic literature is particularly immature**, whilst much more has been written by practitioners on their own regional Entrepreneurial Ecosystems. Until now, the practitioner literature has focused on analysing different Entrepreneurial Ecosystems, with the main initiatives being that of Startup Genome (Startup Genome Project, 2017), the Global Entrepreneurship Monitor (P. Reynolds et al., 2005), the Global Entrepreneurship and Development Institute (Ács, Szerb, & Autio, 2011), or the World Bank Doing Business Index (World Bank Group, n.d.), as well as other regional government research.

The Entrepreneurial Ecosystem is a novel term, and thus there is little academic literature, especially exploring the systemic relationships. Nonetheless, as we previously analyzed, there are many parallelisms between established academic concepts, such as: Ecological Ecosystems, Clusters, Business Ecosystems and Innovation Systems (national or regional).

On the other hand, the academic literature is still recent and not yet mature. Although a variety of authors have outlined which are the main components needed to create a supportive environment for entrepreneurs qualitatively. Little quantitative research evaluating Entrepreneurial Ecosystems has been done by academics, and we could not find any studies that explore causality between the component factors of the Entrepreneurial Ecosystem.

3.2. Related Literature

3.2.1. Ecosystems in Ecology

Throughout this dissertation, we will be using the concept of the Entrepreneurial Ecosystem. The original application of this term comes from ecology, therefore the definition we will use, is derived from the ecological definition.

The **ecological concept** has existed for the past 100 years, with Frederic Clements being responsible for the elaboration of the concept of community development in plant ecology,

(Hagen, 1992) and later verified by Eugene Odum and Howard T. Odum by quantifying the flows of energy and matter in the ecosystem (Odum, 1969). However the term *ecosystem*, is first recognised in writing by Tansley, stating that “*In an ecosystem the organisms and the inorganic factors alike are components which are in relatively stable dynamic equilibrium.*” (Tansley, 1935).

The ecological definition, is that an ecological ecosystem encompasses both the living (biotic) and nonliving (abiotic) components as well as their interactions and interdependencies within a system, functioning as an ecological unit. We will now draw some parallelisms between the substantial ecology literature and Entrepreneurial Ecosystems (Table 3.1).

Table 3.1: Similarities between Ecological ecosystems and Entrepreneurial Ecosystems

Ecological Feature	Application to the Entrepreneurial Ecosystem
Boundaries	Ecological ecosystem often have nebulous boundaries , as do Entrepreneurial Ecosystems. However, unlike the business ecosystem literature, in which the focus is a firm, and thus the business ecosystem may expand across borders upstream and downstream of the value chain, Entrepreneurial Ecosystems are regionally located (as are ecological ecosystems), often within a 100km radius (Startup Genome Project, 2017). This close proximity is necessary to establish the close connections and interactions that are necessary to have a thriving ecosystem. It is true that today companies are globally connected, as are people and capital, however when there are new entrants into a regional system, such as foreign workers, or foreign capital entering the local ecosystem, we will consider that it now forms part of the region, and thus for us, Entrepreneurial Ecosystems will be regionally bound.
Dependency	In ecological ecosystems, organisms within them are dependent on each other as well as other ecosystem components. Similarly, in the Entrepreneurial Ecosystem, startups, support organizations, investors and all stakeholders depend on each other for success and the relationships that relate them are complex and ingrained in the system.
Interdependency	In ecology, adjacent ecosystems can closely interact and are often interdependent for productivity, diversity. Similarly, for Entrepreneurial Ecosystems there are flows of resources, people and ideas, flowing between different ecosystems and connecting them globally. This is also true for Entrepreneurial Ecosystems, in which human capital, resources or goods and services flow between ecosystems.
Cycling	The ecosystem has different communities, populations, and cycling of nutrients and matter and flowing of energy. Similarly, the Entrepreneurial Ecosystem has different interacting communities and members, and capital and resources flowing and being reused by different stakeholders over time. The failure or success of a startup can serve to liberate the resources that were constrained within the firm and are then able to be reused by other firms and serve for their success.

3.2.2. Business Ecosystem

The application of the term ecosystem to the business environment started with James F. Moore, who was fond of ecological metaphors, and applied the concept to the business environment in the 1990s (Moore, 1996, 1997). According to Moore, a **business ecosystem** is:

“an economic community supported by a foundation of interacting organizations and individuals... producing goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies...”(Moore, 1996)

Only after understanding the interactions and interdependencies within the ecosystem components, can we help manage these complex systems.

3.2.3. Other Related Literature

We see that the concept of an “ecosystem” has been applied in the business literature since the 1990s. However, the application to the startup environment is still fairly recent. The Entrepreneurial Ecosystem literature is still in development, therefore prior to going deeper into this new concept, we will build upon related concepts that are well established and recognized within the academic domain. Particularly those of:

- a. Agglomeration (Fujita & Thisse, 2013)
- b. Industrial Districts (Krugman, 1991; Markusen, 1996)
- c. Clusters (Feldman, Francis, & Bercovitz, 2005; Porter, 1998; Saxenian, 1994)
- d. Innovation Systems (national or regional) (Lundvall, 2010)
- e. Business ecosystems (Iansiti & Levien, 2004; Moore, 1993)

Table 3.2: Comparison with industrial district, cluster, and innovation system literature
(Stam & Spigel, 2016)

Table 1. Comparison with industrial district, cluster, and innovation system literature

	Key actors	Key concepts	Input into Entrepreneurial Ecosystem approach	Key outcome	Key references	Key references entrepreneurship
Marshallian industrial district	SMEs	Labor market pooling; specialized goods and services; knowledge spillovers; market competition	Talent (labor market pooling), intermediate services (specialized goods and services), knowledge (spillovers)	Regional economic growth (productivity)	Marshall 1890; Krugman 1991; Markusen 1996	-
Italianate Industrial district	SMEs; local government	Flexible specialization, interfirm cooperation, trust (social embeddedness)	Networks between entrepreneurs and enterprises	Regional economic growth (employment)	Piore & Sabel 1984; Becattini 1990; Harrison 1992	Johannisson et al. 1994; Malecki 1997; Lazerson & Lorenzoni 1999
Cluster	Innovative firms	Factor conditions; demand conditions; related and supporting industries; firm structure, strategy and rivalry	Talent, finance, knowledge, physical infrastructure (factor conditions); demand (demand); support services / intermediaries (related and supporting industries); ...	National / regional competitiveness (productivity of particular industries)	Porter 1990; 1998	Rocha 2004; Rocha & Sternberg 2005; Delgado et al. 2010
Innovation system	Innovative firms; national government	Networks, inter-organizational learning, system	Knowledge, finance, formal institutions, demand	Innovation	Freeman 1987; Lundvall 1992; Braczyk et al 1998	Sternberg 2007; Ylinenpää 2009

Other authors, like Stam and Spigel (Stam & Spigel, 2016) (Table 3.2-3), have already compared and made parallelisms between these related theories, and the input they have had to the Entrepreneurial Ecosystem literature. Although, the Entrepreneurial Ecosystem literature is fairly recent, the theoretical bases comes from as far as the 1890s, with the Marshallian Industrial district, and how regional resources can drive productivity.

First we will be exploring what are some of the similarities with each of these literature fields, to then explore the differences and need for a novel concept.

Table 3.3: Differences and similarities between entrepreneurial ecosystems and related concepts (Stam & Spigel, 2016)

Approach	Industrial District, Cluster, Innovation System	Entrepreneurial Ecosystem
Main focus	Main focus is on economic and social structures of a place that influence overall innovation and firm competitiveness. In many cases, little distinction made between (fast growing) startups and other types of organizations.	Startups explicitly at centre of ecosystem. Seen as distinct from established large firms and (lower-growth) SMEs in terms of conceptual development and policy formation.
Role of knowledge	Focus on knowledge as source of new technological and market insights. Knowledge from multiple sources is recombined to increase firm competitiveness. Knowledge spillovers from universities and other large research intensive organizations are crucial.	In addition to market and technical knowledge, entrepreneurial knowledge is crucial. Knowledge about the entrepreneurship process is shared between entrepreneurs and mentors through informal social networks, entrepreneurship organizations, and training courses offered.
Locus of action	Private firms and state is primary locus of action in building and maintaining industrial district/cluster/innovation system. Little room for individual agency in their creation.	Entrepreneur is the core actor in building and sustaining the ecosystem. While state and other sources might support ecosystem through public investment, entrepreneurs retain agency to develop and lead the ecosystem.

From all of the reviewed literature, that of agglomeration, industrial districts, clusters, Innovation Systems and business ecosystems, that of clusters seems to be the closer in proximity, and the one that we can draw the most from. Therefore we have decided to explore some similarities, to show the relation between concepts, as well as the key differences, and the necessity of establishing a separate concept as is the Entrepreneurial Ecosystem (Table 3.4).

**Table 3.4: Similarities and differences between Clusters (Porter, 1998) and the
Entrepreneurial Ecosystem**

	Clusters (Porter, 1998)	Entrepreneurial Ecosystem
Similarities	“What happens inside companies is important, but clusters reveal that the immediate business environment outside companies plays a vital role as well” (Porter, 1998, p.78).	Similarly, the success of a startup is not only determined by internal firm level factors, but also by the business environment where it is found.
	Paradoxically “the enduring competitive advantages in a global economy lie increasingly in local things - knowledge relationships, motivation - that distant rivals cannot match” (Porter, 1998, p.78).	Similarly, despite global connectedness, there are factors that can only be tapped via a close proximity relation
	“Complementarities. A host of linkages among cluster members results in a whole greater than the sum of its parts” (Porter, 1998, p.81). “Because members of the cluster are mutually dependent, good performance by one can boost the success of the others.” (Porter, 1998, p.81)	In an Entrepreneurship Ecosystem, firms are able to perform better through other’s success. For example, one firm’s successful exit, can improve the investment attractiveness, meaning it may be easier for other startups in the ecosystem to raise funds after this. The more people in the ecosystem, the more benefits for all players.
	“Clusters promote both competition and cooperation. Rivals compete intensely to win and retain customers. Without vigorous competition, a cluster will fail. Yet there is also cooperation, much of it vertical, involving companies in related industries and local institutions. Competition can coexist with cooperation because they occur on different dimensions and among different players” (Porter, 1998, p.79).	Similarly to Porter’s observation, in Entrepreneurial Ecosystems we see this natural cooperation-competition phenomenon as in the ecological ecosystems and clusters.
	“Companies in vibrant clusters can tap into an existing pool of specialized and experienced employees, thereby lowering their search and transaction costs in recruiting. Because a cluster signals opportunity and reduces the risk of relocation for employees, it can also be easier to attract talented people from other locations, a decisive advantage in some industries” (Porter, 1998, p.81).	Similarly, startups in vibrant ecosystems can tap into human capital in the area, and many job opportunities make the area attractive for additional talent to come.
Differences	Clusters are “critical masses - in one place - of unusual competitive success in particular fields” (Porter, 1998, p.78). For Porter, examples of clusters are the California wine cluster, Italian leather fashion cluster, Hollywood’s entertainment cluster, or Wall Street’s Finance cluster.	The Entrepreneurial Ecosystem is not restrictive to a particular field or industry. In case of the Entrepreneurial Ecosystem, they all are multi-industry, focus on innovative products and services.
	“Although clusters often fit within political boundaries, they may cross state or even national borders” (Porter, 1998, p.79).	Nonetheless, in the case of Entrepreneurial Ecosystems, because we are no longer considering supply chains, the Entrepreneurial Ecosystem limits to a geographical location (often within geographic boundaries, around 100km). In cases where there is resources or capital coming into the ecosystem from abroad, once it enters the Entrepreneurial Ecosystem, we consider it as part of that system, allowing us to concentrate on a geographical location.

3.3. The Entrepreneurial Ecosystem as a Conceptual Design to Study Entrepreneurship

From the related literature, there are some known concepts that we would like to see if are applicable to the Entrepreneurial Ecosystem.

Firstly, Porter identified a positive feedback mechanism in new company formation, due to a reinforcement of the benefits every time there is a new entrant into the cluster: *“The formation of new businesses within a cluster is part of a positive feedback loop. An expanded cluster amplifies all the benefits I have described it increases the collective pool of competitive resources, which benefits all the cluster's members. The net result is that companies in the cluster advance relative to rivals at other locations”* (Porter, 1998, p.84). There will be a similar positive feedback mechanism within the Entrepreneurial Ecosystem through new company formation.

Secondly, Porter found that one clusters from, they attain a self-reinforcing cycle drawing in new supporters: *“Once a cluster begins to form, a self-reinforcing cycle promotes its growth, especially when local institutions are supportive and local competition is vigorous. As the cluster expands, so does its influence with government and with public and private institutions”* (Porter, 1998, p.84). Similarly, Entrepreneurial Ecosystems will reach a self-reinforcing cycle, or tipping point after attaining certain size, attracting new supporters.

Thirdly, Porter and others have outlined that the development of a cluster with a clear competitive advantage over others take at least a decade to develop: *“Numerous case studies suggest that clusters require a decade or more to develop depth and real competitive advantage”* (Porter, 1998, p.85). Entrepreneurial Ecosystems will take, as do business ecosystems, around a decade to develop.

Fourthly, Porter identified three main ways in which clusters affect competitions: via an increase in productivity, via improved innovation (faster, learning early, more flexible and able to experiment at a lower cost) and via new business creation: *“Clusters affect competition in three broad ways: first, by increasing the productivity of companies based in the area; second, by driving the direction and pace of innovation, which underpins future productivity growth; and third, by stimulating the formation of new businesses, which expands and strengthens the cluster itself. A cluster allows each member to benefit as if it had greater scale or as if it had joined with*

others formally - without requiring it to sacrifice its flexibility” (Porter, 1998, p.80). Entrepreneurial Ecosystem will affect competition in similar ways.

Fifthly, Porter described how the access to public good, such as investments made in infrastructure or education, positively affect a company’s productivity: *“Access to Institutions and Public Goods. Investments made by government or other public institutions- such as public spending for specialized infrastructure or educational programs-can enhance a company's productivity. The ability to recruit employees trained at local programs, for example, lowers the cost of internal training. Other quasi-public goods, such as the cluster's information and technology pools and its reputation, arise as natural by-products of competition” (Porter, 1998, p.83).* Access to public goods in the Entrepreneurial Ecosystems will improve a startup’s productivity.

Lastly, in the business ecosystem literature, it has been found that weakness of one aspect of the ecosystem decreases the performance of the system as a whole: *“Prior research has suggested that business ecosystem **effectiveness** is dependent on the strength of each individual component and, thus, a weakness in one component decreases the performance of the entire ecosystem” (Iansiti & Levien, 2004).* An important consideration that we would like to push forward in the rest of our thesis is that if one of the ecosystem factors is below a certain threshold it will become a limiting factor for the system as a whole.

For Porter, good examples of clusters include, the Italian leather fashion cluster, the California wine cluster, the Hollywood entertainment cluster, the Wall Street Finance cluster or the Consumer Electronics Japan cluster. Here, it is easy to notice, that the Entrepreneurial Ecosystem concept differs notably, in that it is not industry specific, or specialised in a particular field, startups in the ecosystem come from a variety of industries. In our consideration of Entrepreneurial Ecosystems, they are industry agnostic. What brings together the firms within an ecosystem is not the sectoral focus, but rather the “high growth” potential that we mentioned before.

Additionally, not “many” include government and other institution, but there are clear stakeholders present in the Entrepreneurial Ecosystems globally, regardless of the geographic location. The importance of a particular stakeholder may differ from country to country, yet a healthy, thriving ecosystem will have a well-balanced set of stakeholders. Missing any would limit the performance and growth of the ecosystem as we will see with the system dynamics

model. Another difference arises from the boundaries of the cluster versus those of the ecosystem. For Porter, “Although clusters often fit within political boundaries, they may cross state or even national borders” (Porter, 1998). For us, even though we understand that startups within the ecosystem are connected to other global players, either through capital, talent or resources, we consider that these resources are part of the ecosystem once they enter. In this sense we are able to limit the scope of the ecosystem to a specific geographical location, of around ~100 km in diameter. As we are no longer looking into the supply chain, it is not necessary to extend the borders outside the geographical location where the ecosystem is situated.

Similarly to Porter’s consideration of competition and cooperation, both phenomena occur within the limits of the Entrepreneurial Ecosystem, and we consider that a healthy ecosystem will present both types of phenomenon. “Clusters promote both competition and cooperation. Rivals compete intensely to win and retain customers. Without vigorous competition, a cluster will fail. Yet there is also cooperation, much of it vertical, involving companies in related industries and local institutions. Competition can coexist with cooperation because they occur on different dimensions and among different players.” (Porter, 1998)

Therefore we can conclude that Entrepreneurial Ecosystem concept is **similar enough** that we can use some of the findings from previous literature from related concepts and build upon them. Yet different enough that the concept of the Entrepreneurial Ecosystem in itself should be considered as a **distinct and separate entity** from prior literature. The Entrepreneurial Ecosystem model provides a **unique scope, focus** and size, therefore we conclude that the entrepreneurial ecosystem is a **good conceptual design to study entrepreneurship**.

3.4. Novelty

The novelty of our research lies exactly in this, in exploring the causality, interactions and feedback mechanisms happening within the ecosystem, as it develops over time.

One of the key questions we will be asking is: how to assess the performance of an Entrepreneurial Ecosystem? Depending on how success is measured, the supporting policies towards the Entrepreneurial Ecosystem will be different. Therefore it is vital for us to determine what constitutes success, is it the number of new startups founded, the employment or wealth generated, the innovations created? This is the first question policy makers should ask

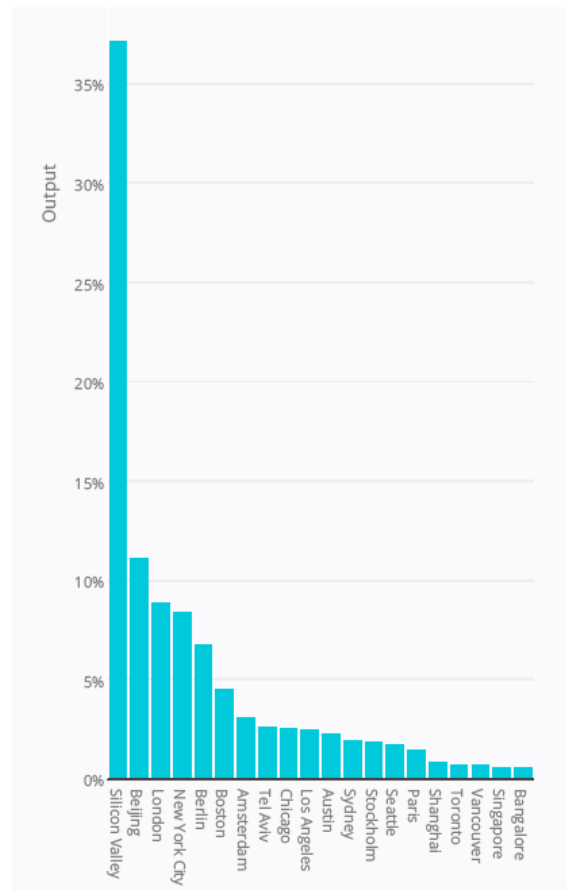
themselves, what will constitute success for them considering their regional strengths and weaknesses, as this question will guide the efforts to support the Entrepreneurial Ecosystem.

The practitioner literature, has noted the positive reinforcing mechanism that the attractiveness of a location may have in the development of the Entrepreneurial Ecosystem. Similar to the network effect, the phenomenon whereby the attractiveness and value of a product or service increases as more people use it (Uzzi, 1996). As entrepreneurs are dependent on their environment for success, the more attractive an ecosystem is, the more individuals and organizations there will be within it, and the more value that could be provided. In a nutshell, an area initially attracts talent, successful startups are created, thus increasing the attractiveness of the area and attracting even more talent in a positive and reinforcing manner. However, until now, to the best of our knowledge, no one has explored in more detail this concept and the causality relationships behind it. This will be one of the main objectives that we hope to accomplish with our research.

3.5. Reference Entrepreneurial Ecosystem

When thinking about a Entrepreneurial Ecosystem, the example that often first comes to mind is that of Silicon Valley. Silicon Valley, considered the “gold standard” of Entrepreneurial Ecosystems, mecca of entrepreneurship, and global leader in terms of startups, capital and exits (Startup Genome Project, 2017). Home to Intel, Oracle, Google, eBay and Apple, just to name a few, Silicon Valley is the classic example of an Entrepreneurial Ecosystem. Silicon Valley is a source of inspiration to other countries, as even still today, Silicon Valley concentrates over 35% of the startup exit value from the Top 20 Entrepreneurial Ecosystems (See Figure 3.1 (Startup Genome Project, 2017)). Exit value is arguably one of the key metrics to measure output in a comparable manner across countries and sectors, being possible to use it as a proxy to measure the value generated by a startup.

Figure 3.1: Distribution of Exit Value Among the Top 20 Entrepreneurial Ecosystems
(Startup Genome Project, 2017)



In addition, Silicon Valley is where the origins of the Entrepreneurial Ecosystem concept can be traced back to. Therefore quite understandably, Silicon Valley has had a deep impact worldwide, with political leaders aiming (or claiming) to replicate the Silicon Valley phenomenon in their own region. So much so, that there are at least 79 “Siliconia” (appropriations of names using a play on words on Silicon Valley, outside of this location) recognized by Wired (“Siliconia,” n.d.), such as Silicon Alley (New York), Silicon Fen (Cambridge), Silicon Valley of India (Bangalore), or even Japan’s Bit Valley (Shibuya). It seems like a near universal ambition to create the next Silicon Valley in your region, but as Isenberg pointed out, this can only set a government for frustration and failure (D. J. Isenberg, 2010).

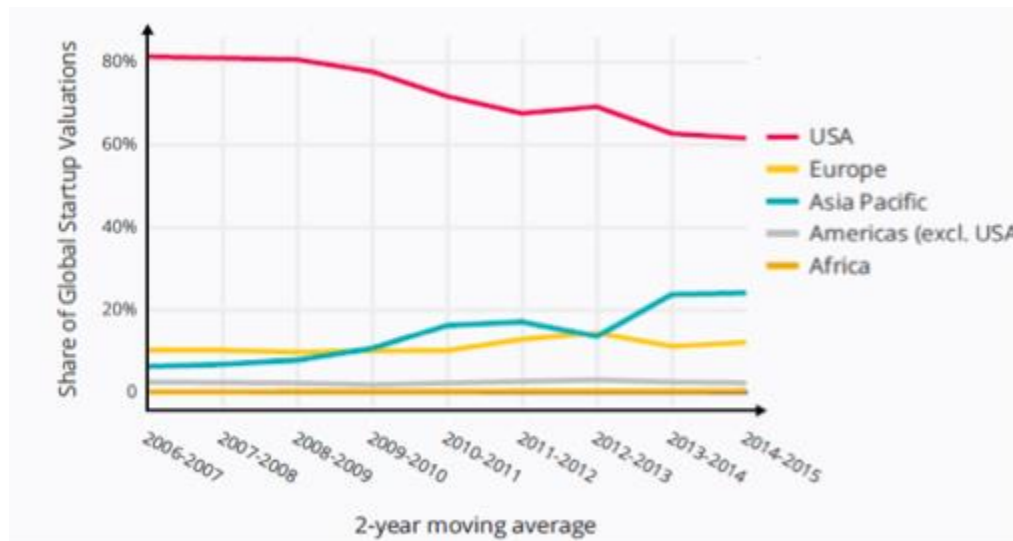
Much of the original literature on Entrepreneurial Ecosystems focuses on understanding how and why Silicon Valley developed and became the center for entrepreneurship worldwide. This was done in an attempt to create a “new Silicon Valley” elsewhere. Researchers, in

particular Steve Blank, have described the well-documented series of events that led to the development of Silicon Valley (Blank, 2008). In a nutshell, Silicon Valley developed thanks to the interaction of skilled STEM research in the universities surrounding the area (particularly Stanford), investment into defense R&D by the United States DoD (Department of Defense), and availability of highly talented human capital. The “*birthplace*” of Silicon Valley, however is often pointed out as being in a garage, more specifically the garage of Hewlett-Packard and their ability to seize the opportunity and rise to the electronic revolution. As well as Fairchild and the “Fairchildren”, or defectors that left Fairchild to build new semiconductor firms around the area.

These insights, though interesting, have limited value to other regions: as it is impossible to replicate history (D. J. Isenberg, 2010). As Adrian Turner pointed out, “it took 60 years to create the structural, cultural and financial infrastructure to repeatedly create new billion dollar tech based industries” (Turner, 2012). Governments should not spend time emulating Silicon Valley in their region, but rather understanding their own unique strengths and overcoming their shortcomings to create the most supportive environment possible for entrepreneurs in their region.

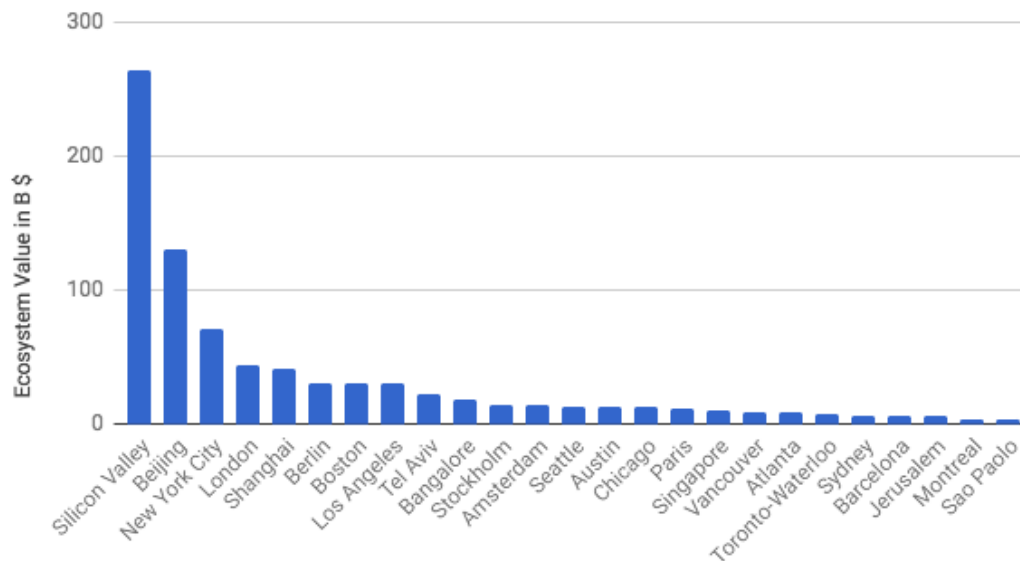
Even though Silicon Valley still concentrates a significant proportion of the global funding and value of startups (See Figure 3.3), its hegemony (and in general that of United States), has been steadily declining over time (See Figure 3.2) whilst other Entrepreneurial Ecosystems are becoming increasingly important.

Figure 3.2: Concentration of Startup Valuations by Region (Startup Genome Project, 2017)



Similarly to the value distribution seen in startups, where a significantly small number of the firms concentrate a disproportionately high value, the same is true for the Entrepreneurial Ecosystems (See Figures 3.1, 3.2 and 3.3). The global distribution of ecosystem value is captured by the top Entrepreneurial Ecosystems. The issue ecosystem stakeholders are trying to address is: how to become one of these top performing ecosystems?.

Figure 3.3: Ecosystem Value for the 25 Entrepreneurial Ecosystems with the highest aggregate value (Data: Global Entrepreneurial Ecosystem Report 2017: Startup Genome).



3.6. Entrepreneurial Ecosystem Literature Review

The Entrepreneurial Ecosystem is similar to other complex adaptive systems, in that a component considered in isolation does not explain the success or not of the ecosystem. The ecosystem is formed by different stakeholders, becoming more than the “sum of its parts”. Nonetheless, still today, the intricacies are not well understood.

As we mentioned, entrepreneurship doesn’t happen in a vacuum, but rather is a collective and systemic process that requires inputs, connections and support from a large variety of stakeholders. In that sense, the Entrepreneurial Ecosystem refers to all elements (individuals, organizations or institutions) that support (or inhibit) startup growth. These elements can be considered entrepreneurship stakeholders, and they have an interest, actually or potentially, in promoting entrepreneurship in their area (Simatupang, Schwab, & Lantu, 2015).

The ecosystem is composed by a network of actors, interacting to foster innovation, entrepreneurship and economic development in a particular region (D. Isenberg, 2011; D. J. Isenberg, 2010)

Following Peter Vogel's definition (Vogel, 2013) and based on prior literature, (Iansiti & Levien, 2004; Mason & Brown, 2014; Van de Ven, 1993) we follow the Entrepreneurial Ecosystem definition of:

*“a **dynamic and interactive** community, within a geographic region, composed of varied and **interdependent** actors (e.g. entrepreneurs, institutions and organizations) and factors (e.g. markets, regulatory framework, support setting, entrepreneurial culture), which **coexist, interact and evolve** over time to promote new venture creation.”*

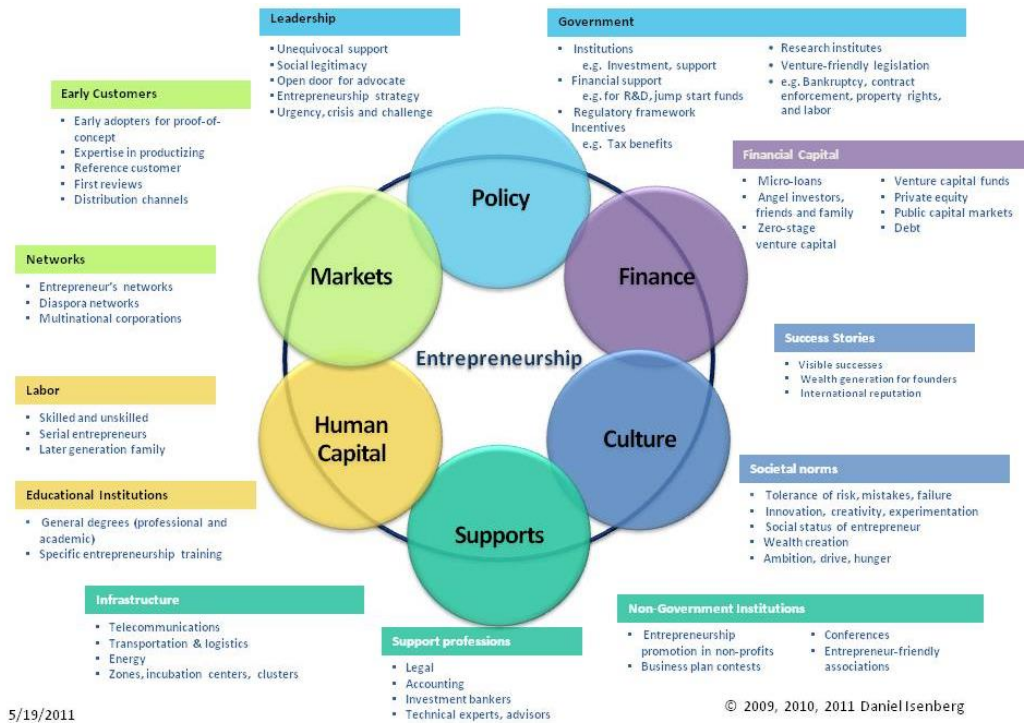
Entrepreneurs in a supportive environment will be more successful if they are able to benefit from the synergies and complementarities provided by other stakeholders, via multi stakeholder collaboration (Van de Ven, 1993). These stakeholder may be public, private, or non-profit, and may provide different services or support mechanisms.

In order for multi stakeholder to take place, there needs to be formal and informal information exchanges for stakeholders to be able to coordinate and collaborate efficiently (Simatupang et al., 2015). In this way, different stakeholders can come together in a geographical location, to collaborate and form the conditions necessary to foster entrepreneurship.

Previous researchers have shown that Entrepreneurial Ecosystem evolved organically, depending on regional conditions (socio-economic, political, cultural or even geographic) (Cohen, 2006).

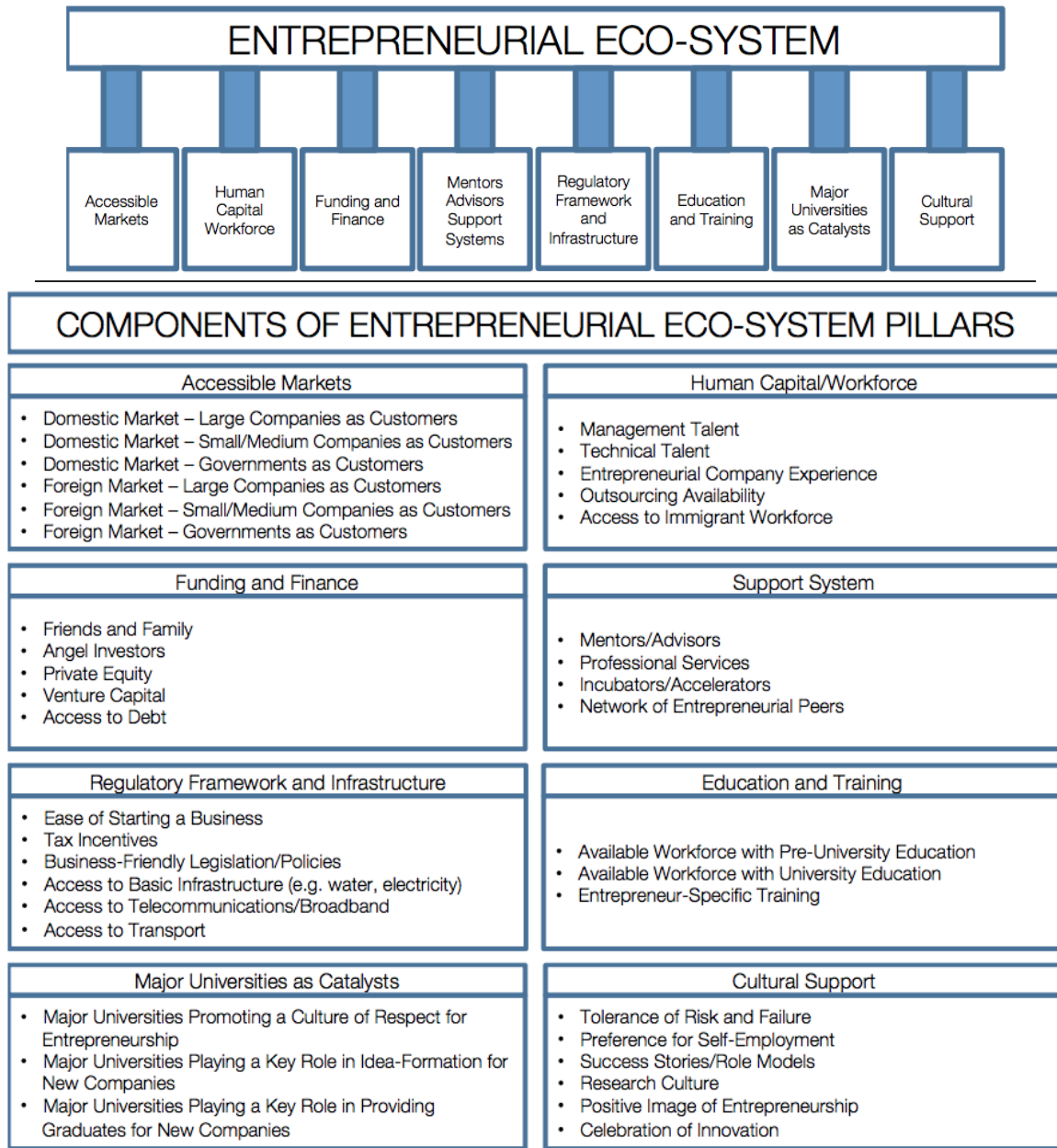
Until now, other researchers have focused on identifying which are the components necessary to create a successful Entrepreneurial Ecosystem. This is a useful first step for practitioners to see which items are present or missing from their own entrepreneurial ecosystem. Two of the pioneer works were that of Daniel Isenberg (D. Isenberg, 2011) which described the domains of the Entrepreneurship Ecosystem (Figure 3.4), and that of Foster et al. for the World Economic Forum that similarly described the Component Pillars of Entrepreneurial Ecosystem (Figure 3.5)(Foster et al., 2013).

Figure 3.4: Domains of the Entrepreneurship Ecosystem according to Daniel Isenberg (D. Isenberg, 2011)



5/19/2011

Figure 3.5: Components of Entrepreneurial Ecosystem Pillars (Foster et al., 2013)



In Table 3.5 below, we summarized the prior literature in Entrepreneurial Ecosystems. As can be seen, there is much overlapping and agreement between authors in which dimensions are important to foster entrepreneurship.

Table 3.5: Summary of the prior literature and the overlapping of the different categories

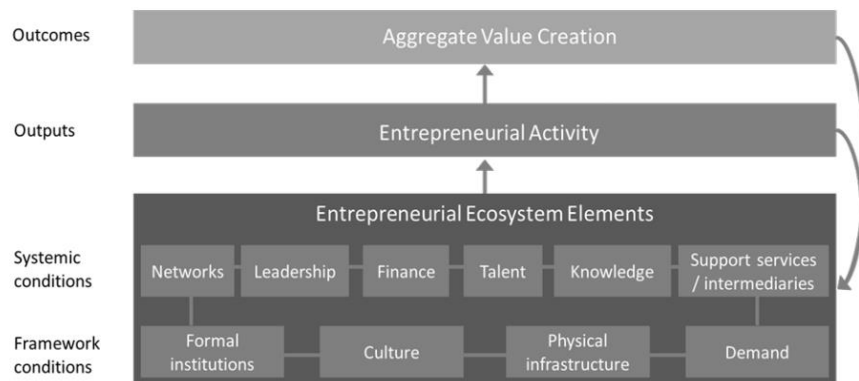
Study	Framework of Entrepreneurial Environments	Entrepreneurial system view of new venture creation	GEM Entrepreneurial Framework Condition	Domains of the ecosystem	Attributes of start-up community	Entrepreneurial ecosystem pillars	Ecosystem Components	Entrepreneurial Ecosystems	Entrepreneurial Ecosystems
Author/s	(Gnyawali & Fogel, 1994)	(Neck, Meyer, Cohen, & Corbett, 2004)	(P. Reynolds et al., 2005)	(D. Isenberg, 2011)	(Feld, 2012)	(Foster et al., 2013)	(Vogel, 2013)	(Mason & Brown, 2014)	(Stam & Spigel, 2016)
1. Human Capital	X	X		X	X	X	X		X
2. Support Services	X	X		X	X	X	X	X	X
3. Universities		X	X			X	X	X	X
4. Cultural Aspects			X	X		X	X	X	X
5. Government	X	X	X	X	X	X	X		X
6. Markets				X		X	X		X
7. Corporations					X			X	
8. Networks		X			X		X		X
9 Infrastructure			X				X		X
10. Other	Socioeconomic Conditions		R&D transfer		Leadership		Visibility, Geographic Location, Innovation	Information Rich, Entrepreneurial Recycling	

Although understanding these factors was a necessary and useful first step in comprehending the Entrepreneurial Ecosystem, these factors feel like a long “laundry list” with little connection or explanatory power on the development of the Entrepreneurial Ecosystem. It is known that these factors affect the survival and survival rate of entrepreneurs, yet how and why, the timing, interaction or feedback mechanisms there may be between factors, is still largely unknown.

Stam, recently explored a basic causality between the elements, outputs and outcomes, yet this was limited to a very simple relationship without much explanatory power. Stam

categorised the Entrepreneurial Ecosystem into four ontological layers whereby the intra-layer components interact as well as upward and downward causation that feeds back into the system (Figure 3.6).

Figure 3.6: Key Elements, outputs and outcomes of the entrepreneurial ecosystem (Stam, 2015)



3.7. Entrepreneurial Ecosystem Components

As the next in comprehending the Entrepreneurial Ecosystem, we would like to go through each of the above mentioned components and stakeholders and briefly describe why they are important to entrepreneurs and/or startup creation, growth or exit. In the pages to follow we will explore the components: Funding & Finance, Human Capital, Support Services, Universities, Cultural Aspects, Government, Markets, Corporations, Networks, Infrastructure and Other.

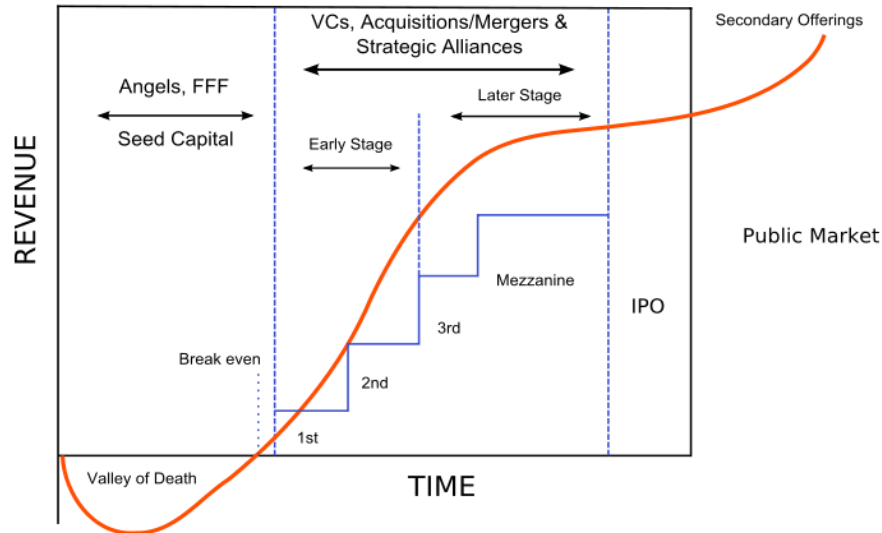
3.7.1. Funding and Finance

Access to funding is a critical factor for startup success and is well-recognised across the academic literature (van der Borgh, Cloudt, and Romme (2012); Kenney and Patton (2005); Malecki (2009)). The access to capital in the area is determined by combining a variety of sources and institutions that are able to offer funding and financing opportunities. As startups grow and scale they need access to different sources of finance funding, as their requirements change, to fuel their growth. Therefore, availability of capital is critical in the development of the

startups and thus the Entrepreneurial Ecosystem. Some of the necessary sources of capital and funding are:

- a. Angel Investors/Seed Investors: prior to raising Venture Capital, startups need to get some traction, to reach this point they often need early investors that provide the startup with seed capital. These are often Angel Investors, who are wealthy individuals (either generated wealth by their own entrepreneurial ventures or others).
- b. Venture Capital: startups require of a strong, dense, and supportive community of Venture Capitalists (both domestic and International firms, as well as Corporate Venture Capital) investing at the early and growth stage phases of a company. VCs provide the funding to the company, assuming a large part of the risk in case of failure, in return for a percentage in equity of the firm.
- c. Private equity: enables so-called “liquidity events”, such as an initial public offering (IPO) or a sale to a public company, in more mature firms.
- d. Alternative sources of financing: In addition, alternative sources of financial capital should be available, visible, and accessible across sectors, demographics, and geography (Feld, 2012). These include: personal savings and funding from the close circle of relationships (commonly known as friends, family and fools (FFFs)), low-cost loans, grants, crowdfunding, accelerators: often exchange equity for participation + initial funding (different models), microfinancing...

Figure 3.7: Distribution of funding over the startup lifecycle (Wikimedia Commons, n.d.)



3.7.2. Human Capital

As we saw, startups are characterized by having high growth, therefore it is vital for startup growth and scaling to have access to skilled human capital who are willing to work at startups (Arruda, Nogueira, & Costa, 2013; Audretsch, Falck, & Heblich, 2011; Bahrami & Evans, 1995; Harrison & Leitch, 2010; Spiegel, 2017).

These workers need to be able to work in a fast-paced environment, often more flexible, but with less salary, than if working for large, established corporations. It is also important that the workforce available has a variety of skills and education: from engineering and other technical talent, to business, management or vocational training.

There are many factors that affect the availability of human capital, yet some of the main sources of talent are:

- Large corporations: employ a large number of the workforce, and have an important role in training, as well as attracting recent graduates or human capital to come to work to the area by offering a job.
- Startups: Workers become experienced in working in an innovative, fast-paced environment, and may take the learnings in one startup and move on to the next

startup, with a recycling process happening within the startup community. In addition, the failure of one startup, can contribute to the success of another.

- Migration: the human capital in the area may be local residents or may have immigrated from other locations (both nationally and internationally). Migration phenomenon, will affect the human capital availability, positively in case of immigration phenomenon and negatively in the case of emigration. Global talent is a great addition to the Entrepreneurial Ecosystem, as they have different skill sets, languages, culture, adding diversity to an early stage company and possibly making it more competitive to compete globally. The governments, of the UK, Estonia, France or Singapore (insert citation) taking one step forward in creating special visas for founders and workers, for startups to access highly skilled employees. At this point we would like to bring up the access to talent across borders, via outsourcing of work or having remote workers. Many startups hire foreign workers, either because of a lack of talent availability in their own region or due to cost advantages of remote workers. However, in our study, we will consider that any resource (be it funding, or human capital or other), that enters the Entrepreneurial Ecosystem becomes part of the local environment.

3.7.3. Support Services

Apart from the financial resources, outlined previously, entrepreneurs need access to non-financial support services, and resources to build a successful company. These forms of assistance come from organizations or individuals such as accelerators, incubators, service providers or other support organizations.

- a. Incubators and accelerators: Solid presence of effective, visible, well-integrated accelerators and incubators, with connections expanding locally and internationally, that help startups in their early stages.
- b. Mentors and Advisors: Having many well-respected mentors and advisors giving back across all stages, sectors, demographics, and geographies (Feld, 2012).

- c. Professional Support Services and Service Providers: Entrepreneurial support services: legal (patent, IP, lawyers, HR, tax), accounting, real estate, insurance, consulting, experts, and export support are integrated, accessible, effective, and appropriately priced and targeted to the startup's needs (Vogel, 2013).

3.7.4. Universities

Universities and other higher education institutions have two main roles: first is to produce new knowledge spillovers and commercialization of new technologies (Audretsch et al., 2011; Dubini, 1989; Feldman et al., 2005; Wolfe, 2005), and second is the education and training of human capital (both new entrepreneurs and skilled workforce).

3.7.4.1. Commercialization of academic research

In the past, Universities were considered *the* source of Innovation into the Entrepreneurial Ecosystem. This was partly due to the initial success stories of certain University campuses that generated spillovers to their region. The most notable examples are probably, Stanford University's influence in the development of Silicon Valley, MIT's impact in Boston's Entrepreneurial Ecosystem development, and The University of Cambridge's importance in the development of "Silicon Fen". These success stories, influenced the perception that universities were the source of technological advances that lead to the development of the Entrepreneurial Ecosystem. This led to the development of Technology Licensing Offices (insert citation), with the hope of promoting more commercialization of research and bridging the gap between the academia and the industry.

Although this was true for some ecosystems, like the above mentioned Silicon Valley, Boston, or Cambridge that were deeply influenced by initial success stories of University commercialization, this is not true for all Entrepreneurial Ecosystems. For example, New York, considered the second largest Entrepreneurial Ecosystem by Startup Genome, does not have an engineering university in the city.

3.7.4.2. Training and Education

Nonetheless, it seems like the more ubiquitous and arguably more important role of universities is through education of the future workforce and via the promotion of entrepreneurship.

Leading Universities are a magnet for talented high school students and undergraduate students that move to the area to study in these education centers. This young talent is attracted to the University and they then make personal and professional connections during their time in the area and possibly, want to stay and work or create a startup after they graduate. The top universities of a country can attract the best talent from the country, additionally the best universities in the world can attract the top talent from all around.

Universities can be considered a source of human capital, recent graduates with a variety of expertise, from business to technical skills, that prepare them to work for a startup.

Equally important is offering entrepreneur-specific training, and promoting a culture of respect for entrepreneurship. During their time at University, it is a great opportunity for students to get first hand experience in what it is to be an entrepreneur and to develop an innovative business idea. Events, classes, business plan competitions, hackathons or other experiential learning can be of great value.

3.7.5. Cultural Aspects

Entrepreneurs are known for being challengers and divergers of the norms, therefore it is important that Entrepreneurial Ecosystems have a supportive public attitude toward entrepreneurship and its characteristics (mindset, ambitions, drive, creativity, self-efficiency and self-promotion skills).

Other important cultural aspects are the recognition and celebration of innovation and performance, for example via media coverage. This can have a great influence in the public perception and social status of entrepreneurs. As well as the acceptance or tolerance for risk and failure and the learning that it can provide.

In addition, Silicon Valley, the Entrepreneurial Ecosystem of reference, is known for its give back culture (give before you take), sharing nature (information and advice), and building upon each other's ideas.

3.7.6. Government Policy and regulatory framework

Both State and Regional policy are important for the development of the Entrepreneurial Ecosystems. Government intervention can affect, both positively or negatively, the Entrepreneurial Ecosystem and its attractiveness in many aspects. Therefore it is vital that government understands and supports startups (Table 3.6).

- a) Directly affecting startups: governments can influence startup success or failure directly at the three life stages of a firm (measures affecting the starting, running or exiting of a company).

Table 3.6: Examples of government influence factors on starting, running or exiting a business.

Ease of starting a business	<ul style="list-style-type: none"> ● Entry barriers: remove or impose ● Procedural requirements for registration and licensing ● Funding: direct or indirect investment vehicles
Ease of running a business	<ul style="list-style-type: none"> ● Number of institutions for entrepreneurs to report to ● Rules and regulations governing entrepreneurial activities ● IP protection: Laws to protect proprietary rights ● Labour law
Ease of exiting a business	<ul style="list-style-type: none"> ● Provision of bankruptcy laws ● Flexible labour laws to deal with startup uncertainty

- b) Indirectly affecting startups: governments may also influence other conditions that indirectly affect startup success, such as:

- Immigration: easen or burdening
- Tax incentives and exemptions
- Regional economic development
- Public research institutions and R&D availability
- Access to infrastructure, telecommunications/broadband, and transport

3.7.7. Markets

Equally important for startup growth is being able to access a pool of customers, whether that be locally or globally, and for there to be a startup friendly market, whereby the population is willing to buy and/or adopt the services/products from startups. As we mentioned, there are two market accesses:

- Domestic market reach
 - Local market: dependent on the population size, willingness to adopt products/services from startups.
 - Large/medium/small companies as customers
 - Governments as customers
- Foreign/global market reach
 - Strategic location
 - Unimpeded access to global markets
 - Taxation and other regulation

In terms of market reach, another important consideration is the collaboration between startups and large Corporations. Corporations can be customers or strategic partners, they can be great vehicles for startups to access new customers by collaborating with large, established businesses with networks. Corporations can improve a startup's market reach by giving them access to a larger customer base, and gaining more trust that comes from the corporation's brand image. The cooperation can be mutually beneficial. Also access distribution channels and suppliers. Achieve scale rapidly, by reaching to customers across the world.

3.7.8. Corporations

Aside from the abovementioned **market reach**, corporations are important to the Entrepreneurial Ecosystem in terms of providing **employability**. Often new individuals are attracted to the ecosystem as a source of potential job opportunities. Large established business play an important role in this sense, as they have a larger workforce, especially prestigious MNCs and can attract talent from other locations by offering competitive packages and benefits.

Corporations can **train** the workforce, providing their workers with additional skills. Once these people leave the company, they can take the acquired skills with them. If they then decide to join a startup, as well as an understanding of the corporate sector that can improve collaboration between startups and corporations, as they can serve as a link between startup and corporate world.

The presence of MNCs, can act as a **signaling effect**, growing opportunities for others. This is especially true when MNCs decide to establish R&D centers in an ecosystem. This signals good availability of talent in the area as well as a possible source of innovation and tech transfer, in the form of new methods and processes: IP, published scientific papers...

Finally, MNCs can also act as **acquirers** of startups for either their technology/assets or their talent (strategy known as acqui-hire), as well as be the possible source of source of new innovations.

3.7.9. Startup Community or Network

The startup community is one of the vital aspects of a healthy Entrepreneurial Ecosystem. It is composed of a variety of actors, with different roles, coming together and collaborating to create a thriving community.

Entrepreneurs need a strong network of (accessible and committed to the region) entrepreneurial peers to succeed in building their company. Having a group of other entrepreneurs that are going through the same process/struggles/challenges can be of great benefit for support and advice.

Interactions between entrepreneurs and other community members allow them to access and transfer information, facilitates collaboration, and allows for learning from other successful or unsuccessful ventures.

As in the case with other networks, the startup community is influenced by the “network effect”: the more members there are, the more benefits each member receives. This is due to each individual bringing their own information allowing for more information sharing, transfer of ideas, introductions, inspiration, competition, or coopetition.

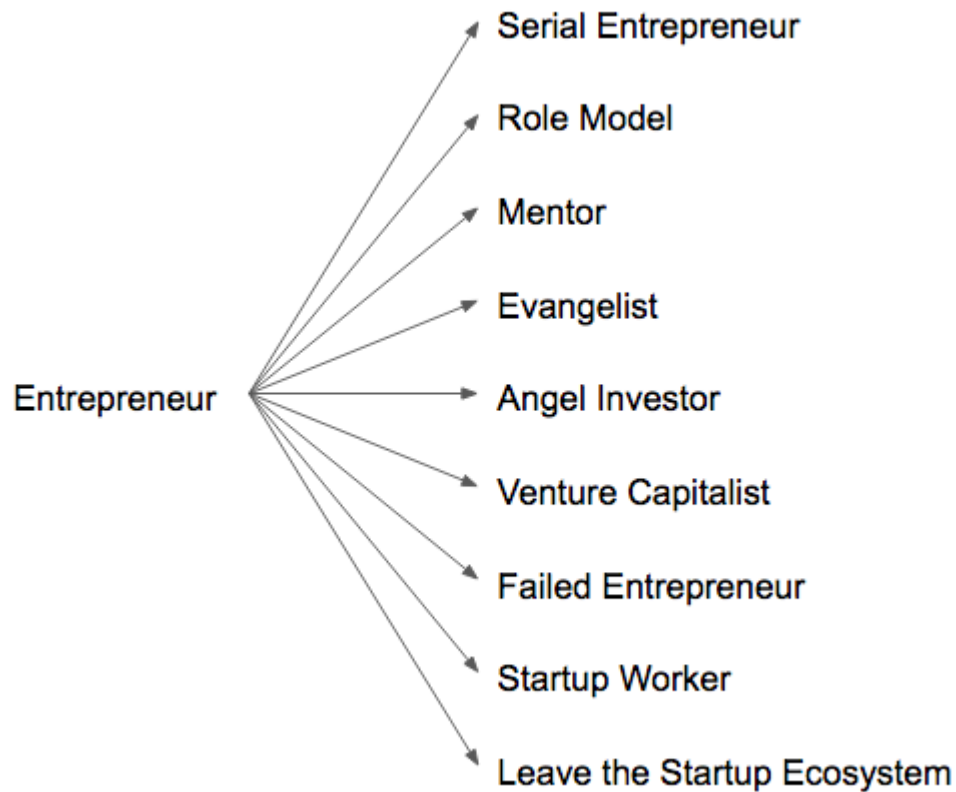
Neck et al. distinguish between two types of network: the Formal and Informal network:

- A. Formal Network: universities, government, professional and support services, capital sources, talent and large corporations) (Neck et al., 2004)
- B. Informal Network: Friends, family, colleagues and informal relations with similar companies) (Neck et al., 2004)

An important factor is the density of the network. A deep, well-connected community of startups and entrepreneurs along with engaged and visible investors, advisors, mentors and supporters (Feld, 2012). Optimally, these people and organizations cut across sectors, demographics, and culture engagement. Some of the events that bring the startup community together are: meetups, conferences, pitch contests, startup awards, media/press releases, hackathons, networking events, or bootcamps.

An important consideration of the startup community, is that the stakeholders and roles within it are diffuse and can vary over time (Figure 3.8). An entrepreneur may build another company in the future becoming a serial entrepreneur or may become a role model, mentor or evangelist, giving back to others within their community. An entrepreneur may also become an angel investor or venture capitalist, and reinvest part of their gains into new companies in the ecosystem. An entrepreneur may also become a failed entrepreneur that was unable to succeed in building their business, or may go on to work for a different startup or may just leave the ecosystem.

Figure 3.8: Multiple roles that an entrepreneur may play over time



3.7.10. Infrastructure

The availability of both physical and digital infrastructure and the ability to do business are highly related.

- Physical Infrastructure: Modern transport (roads, airports, public transport options) and logistics infrastructure, impacts movement of goods and people. Affordable office space is an important factor too, especially for high growth firms.
- Digital Infrastructure: telecommunications, ICT and connectivity.

3.7.11. Other Factors

a) Livability

People make decisions on where to live (either move or remain in an area) based on the opportunities available as well as the quality of life/livability conditions. Some of the conditions or resources that affect the livability and thus the attractiveness of the ecosystem as a whole are factors such as weather, transportation, or infrastructure or cultural and recreational attractions (gyms, parks, restaurants...).

b) Affordability

The lower cost of living and hiring of talent makes an ecosystem more attractive; possibility of doing more with the money raised. However, as the ecosystem expands, and talent becomes scarcer, hiring costs tend to increase.

Table 3.7: Variables affecting the attractiveness of the Entrepreneurial Ecosystem

Attractiveness of the Ecosystem	Component Factors
Talent	Local Population, Immigration, Universities, R&D centers, Corporations, Unemployment Rate
Funding	Venture Capital (local and foreign), angel investment, access to debt funding, FFF, Private Equity
Community	Successful Entrepreneurs, Events, Dealmakers, Mentors/Advisors
Market Reach	Local Market, Global Market Reach, Strategic Location, Supply Chain
Affordability	Office Space, Housing, Cost of Living
Resources	Accelerators, Incubators, Co-working Spaces, Service Providers, Support Organizations
Liveability	Weather, Infrastructure, Transportation, Quality of Life, Cultural Attractions

3.8. Simplification

Reached this point, we are able to understand that the Entrepreneurial Ecosystem is a **multi-stakeholder, complex and dynamic system**. However moving forward, it is important to be able to reduce the ecosystem to a set of variables that are well understood and deemed relevant for the problem at hand. As a vital step for analysing the development, it is important that we narrow down our scope and focus areas.

One possibility, to reach a simplification, is to use the work done by the World Economic Forum, whereby they surveyed **1042** entrepreneurs from around the world on which were the key pillars that determined the success of their companies (Breakdown of Respondents by Continent: North America 664, Europe 160, Australia/New Zealand 28, Asia 117, Middle East/Africa 20, South America and Mexico 53 (Foster et al., 2013)). Their findings showed that across countries, three main pillars were considered most important for success by entrepreneurs consistently; **Human Capital Workforce** (62%), **Accessible Markets** (60%), and **Funding and Finance** (59%) (Table 3.8, Foster et al., 2013). What is the most interesting is that the relevance importance of each of these factors is fairly extended, and shared amongst entrepreneurs globally, irrespective of their geographical location.

Other resources and ecosystem stakeholders are considered somewhat less important for the success of their company. The next in importance are, Mentors/Advisors/Support Systems (26%), Regulatory Framework (18%), Education and Training (15%), Major Universities as Catalysts (8%), and Cultural Support (18%) (Table 3.8, Foster et al., 2013).

Table 3.8: Most important Pillars for the growth/success of their company according to entrepreneurs in Entrepreneurship Ecosystems Globally (Foster et al., 2013)

Pillar	US - Silicon Valley	US - Other Cities	North America	Europe	Aus/NZ	Asia	MEA	South/Central America and Mexico	Average Score
Accessible Markets	44%	59%	53%	59%	74%	65%	68%	57%	60%
Human Capital Workforce	63%	70%	67%	64%	41%	67%	59%	63%	62%
Funding and Finance	64%	62%	63%	49%	56%	56%	55%	63%	59%
Mentors/Advisers/Support Systems	35%	24%	29%	23%	33%	27%	14%	22%	26%
Regulatory Framework/Infrastructure	10%	11%	11%	21%	19%	27%	14%	33%	18%
Education and Training	10%	14%	12%	17%	15%	23%	18%	9%	15%
Major Universities as Catalysts	17%	9%	13%	9%	7%	5%	5%	0%	8%
Cultural Support	31%	19%	24%	10%	7%	11%	32%	11%	18%

According to the World Economic Forum findings, the accessibility to talent (Human Capital Workforce), customers (Accessible Markets) and funding (Funding and Finance) are the most important factors to entrepreneurs around the world in order to build and grow their companies. This holds true irrespective of the availability of resources; even in countries where one of the resources was not as readily available, such as Accessible Markets from South/Central America and Mexico, or Funding and Finance from Asia (Table 3.9).

Table 3.9: Most readily available Pillars across Entrepreneurial Ecosystems (Foster et al., 2013)

Pillar	US - Silicon Valley	US - Other Cities	North America	Europe	Aus/NZ	Asia	MEA	South/Central America and Mexico
Accessible Markets	92%	83%	85%	72%	69%	68%	68%	62%
Human Capital Workforce	93%	87%	90%	81%	81%	73%	50%	71%
Funding and Finance	91%	76%	82%	57%	69%	44%	55%	45%
Mentors/Advisers/Support Systems	91%	72%	78%	52%	58%	38%	36%	35%
Regulatory Framework/Infrastructure	67%	57%	62%	54%	54%	39%	55%	42%
Education and Training	80%	62%	70%	60%	38%	34%	32%	27%
Major Universities as Catalysts	88%	67%	75%	52%	42%	30%	23%	27%
Cultural Support	90%	64%	75%	33%	35%	26%	45%	16%
Average Score	86%	71%	77%	58%	56%	44%	45%	41%

Across all geographies, accessibility to talent (Human Capital Workforce), customers (Accessible Markets) and funding (Funding and Finance) are considered the most important

pillars to create and grow our company throughout the world. Therefore when building our generic model of Entrepreneurial Ecosystems that can be applied to geographies globally, we will be primarily focusing on these three pillars.

For future work, the method used by the World Economic Forum, a questionnaire for entrepreneurs, is a simple and insightful way of understanding the relative importance of each of the Entrepreneurial Ecosystem components to **adapt** the model to the **peculiarities** of the geography.

3.9. Gap in the Literature and Next Steps

As can be seen from the above literature review and summary of the Entrepreneurial Ecosystem literature, until now, most academics have been focused on listing and describing what are the elements that compose the ecosystem. There is sufficient research describing these elements, nonetheless it is a very static, almost “laundry list” approach. There is very limited research on how startup ecosystems grow and evolve, what are the enablers and inhibitors for entrepreneurship, and how value is generated within the region.

Therefore my goal is to build a dynamic model of a generic entrepreneurial ecosystem that can be used to understand the enablers and inhibitors for entrepreneurship and how the ecosystem grows and evolves over time according to varying circumstances.

Secondly, in terms of innovation policy making, as has been pointed out by several authors, “the quest to generate the next Silicon Valley become something of the ‘Holy Grail’ for regional policy makers intent on ‘replication’, (Neck et al., 2004, Isenberg, 2011, Feldman, 2014). Globally, numerous ecosystem stakeholders aim to replicate Silicon Valley in their region without considering the regional circumstances.

Therefore my second goal is to adapt the generic model to several regional entrepreneurial ecosystems to explain the historical dynamic development of each region and how this is related to different rates of value generation within the region. With the aim of creating a tool for policy-makers to understand how their efforts can affect the development of their ecosystem and be able to maximize innovation and entrepreneurship regionally.

Chapter 4: System Dynamics Model of the Entrepreneurial Ecosystem

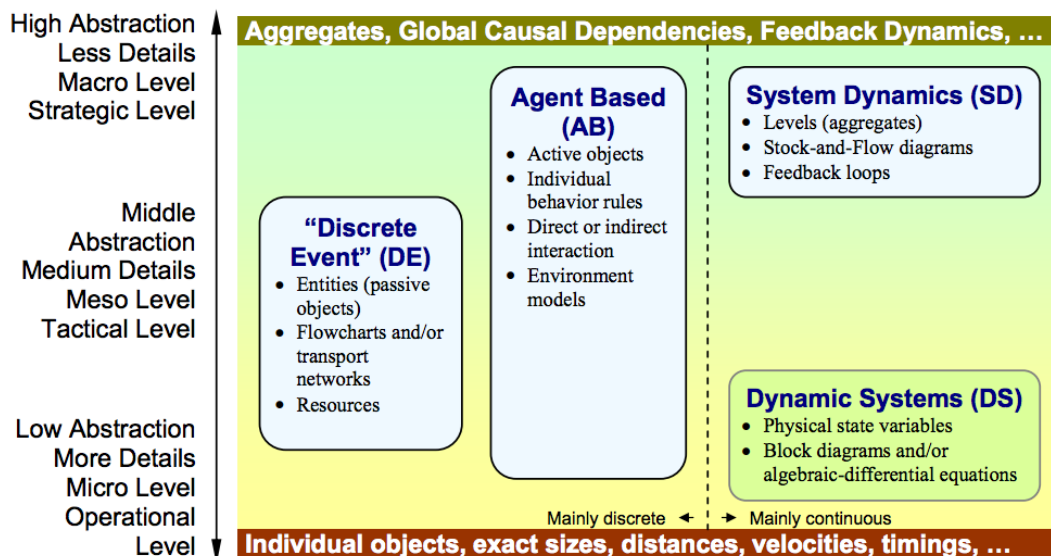
Chapter 4: System Dynamics Model of the Entrepreneurial Ecosystem

This chapter introduces the methodology that we have selected to model the Entrepreneurial Ecosystem; system dynamics modeling, and explains the reasons for the selection. As well as defines the steps taken to devise our model, the modelling purpose, the setup of the reference mode as well as the initial validation.

4.1. Introduction to System Dynamics

After exploring several alternative methodologies, we opted to use Systems Thinking and System Dynamics modeling as it was able to capture the complexity, high abstraction level and strategic importance of the Entrepreneurial Ecosystem (See Figure 4.1). If we remember from the the definition of the Entrepreneurial Ecosystem we need a methodology that is able to capture the dynamic, interactive, interdependent and evolving nature of the Entrepreneurial Ecosystem and system dynamics is able to do just that.

Figure 4.1: Approaches in Simulation Modeling on Abstraction Level Scale (Borshchev & Filippov, 2004)



System dynamics was developed by Jay Forrester (Jay W Forrester, 1971; Jay Wright Forrester, 1997), in the 1950s, at MIT (Massachusetts Institute of Technology) as the means to frame, understand and discuss complex issues, especially those addressed that aim to analyse and design policy issues. System dynamics is interdisciplinary in nature, so it fits well with the multidisciplinary nature that the Entrepreneurial Ecosystem entails.

As Lewis Thomas pointed out when considering systems: *“If you want to fix something you are first obliged to understand ... the whole system ... Intervening is a way of causing trouble”* (Thomas, 1979). This is applicable to the Entrepreneurial Ecosystem too. In this way, our first goal is to use Systems Thinking and System dynamics to **gain a better understanding** on the **interactions and feedback mechanisms** that take place within the Entrepreneurial Ecosystem, as the first step in **guiding future intervention and development** of regional Entrepreneurial Ecosystems.

4.2. Application of System Dynamics to the Entrepreneurial Ecosystem

John D. Sterman, another of the leading scholars in System Dynamics outlined (J. D. Sterman, 2001) what are some of the sources of dynamic complexity that system dynamics can help to explain. Following his outline, we have proposed how the system characteristics may apply to the Entrepreneurial Ecosystem, in an effort to explain the selection of the methodology (Table 4.1).

Table 4.1: Sources of dynamic complexity in the Entrepreneurial Ecosystem: why use system dynamics to explore the Entrepreneurial Ecosystem (J. D. Sterman, 2001).

System Characteristics	Application to Entrepreneurial Ecosystems
1. Constantly Changing	Entrepreneurial Ecosystems are changing constantly at different timescales. For example, the total number of startups over the course of a year may not change much, yet, individually many startups will have failed and others will have been created and taken their place. As well as having a constant entrance and exit of resources and people into the system.
2. Tightly Coupled	Actors and stakeholders of an Entrepreneurial Ecosystem (entrepreneurs, investors, mentors, policy-makers) are closely connected and interact constantly, transferring information, resources or advice between them.
3. Governed by Feedback	There are numerous positive (reinforcing) and negative (balancing) mechanisms affecting the attractiveness and thus size of the Entrepreneurial Ecosystem, as we will later see.
4. Nonlinear	The effects of certain triggers are often disproportionate to the causes, in a nonlinear fashion, due to the interaction of many stakeholders and delay mechanisms present in the Entrepreneurial Ecosystem.
5. History Dependent	The conditions of the ecosystem are dependent on culture and historical events and conditions especially since the development of the ecosystem takes several decades.
6. Self-Organizing	Without any external actions, stakeholders are able to come together self-connect and interact spontaneously.
7. Adaptive	The Entrepreneurial Ecosystem is constantly adapting over time to new stimuli, and reaching new equilibriums according to input and output

	factors.
8. Characterized by Tradeoffs	Short-term and long-term effects of policy decisions and interventions can be very different in the development of the Entrepreneurial Ecosystem. It is important to design policies without the constraints of a short-term political agenda, by better understanding dynamic relations.
9. Counterintuitive	In the development of the Entrepreneurial Ecosystem, a cause and its effects may be very distant in time, making it difficult to find the underlying cause that is able to explain the change. Correlations between cause and effect tend to be distant in time and space.
10. Policy Resistant	Our interventions in the development of the Entrepreneurial Ecosystem can create unanticipated side effects and to be defeated by the intervention in itself due to feedback mechanisms.

4.3. Reasons for Selection of the Methodology

Some additional reasons for selecting system dynamics to analyse the problem at hands were the following:

1. Able to achieve a high level of complexity; understand the complex relationships between variables in our problem of study (See Table 4.1).
2. Simplicity and elegance to capture complex processes; closer to reality than other approaches (Wolstenholme & Coyle, 1983)
3. Test mutual causations; understand the interaction mechanisms between different variables
4. Understand feedback mechanisms; interpret the balancing and reinforcing effect of feedback mechanisms in our problem of study
5. Testing policy-making; testing policies before their implementation to estimate how the system may perform, as a rapid and cost-effective first approach.

When considering complex systems, such as is the Entrepreneurial Ecosystem, with multiple stakeholders, connections and feedback mechanisms, our mental models are limited by our own cognitive limitations. As Herbert Simon said, “the complexity of the world dwarfs our understanding” (Simon, 1996). Our mental models are “**limited, internally inconsistent, and unreliable**” (J. D. Sterman, 2001) and tend to be “**static, narrow and reductionist**” (J. D. Sterman, 2001). The systems thinking approach and the act of modeling in itself provided us with invaluable understanding of the relationships between variables, and ways in which to refine and modify our mental model. In isolation, some of the relationships we point out might be intuitive, but when considering the behaviour of the whole system, we have detected many unintuitive feedbacks that would have otherwise been impossible to address without systems thinking.

The modeling process allowed us to gain a **deeper understanding** of the problem at hands, and helped drive the discussions with a variety of stakeholders, for them to understand how their actions may relate to the development or lack of thereof of the Entrepreneurial Ecosystem and the further refinement of our model. When discussing with different stakeholders, we realised that our mental models were often very different, incomplete or biased towards our own field of expertise. In this way, discussing with the aid of the systems thinking and system dynamics modeling allowed to better understand the phenomenon occurring within the Entrepreneurial Ecosystem. We realized that other researchers, policymakers, entrepreneurs or stakeholders shared our same pain, of having an incomplete understanding and imperfect appreciation on how the Entrepreneurial Ecosystem develops over time and what effect different policy making may have on the development of the Entrepreneurial Ecosystem. As we built complexity levels and interactions, we became aware that our own cognitive limitations would have not allowed us to achieve this type of understanding of the problem and the dynamic relations, without the use of system dynamics.

Furthermore, Entrepreneurial Ecosystems **develop over a long time period** (over several decades), making it difficult to understand what were the initial triggers that helped the development and easy to dismiss the importance of trigger effects or policies may have delayed results. We have seen that governments globally, have tried to replicate Silicon Valley (“Siliconia,” n.d.) (See Chapter 4) by looking at Silicon Valley today and what stakeholders and

policymakers are doing right now. Yet, without considering the mechanisms that allowed for the development of Silicon Valley or their own local strengths or constraints, this approach has limited value. Additionally, because of the delay between cause and effect, it is possible that decision makers may be misguided with regards to what were the actual connections between policies and events.

In the modeling process, we will be identifying patterns of behaviours and trying to build a model that is able to mimic these changes. At a second stage we will be able to test how this model responds to different policy making. We hope to leverage the better understanding of the development of the Entrepreneurial Ecosystem to create more robust policies.

4.4. Motivation Behind our Study

Until now, the Entrepreneurial Ecosystem literature had focused primarily on studying single components and their effects on entrepreneurship. However, as Simatupang (Simatupang et al., 2015) points out, “*dynamic interdependencies between the various system components have received limited research attention*”, and “*the evolutionary dynamics of entrepreneurial ecosystem development and the identification of corresponding stages of entrepreneurship ecosystems development deserve research attention*”. This is what our study will focus on, understanding the **interaction effects and complementarities** between stakeholders and their actions in the development of the Entrepreneurial Ecosystem.

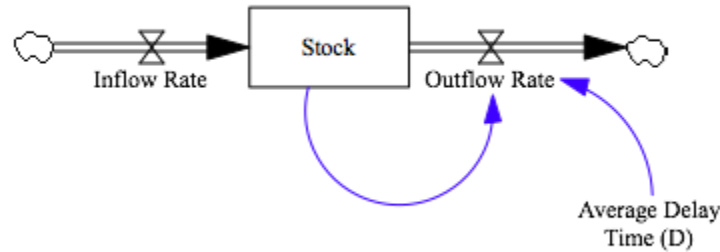
4.5. Elements of Dynamic Systems

There are four main elements that compose dynamic systems: **accumulation/dispersal, feedback mechanisms, time delays, and nonlinearities** (J. D. Sterman, 2000). Together they add complexity levels to the system and make it oftenly behave in counterintuitive ways.

Table 4.2: Elements that compose dynamic systems.

Elements	Description
Accumulation and dispersal	<p>Stocks and flows are the basic components of system thinking and system dynamics. In a nutshell, stocks are the state of a variable experiencing a problem, whilst flows are how the system changes over time. The dynamic behaviour occurs through a process of accumulation, or a flow building up into a stock. On the other hand, dispersal takes place when a resource in a stock is reduced due to a flow.</p>
Feedback mechanisms	<p>One of the behaviours that system dynamics allows us to identify is that of feedback; when an output is fed-back to modify the next action. Feedback often create counter-intuitive and difficult to predict behaviours.</p> <ul style="list-style-type: none"> • <u>Positive feedback</u>: Positive feedback loops are those that show a self-reinforcing mechanism over time; where an action generates more of the result which in turn generates more of the action. These can make a system either grow or decline, amplifying whatever is happening in the system. • <u>Negative feedback</u>: Negative feedback loops keep a system at a particular stage, having a stabilizing, self-correcting effect.
Time delays	<p>There is often a significant period of time separating an intervention or corrective action and the results. Therefore often we see effects of overshooting or instability (J. D. Sterman, 2001), specially when cause and effect are often distant in space and time.</p>
Non-linearities	<p>The effects of certain triggers are often disproportionate to the causes, in a nonlinear fashion, due to the interaction of many stakeholders and delay mechanisms present in the Entrepreneurial Ecosystem.</p> <p>In our case, we would like to identify and take advantage of these nonlinearities for better resource allocation: is there any actions that may have disproportionate effects or consequences?</p>

Figure 4.2: Overview of a Stock, Flow and Delay mechanisms employed in System Dynamics



The flow within a System Dynamics Model is expressed by the rate of change with respect to time of a certain variable, and mathematically it is equivalent to a differential equation. The flow into a stock is called an inflow rate (rate at which the stock increases over time), whereas the rate out of a stock is called the outflow rate (rate at which the stock decreases over time) (Figure 4.2). In System Dynamics, both the inflow and outflow rates have a “valve” that is able to control the rate at which the stock enters or leaves.

The net flow can be calculated for every stock, which is the change over time of its state (ds/dt). The net flow can either be positive, negative or zero according to the difference in inflow and outflow.

$$d(Stock)/dt = Inflow(t) - Outflow(t)$$

- Positive: An inflow (positive net flow), makes a stock accumulate:

$$\frac{ds}{dt} > 0, \text{ for interval } [a,b]$$

- Negative: An outflow (negative net flow), makes a stock deplete:

$$\frac{ds}{dt} < 0, \text{ for interval } [a,b]$$

- Zero: A stock is in equilibrium when it has a zero net flow/is stationary:

$$\frac{ds}{dt} = 0, \text{ for interval } [a,b]$$

Stocks are the state variables that describe the status of the system and which may be accumulated over time. Therefore, the mathematical equivalent of a stock is the integral of the net flow added to the initial value of the stock.

$$Stock(t) = \int_0^t [Inflow(s) - Outflow(s)]ds + Stock(0)$$

Where Stock (0) is the value of the stock at t=0

In most of systems, the order of outflow is independent to the inflow, as the inflow can be well mixed with the initial quantity in the stock and flow out which give each quantity a different delay time. In this case, the behavior of the system is calculated based on the average delay time. The outflow from a first-order material delay is linearly proportional to the stock (S(t)) by average delay time (D).

$$Outflow(t) = Stock(t) / D$$

$$dS(t)/dt = Stock(t) / D$$

$$dS(t)/dt - Stock(t) / D = 0$$

$$S(t) = S_0 e^{-t/D}$$

(Choopojcharoen et al. (2012))

The above is a first-order homogeneous differential equation which can be solved by using integrating factor method (where S_0 is the initial quantity in stock). However, delays also occur in higher order system where there are multiple stocks. In order to solve for general higher-order delays, a system of differential equations is needed. Most of the time, computer simulation is required for analyzing higher-order delays with large number of stocks, as analytical solutions are either unknown or computationally challenging (Sterman, 2000). (Choopojcharoen et al. (2012))

4.6. Software Package for the Computer Simulation

To create our model and conduct the computer simulations, we used the software package **Vensim PLE**. This software, allowed us to build complex relationships between variables (stocks, flows, feedback loops...) and to relate the variables via equations that explain these relations. The Vensim package also allowed us to calculate a numerical solution to the problems and phenomena we were analyzing, and thus explain the different achievable equilibriums. In a sense, the behaviour of our system will be more than “the sum of its parts”. The simulation will allow us to gain a better understanding of the problem, by calculating simulated solutions.

4.7. Purpose of the Modeling Process

First of all, before defining the model purpose, we would like to state who the target audience of our model is. We hope that our model is used by **policy makers** and other **Entrepreneurial Ecosystem stakeholders** (entrepreneurs, VCs, accelerators, mentors or other supporters) that would like to better understand the development of the Entrepreneurial Ecosystem in their region over time, and how to enhance/strengthen/support the future development of their area.

With these stakeholders in mind, the purpose of our model is twofold: to create a **tool** that brings a **better understanding** to the important processes that occur in the **development** of Entrepreneurial Ecosystems, as a vital **first step** to be able to **guide future development**.

Gain a Better Understanding:

There are few well-known and documented success stories of Entrepreneurial Ecosystems globally, yet startups are perceived as a promising way to value creation within a region. We believe that by building a system dynamics model we can enhance the learning opportunities from the successful Entrepreneurial Ecosystems, and apply these lessons to other regions with developing Entrepreneurial Ecosystems.

- a. We believe this is an opportunity to improve our and other Entrepreneurial Ecosystem stakeholders’ understanding. As Entrepreneurial Ecosystems are a fairly new academic concept, are broad in nature, multi-stakeholder and take

several decades to develop, we think that system dynamics can bring valuable insights and understanding. To develop our mental models, not think so narrowly and to identify and recognise feedback mechanisms that may be guiding the dynamics within the development of the Entrepreneurial Ecosystem.

- b. Help ecosystem stakeholders identify their role within the ecosystem and the rippling effect of their actions, in an effort to realise the network effect, possible complementarities, and find mutually benefiting opportunities.
- c. Become en par with the practitioner literature which until now is more developed than is the academic literature.

Guiding of Future Actions

The second purpose of the model is to guide the actions necessary towards creating a more supportive Entrepreneurial Ecosystem

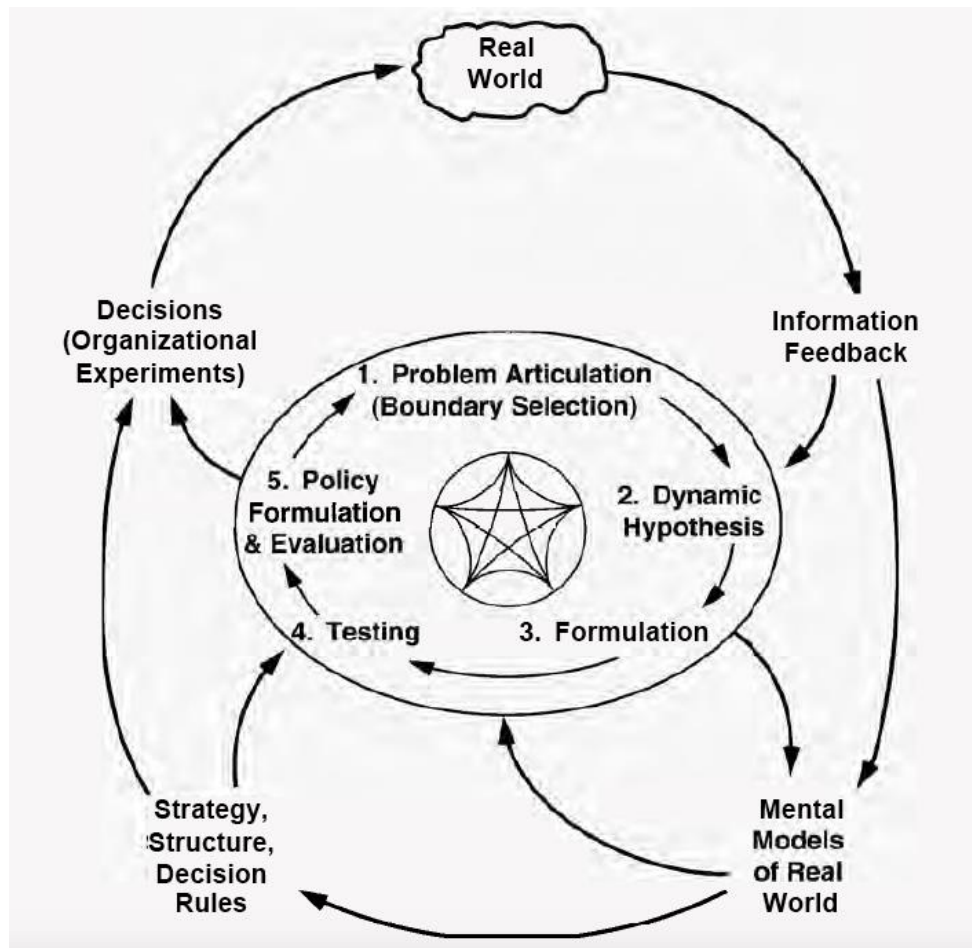
- a. Secondly, the purpose behind this model is to help guide policy makers better understand the development and reinforcing and balancing mechanisms that take place in the development of the Entrepreneurial Ecosystem, and thus allow them to **designing more effective policies** to support entrepreneurs and the development of the Entrepreneurial Ecosystem. The model may also help policymakers in their decision making process by helping them identify objectives that are aligned with their long-term goals. The feedback loops that dominate the development of Entrepreneurial Ecosystems, take several decades to occur, yet modeling tools allows us to see these effects in a matter of minutes. Policy-makers may fall into short-term thinking because of the lack of understanding of their actions in the long term. (Short-term vs. long-term consequences might be different or even contradictory if you don't recognise the importance of feedback mechanisms)
- b. Policy-makers have limited resources for allocation to support entrepreneurship, therefore a system dynamics model may help them in identifying which is the most effective resource allocation.

It is worth noting that the purpose of our study is **not** to create a decisive/definite/conclusive model of the Entrepreneurial Ecosystem, as this will require the input from other researchers and stakeholders and a better understanding of the development of Entrepreneurial Ecosystems globally. In addition, our aim with the modeling, is not to predict the future state of the system, as this is impossible except for in the short term (Shmueli, G., 2010) (Batty, M., 2001), but to provide a tool for policy makers to design a more resilient system that is able to withstand change, whatever that change may be.

4.8. Modeling process

Our goal is to model the structure of the Entrepreneurial Ecosystem, as following the system dynamics principle, the structure gives rise to the system's behaviour (J. D. Sterman, 2001). Our purpose is to explore possible scenarios and unintended long-term consequences of policy making, not exact model prediction. Following J. D. Sterman, we will proceed with the modeling process outlined in Figure 4.3. Namely; selecting the boundaries of our problem, defining the dynamic hypotheses, formulating the System Dynamics model, testing the model, formulating and evaluating the hypotheses and repeating these steps continuously.

Figure 4.3: Modeling iteration: constant iteration between experiments in the virtual and learning in the real world (J. D. Sterman, 2000)



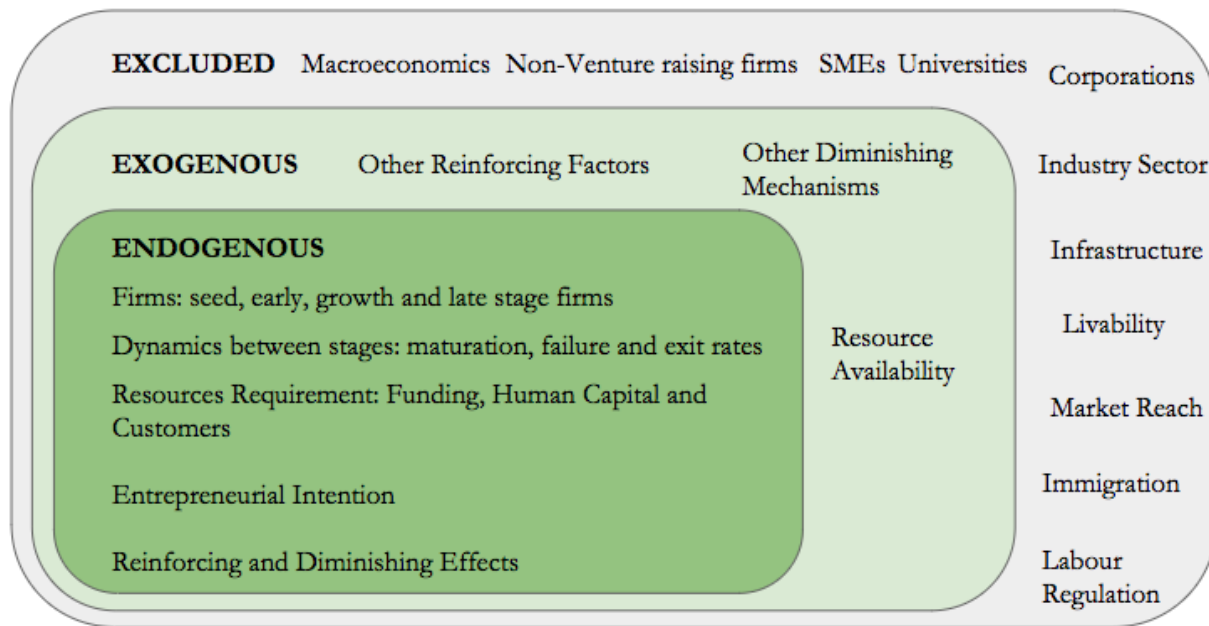
Model boundaries

According to J. D. Sterman, instead of trying to model the whole system, we will focus on a particular set of problems to solve. In this way, we can set boundaries to our problem, that will allow us to discard variables that do not directly affect the problem in question, although they may be part of the Entrepreneurial Ecosystem.

We would like to clarify the **model boundaries** that we have selected and that we believe are the components that are necessary to generate the behaviour of interest intended with our model (Figure 4.4). To do so, we initially brainstormed which components may form part of the system as got rid of those that were unnecessary, aggregated those that were similar and used directional components that could be measured for all variables.

We then proceeded to categorize them into three categories: endogenous variables within our model, exogenous variables to our model or excluded variables from our model.

Figure 4.4: Boundary Definition of the Entrepreneurial Ecosystem Model



Endogenous Variables

Factors in a model whose value is determined by the states of other variables in the system. They are considered to be dynamic, as they change in time as their values are calculated at every time step of the model. All variables that are part of a loop are called endogenous or auxiliary variables.

Exogenous Variables

Factors in a model whose value is independent from the states of other variables in the system and are only affected by factors or variables outside the system under study. Exogenous variables can have a constant value (called constants or parameters) or predefined pattern (called table or transfer functions).

Excluded Variables

Factors not considered in the current model. To explain some of the exclusions of our model, we did not include non-venture capital raising startups or SMEs as it is not possible for us to track them according to the current model we proposed. Universities are not explicitly included in the model, yet the two most important contributions that they make, are accounted for. These are the attraction and training of Human Capital in the region and firms originated from University research established as spin-offs and going forward to raise further funds. The infrastructure is not directly accounted for, yet will be one of the factors that determines the Ease of Doing business in the area. Corporations are not directly considered, yet via their support mechanisms to startups like Corporate VCs or Corporate Accelerators, as well as via firm acquisition, they are accounted for. Immigration or labour laws are not directly accounted for, yet they will be one of the affecting factors affecting the availability of Human Capital in the area. The livability or attractiveness of the area is not a factor that is currently directly accounted for, but its results: the attraction of Human Capital and other resources to the area is. Also the industrial sector or focus are not currently being considered, as the Entrepreneurial Ecosystem is formed from firms from different industries and business models. This is an important point to note in order to understand how our model differs from other models that have been created for example to explain the rise and fall of an industrial cluster. In those cases, as the cluster is built around one sector, it is typical to see the rise, stagnation and finally fall of the cluster following industrial cycles. However within the Entrepreneurial Ecosystem, the fall of a particular industrial sector would be offset by the rise of another industry that may be disrupting it. In this case we do not expect to see the same dynamics as those that happen in the industrial cluster.

Key variables in the model

Next we identified which are the **key variables** to assess the status of a Entrepreneurial Ecosystem, are those that measure the positive spillover effects that are happening as a result of the startups, and in the case of our model these would be as follows:

- Size of the ecosystem: number of firms in the area and breakdown by stage. However this is not enough as the impact/socio economic effect that startup have on their region greatly depend on the stage of the firm and area of expertise.

- A proxy for the value being created within a Entrepreneurial Ecosystem can be tracked by the “Size of the Ecosystem”; calculated from the sum of firms across stages (seed, early, growth and late). This may serve as a proxy for value creation because the more firms in the ecosystem, the more employment being generated, the more innovative products and services being created, the more customers being served, the more economic value being generated within the region, to name a few.

However, it is not just the “Size of the Ecosystem” that is important but also the **stage** of firms within it. This is true as later stage firms are larger in scale and are bigger creators of employment, products and value than are earlier stage firms. Therefore two ecosystems with equal number of firms but one of which had higher number of late and growth stage firms, would have a higher value generation. Nonetheless, our model is able to track both the size as well as composition and thus we are able to estimate the value creation over time across the three value propositions being tracked: creation of employment, creation of wealth and serving customers with products and services. Therefore, although the causal loop diagram captures the variable as “Size of the Ecosystem”, we will be tracking also the value generating activities.

- Employment generation: in this case it would be direct employment generation by these fast-growth firms. However as we previously mentioned, startups have spillover effects that expand beyond their own firm, creating employment in other supporting industries.
- Wealth creation: in this case we will be using the measure of funds raised, as a proxy to the positive impact that startups are having in the region. Startups are still privately owned firms, therefore capital raised (which is a function of the valuation) is the closest measure to market capitalization that we currently have.
- Creation of innovative products/services: number of customers that they are reaching by providing innovative products and services to them.

- Time: time required for the firms to grow, scale and have the positive spillover effects. All above variables will be tested to see how their values may change over time according to several modeled scenarios.

4.9. Causal Loop Diagrams

We began our modeling by conceptualizing and deciding which was the basic mechanism of the system that explained its dynamic behaviour. In a nutshell, all factors that affect the size of the ecosystem (which is being used to trace value creation within the region). This may happen via three mechanisms; factors affecting new firms being created, factors affecting the survival rate of existing firms, or factors affecting the failure rate of existing firms.

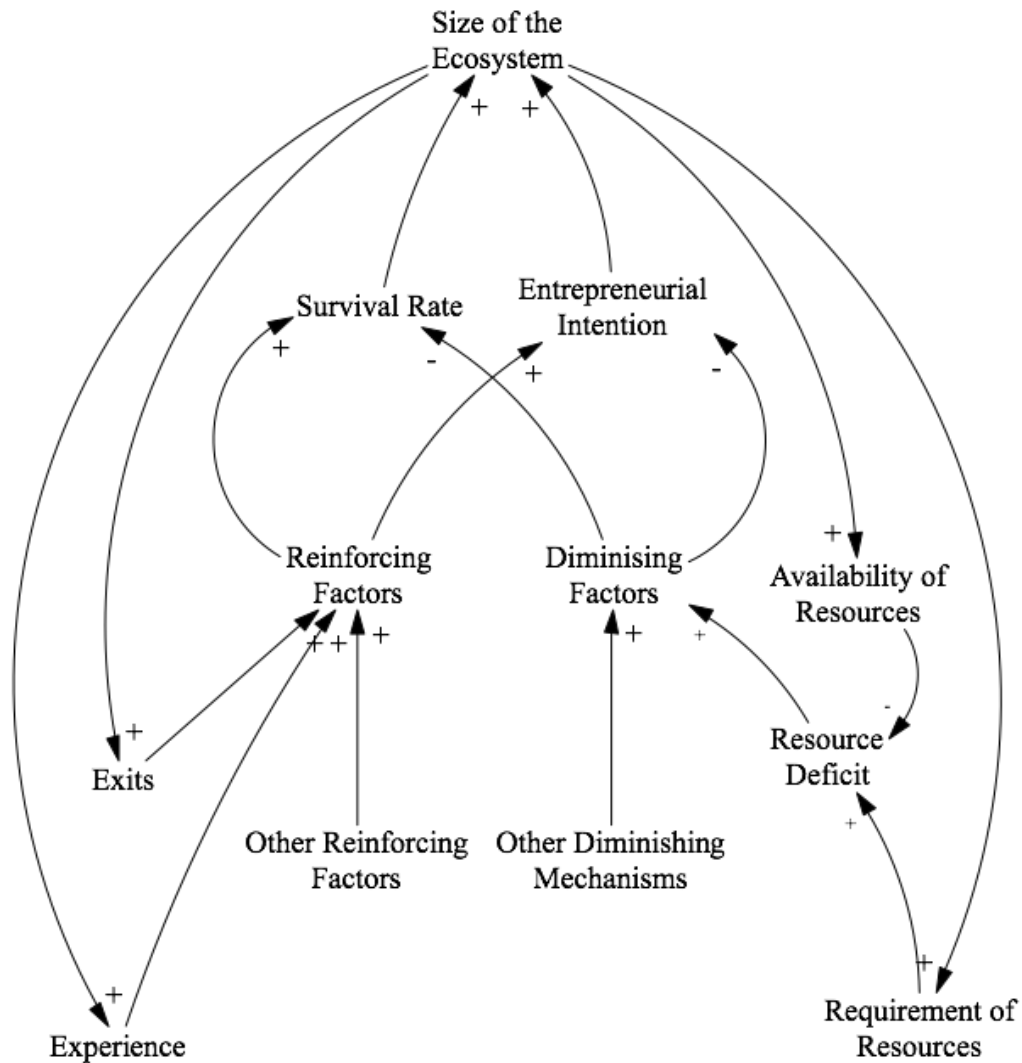
We then established the causal loop diagrams that explained the different mechanisms that affect the development of the Entrepreneurial Ecosystem. With this, we were able to capture in an intuitive way how the different variables affected, either positively or negatively, the system. For each pair of variables we considered *ceteris paribus* (if all other variables were to remain constant), how the variable at the tail of the arrow would affect the one at the head of the arrow. If it the effect was a movement in the same direction, we used the plus sign (+), whilst if the variables were moving in the opposite direction, we used the minus sign (-).

Causal loop diagrams allow for gaining basic understanding of the relations and feedback mechanisms within the system, yet are inadequate for simulation, as it is possible that the behaviour of the component loops is different when taking into consideration the overall system, or there may be hidden loops or non-linear relations that cannot be understand exclusively looking at the causal loop diagram. (System Dynamics, 2018)

We then described the feedback (reinforcing and balancing) mechanisms affecting our problem of study. The variables and relationships were discovered by a combination of literature review, conversations with over 100 experts (entrepreneurs, Venture Capitalists, Accelerators, Policy Makers and other ecosystem stakeholders) from ecosystems all around the world (Silicon Valley, New York, Boston, London, Cambridge, Paris, Lyon, Berlin, Munich, Madrid, Barcelona, Amsterdam, Rotterdam, Zurich, Tel Aviv, Jerusalem, Seoul, Taipei, Beijing, Shanghai, Myanmar, Vietnam and Tokyo) held during the course of my PhD, and personal experience after having worked for 3 years, firstly founding a startup in Japan, and secondly within a Support

Organization (Deloitte Tohmatsu Venture Support) working together with Startups, corporates and Innovation Policy makers to support the development of the Entrepreneurial Ecosystem. The outcome of these interviews and systems thinking can be found on Figure 4.5.

Figure 4.5: Causal Loop Diagram between variables in the Entrepreneurial Ecosystem



4.10 Reinforcing Mechanisms

A closed cycle is either defined as a reinforcing or balancing feedback loop. A reinforcing loop is a cycle in which the effect of a variation in any variable propagates through the loop and returns to the variable reinforcing the initial deviation. Throughout the review of the academic literature and the interviews with the ecosystem stakeholders, we identified there were 4 major reinforcing mechanisms that support the development of the entrepreneurial ecosystem, outlined in Figure 4.6 and described on Table 4.3.

Figure 4.6: Causal Loop Diagram with the Reinforcing Mechanisms of the Entrepreneurial Ecosystem

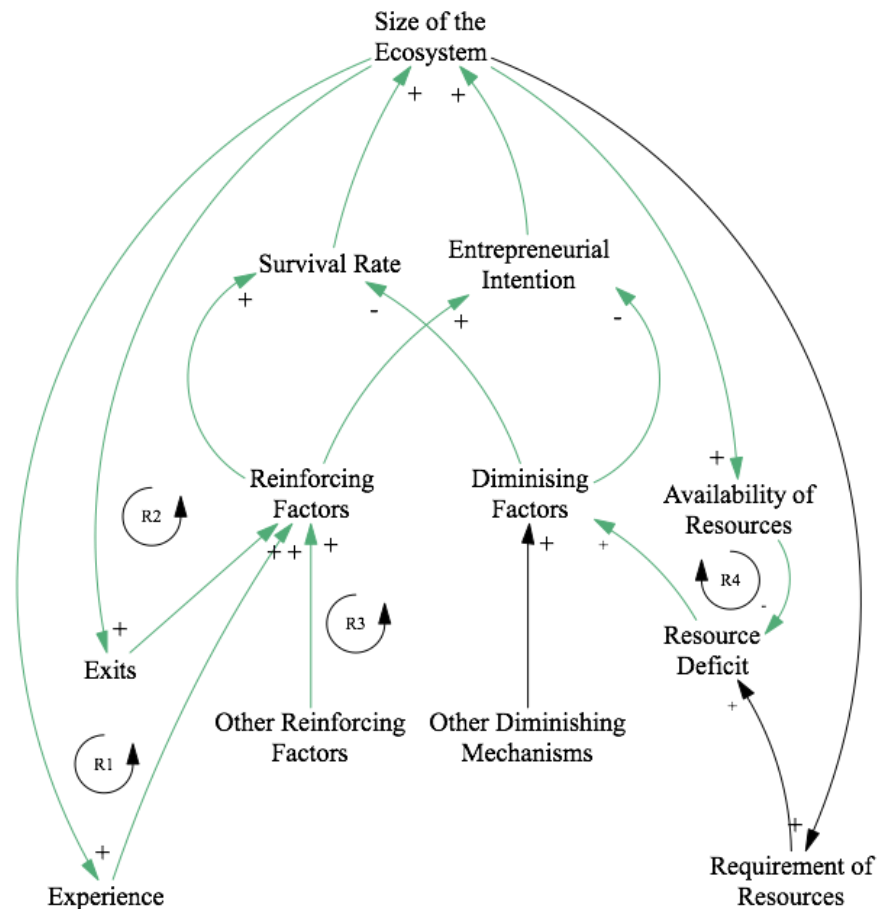


Table 4.3: Reinforcing Mechanisms Supporting the Development of the Entrepreneurial Ecosystem

Loop	Description
R1: Experience Reinforcement	<p>The larger the size of the ecosystem, the more vibrant the ecosystem become as knowhow accumulates and is shared (speakers, influencers, mentors or working for a different startup) (Isenberg, 2009, Mason, 2008, Mason & Harrison, 2006, Westhead & Wright, 1999):</p> <ul style="list-style-type: none"> ○ Variable: “Survival Percentage” (seed, early, growth and late) increases over time. <p>Also, the more likely that individuals with entrepreneurial tendencies get to meet an entrepreneur within their network, having a role model that may encourage them to start their own business (Brown et al., 2017, Malecki & Spigel, 2017, Feldman, 2014.):</p> <ul style="list-style-type: none"> ○ Variable: “Entrepreneurial Intention Rate” increases over time.
R2: Exit Reinforcement	<p>Exits lead to a more positive attitude towards entrepreneurship, and thus more people wanting to pursue the opportunity of starting and running their own business, as well as exited entrepreneurs become serial entrepreneurs, building new companies (Parker, 2013, Isenberg 2010, Napier et al., 2011, Feldman, 2006, Stuart et al., 2003):</p> <ul style="list-style-type: none"> ○ Variable: “Entrepreneurial Intention Rate” increases over time. <p>Successful exits within an ecosystem lead to higher survival percentage over time, as experienced entrepreneurs know how to run, scale and exit a business and provide advice to others going through the same process (Zhang, 2011, Gompers et al., 2006):</p> <ul style="list-style-type: none"> ○ Variable: “Survival Percentage” (seed, early, growth and late) increases over time (to note that the later the exit, the larger the effect it will have: non-linearity).
R3: Other Reinforcing Mechanisms	<p>Support Institutions, informal networks and other reinforcing factors help entrepreneurs in running their companies (Miller and Bound, 2011, Clarysse et al., 2015):</p> <ul style="list-style-type: none"> ○ Variable: “Survival Percentage” (seed, early, growth and late) increases over time. <p>They also provide tools and support to non-entrepreneurs, allowing them to have a better understanding or resources of what is needed to build a company, thus increasing the rate than the entrepreneurial intention is realized (Isenberg, 2009):</p> <ul style="list-style-type: none"> ○ Variable: “Entrepreneurial Intention” increases over time.
R4: Network Effect on Resource Availability	<p>The larger the ecosystem, the more attraction of resources into the area (network effect, signaling effect). The ability to secure resources means less startups fail and thus larger the ecosystem becomes.</p> <ul style="list-style-type: none"> ● Increased availability of resources (Lipper & Sommer, 2002, Harrison et al., 2010, Brown et al., 2017): <ul style="list-style-type: none"> ○ Funding: investors with positive returns may reinvest part of their gains aiming for additional returns and also may attract other

	<p>investors to do the same</p> <ul style="list-style-type: none"> ■ Variable: “Yearly Funding Available” increases over time. ○ Human capital: employment is being created in the area (by new startups being created and startups scaling in size), therefore acting as a signaling effect and attracting job seekers to move to the area in search of opportunities <ul style="list-style-type: none"> ■ Variable: “Yearly Human Capital Available” increases over time. ○ Customers: notoriety and media exposure of startups, helps in building the trust of the public in these firms, and the willingness of customers to buy startups’ products and services <ul style="list-style-type: none"> ■ Variable: “Yearly Customers Available” increases over time.
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4.11 Balancing Mechanisms

A closed cycle is either defined as a reinforcing or balancing feedback loop. A balancing loop is the cycle in which the effect of a variation in any variable propagates through the loop and returns to the variable a deviation opposite to the initial one. Throughout the review of the academic literature and the interviews with the ecosystem stakeholders, we identified there were 2 major balancing mechanisms that may hinder the development of the entrepreneurial ecosystem, outlined in Figure 4.7 and described on Table 4.4.

Figure 4.7: Causal Loop Diagram with the Balancing Mechanisms of the Entrepreneurial Ecosystem

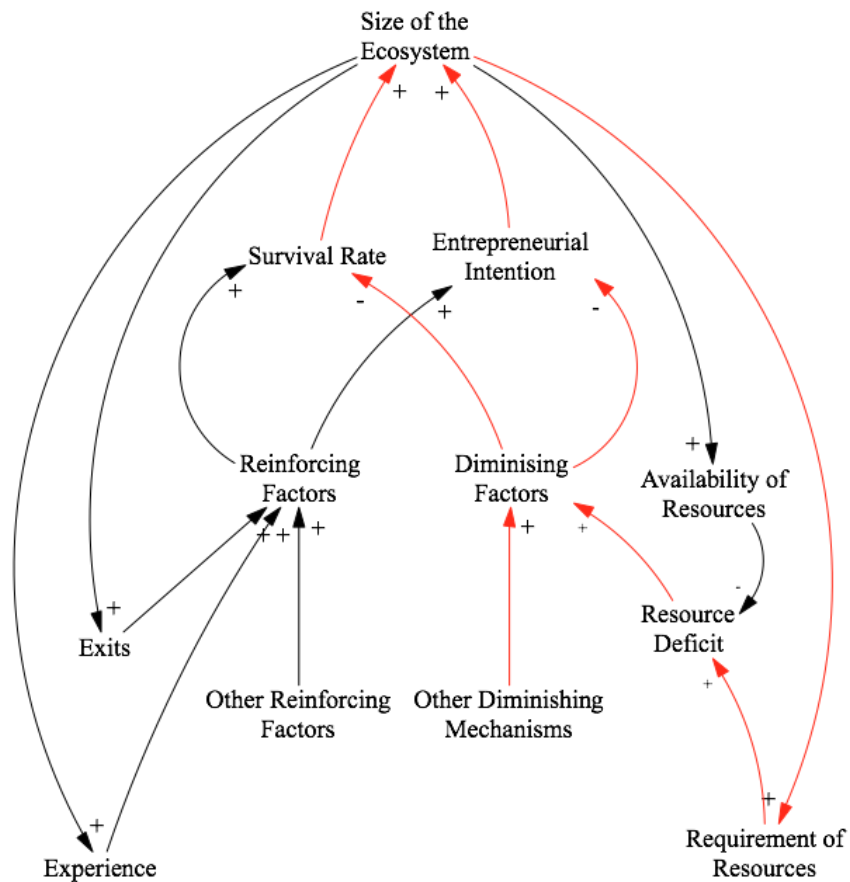


Table 4.4: Balancing Mechanisms Affecting the Development of the Entrepreneurial Ecosystem

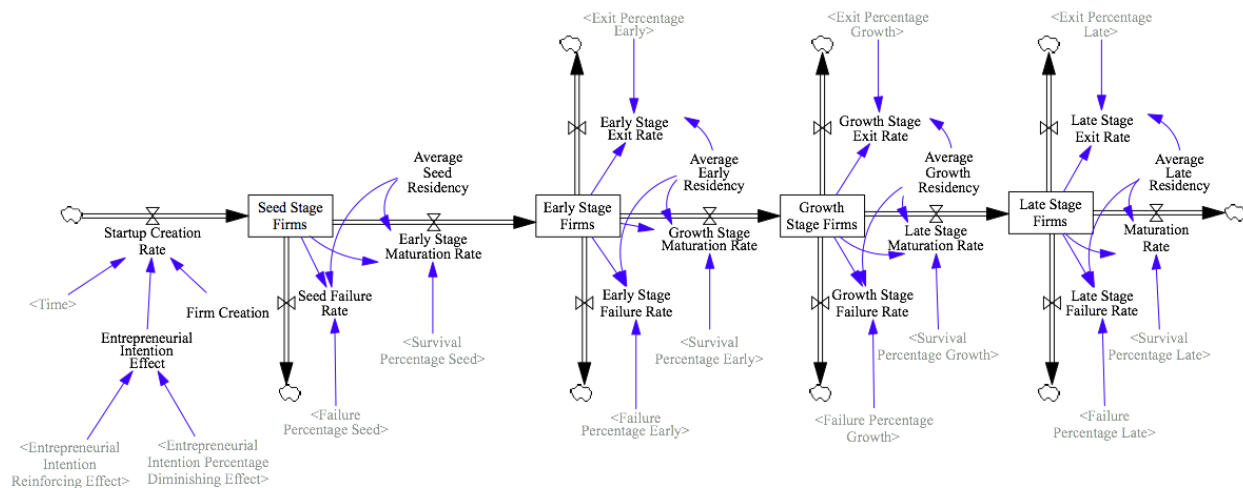
Loop	Description
B1: Competition for Resources	<p>The larger the size of the ecosystem, the more resource requirements the firms have, reducing the resource availability, leading to other firms not being able to secure the resources they need in order to survive and grow, thus reducing the size of the ecosystem over time (Acs et Al, 2014, Roundy et al, 2018).</p> <ul style="list-style-type: none"> ○ Variable: “Survival Percentage” (seed, early, growth and late) decreases. <p>The larger the size of the ecosystem, the more competition for resources, and more firms being unable to secure resources for their growth triggering a slower rate of entrepreneurial intention, as aspiring entrepreneurs might believe it is too difficult to succeed in the competitive environment.</p> <ul style="list-style-type: none"> ○ Variable: “Entrepreneurial Intention Rate” decreases
B2: Other Balancing Mechanisms	<p>The more difficult it is to create and run a business in the area, the less entrepreneurial intention the population will have, as it will be hard to start and run your own company, deterring certain entrepreneurs to be from doing so (Roundy et al, 2018).</p> <ul style="list-style-type: none"> ○ Variable: “Entrepreneurial Intention Rate” decreases <p>The more difficult it is to create and run a business in the area, the more failure there will be, leading to a smaller size in the ecosystem.</p> <ul style="list-style-type: none"> ○ Variable: “Survival Percentage” (seed, early, growth and late) decreases

After describing the causal relations between various components of the system we then transformed the Causal Loop Diagram model into a System Dynamics simulation model. Each of the variables was formulated mathematically to sustain the above mentioned causal relations. With the final goal being, that the complete model is capable of performing quantitative assessment that can be verified against observed dynamic trends. If the model is able to explain these trends, it can then be used to test different scenarios for comparative studies and as a policy analysis tool. The System Dynamics model was composed of 5 inter-connected constructs that connected the 107 Parameters within the model and the 6 feedback mechanisms (4 reinforcing and 2 balancing) mechanisms explained in Table 4.3 and 4.4.

4.12 Mathematical Description of the Dynamics of the Entrepreneurial Ecosystem

According to our research, we determined that there are four distinguishable stages in the lifecycle of a startup: **seed**, **early**, **growth** and **late** (See Figure 4.8). A startup begins as an idea in the mind of an entrepreneur, then the entrepreneurs may find one or more co-founders to build their company and either bootstrap (self-finance) or raise some **seed** funding from angel investors or serial entrepreneurs (seed stage). The team starts working on developing their product or service, and may manage (or not) to raise some **early stage** funding (series A and B) to keep scaling their business. This new company may continue to grow, creating new employment, producing more innovative products and services and raising more funds to fuel this growth, becoming a **growth** (series C and D) or **late stage** firm (series E and later). At one point the firm may experience an exit (either by a Merger & Acquisition (M&A) or an Initial Public Offering (IPO)) providing a return on investment (ROI) on all of those that supported the startup throughout their lifecycle entrepreneurs and investors alike. However, the chances of success across all stages are very low, and the startups might fail at any of the above stages, and the remaining resources (human capital, time, know-how) will be released back into the ecosystem adding to the pool of available resources for other startups to use.

Figure 4.8: Lifecycle of Startups across Stages (Startup Lifecycle Construct)



The four stages considered in the model are modelled as an “aging chain” (Figure 4.8). It is important to note that the model does not intend to capture the dynamics of an individual firm, but rather, this is an aggregated **macro overview** of the firms in an area, grouped by their

development stage. At each of these stages, startups can either succeed and proceed to the following stage, after the delay period, or they can fail and/or leave the ecosystem.

The function that we used to model this “aging chain” is that of a “perfectly mixed scenario”. In our model, we are accounting for firms of different industries (Manufacturing, Life Science, Education, Sports, Transportation, Security, Space, Advertising, Banking, Retail...), technologies (Hardware, Software, AI, Blockchain, IoT...) and business models (B2B, B2C, B2B2C...), and aggregating them based on the investment cycles that are common to all in the 4 mentioned stages (seed, early, growth, late). We are therefore using approximations and an average residency time for all of these different firms. However due to the difference in the nature of the firms, as well as the capabilities of the founders (more and less experienced/better-worse at running a company), there will be firms that will either take shorter or longer to move on to the next stage. Therefore modeling each of these four stages as a perfectly mixed scenario with an average residency time allows to account for these differences.

The model equations for the Startup Lifecycle construct are described in Table 4.5.

Table 4.5: Equations of Model Parameters involved in the Startup Lifecycle Construct

Parameter	Equation
Startup Creation Rate	Startup Rate(Time)*Entrepreneurial Intention Effect
Seed Stage Firms	(Startup Creation Rate)-(Seed Failure Rate)-(Early Stage Maturation Rate)
Early Stage Maturation Rate	(Seed Stage Firms*Survival Percentage Seed)/Average Seed Residency
Seed Failure Rate	Seed Stage Firms*Failure Percentage Seed
Early Stage Firms	Early Stage Maturation Rate-Early Stage Exit Rate-Growth Stage Maturation Rate-Early Stage Failure Rate
Growth Stage Maturation Rate	(Early Stage Firms*Survival Percentage Early)/Average Early Residency

Early Stage Failure Rate	Early Stage Firms*Failure Percentage Early
Early Stage Exit Rate	Early Stage Firms*Exit Percentage Early
Growth Stage Firms	Growth Stage Maturation Rate-Growth Stage Failure Rate-Growth Stage Exit Rate-Late Stage Maturation Rate
Late Stage Maturation Rate	(Growth Stage Firms*Survival Percentage Growth)/Average Growth Residency
Growth Stage Failure Rate	Growth Stage Firms*Failure Percentage Growth
Growth Stage Exit Rate	Growth Stage Firms*Exit Percentage Growth
Late Stage Firms	Late Stage Maturation Rate-Continued Growth Rate-Late Stage Exit Rate-Late Stage Failure Rate
Continued Growth Rate	Survival Percentage Late*Late Stage Firms
Late Stage Failure Rate	Late Stage Firms*Failure Percentage Late
Late Stage Exit Rate	Late Stage Firms*Exit Percentage Late

4.13 Building of the Reference Mode

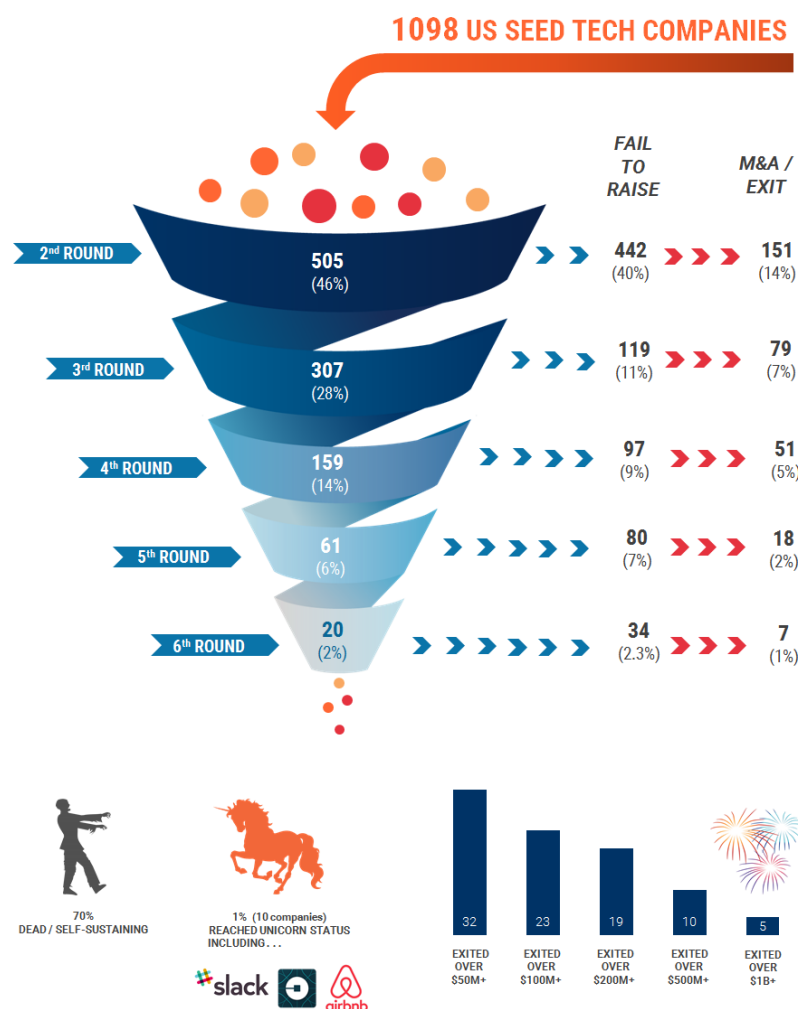
In building our reference mode we looked for longitudinal studies that had followed the success and failure of a cohort of startups over time. The best data source that we were able to find was that of CB insights. CB insights performed an interesting study in which they shed some light in what they call the “Venture Capital Funnel”, showing the percentage of companies that are able to raise further rounds of investment over time (CB Insights, n.d.). They tracked a cohort of 1,098 startups from the moment they raised their first seed investment (between 2008 - 2010), in the United States, until 2017. These 1,098 firms, were selected on the basis that they had disclosed their valuations over time.

Out of the 1,098 companies that raised a seed round between 2008-2010, 46% were able to raise a follow on round (series A), 28% series B, 14% series C, 6% series D and 2% series E. As time goes on, a smaller number of companies manages to raise a subsequent round of

financing, and these are much larger in size. Investors keep funding these selected companies in the hopes of having larger returns on investment in the future.

The study also found that 306 (28%) of the companies in the study exited through an M&A or IPO within 6 rounds of funding, and within the time period studied (2008 - 2017). They also found that less than 1%, 10 (0.91%) firms from the seed cohort studied, ended up becoming unicorns, (privately owned companies that are valued at over \$1B) (CB Insights, n.d.) (Figure 4.9)(Table 4.6).

Figure 4.9: Original CB Insights Article (Source: CB Insights, n.d.)



Note: All numbers based on cohort of companies that raised Seed in 2008, 2009 or 2010 and disclosed valuations only.

CBINSIGHTS

Table 4.6: Original CB Insights Article (Source: CB Insights, n.d.)



US TECH COMPANIES THAT RAISED A SEED ROUND IN 2008, 2009, 2010

	COUNT	% OF PREVIOUS COHORT	% OF ORIGINAL	AVG. AMNT (\$M)	MEDIAN AMNT (\$M)	AVG. MONTHS IN BETWEEN	MEDIAN MONTHS IN BETWEEN
ORIGINAL ROUND	1098	***	***	0.69	0.35	***	***
FOLLOW-ON 1	505	46%	46%	4.20	3.12	20	16
FOLLOW-ON 2	307	61%	28%	10.58	7.77	21	18
FOLLOW-ON 3	159	52%	14%	22.82	15.00	19	18
FOLLOW-ON 4	61	38%	6%	62.86	25.00	18	17
FOLLOW-ON 5	20	33%	2%	174.60	40.00	13	12

CBINSIGHTS

4.14 Difficulties in the Data Available

One **difficulty** from the study is differentiating between companies that **fail** and those that become **self-sustaining** (and thus do not require raising further rounds of investment), as there is little publicly available information when a company ceases to exist, or when it is profitable or self-sustainable. From this cohort, 70% of the firms in the study either failed or became self-sustaining. The authors of this study argued that although self-sustaining firms are per se not failed startups, as they are able to sustain their business through the revenue created from their company, without the need to raise further funding. However, for the investors that invested in them early on, hoping for a large exit that would bring them a positive return on investment for the risk taken in support this early stage venture; this does not take place. Therefore from an investor's perspective (not from the founder's), a self-sustaining firm could be considered as a “failed” investment. We will extend this definition to our own study, and therefore companies that either fail to raise subsequent rounds of investment or cease to exist will be considered as a “failed” startup (even if the firm continues to exist and is sustaining itself via the revenue it is creating). However we do recognise that this is a limitation of the data that we now have available, and hope to overcome this limitation in the future.

The study also tracked the average and median amounts of funding for each stage, finding that the gap between the average and median amounts of funding increases in later rounds, with the average becoming positively skewed towards “mega” financing rounds. Once again, we see that a small percentage of startups concentrate a large amount of the resources available (and in addition, the value being created). This will also be used in our model, as the

distribution for funding for the firms in our study will follow this positive skew towards a small number of high performing firms; we will therefore use mean data sources (instead of the median) to illustrate our model.

From the 1,098 firms in the study, only 10 firms exited for over \$500M in the time period studied, with 5 doing so for over \$1B+. Showing that achieving these high value exits (that arguably all investors and entrepreneurs seek), is still a rarity. Nonetheless, firms are tending to remain private for a longer period of time, therefore it will be interesting to revisit the results of this cohort of firms in a few years, to have more final statistics on the success and failure of these firms. This is another limitation that we acknowledge and hope to overcome in the future.

We will extend the maturation time between stages and survival rates at each stage and use them in our generic model, although we are aware that this is a limited and imperfect source of data, and that each regional ecosystem will have slightly different rates and maturation times. However, for the time being, the data can bring many important insights and improved understanding on the Entrepreneurial Ecosystem and its development.

The CB Insights data broke down the funding between: seed, and follow on 1, 2, 3, 4, 5 (that correspond to series A, B, C, D, E). As argued before, following other work in the field, we can distinguish four main stages of firms: seed, early, growth and late stage firms. From the data, seed stage firms naturally correspond to seed stage funding, early stage firms would correspond to follow on 1 and 2 (series A and B), growth stage firms would be follow on 3 and 4 (series C and D), and late stage firms would be follow on 5 (series E). We therefore grouped the CB insights to the accepted stages of firms used in the startup literature (Table 4.7). As the cohort raised their seed round between 2008-2010, it is still possible that there will be **additional exits or fundraising events that would slightly alter the below mentioned statistics**. This is a limitation that we are aware of, and we hope that future revised versions of the model take these new statistics into account.

Table 4.7: Aggregation of time, success, failure and capital raised by firms across the startup lifecycle (CB Insights, n.d.)

Firms	Investment Stages	Total time in the stage (Average)	Mean capital raised	Mean capital raised/ time at the stage (\$/year)
Seed Stage	Seed	1 year (assumed)	\$0,69M	0,69M \$/year
Early Stage	Follow on 1 and 2 (series A and B)	41 months (20 + 21 months) = 3.41 years	\$14.78M (\$4,2M + \$10,58M)	4.33M \$/year
Growth Stage	Follow on 3 and 4 (series C and D)	37 months (19 + 18 months) = 3.08 years	\$85.68M (\$22.82M + \$62.86M)	27.82M \$/year
Late Stage	Follow on 5 (series E)	13 months and over = 1.08 years	\$174.6M	161.67M \$/year

4.15 Adaptation for our study

Table 4.8: Survival, Failure and Exit Rate and Average Residency Time at each firm stage (Source: Adaptation from CB Insights to reflect the 4 stages in the Entrepreneurial Ecosystem and breakdown of rates by stage)

Stage of Firms	Survival Rate (%)	Failure Rate (%)	Exit Rate (%)	Period (Average Residency Time) (Years)
Seed	60	40	0	1
Early	47	18	35	3.41
Growth	20	58	22	3.08
Late	33	56	11	1.08

However, from the study of CB Insights, we are only able to see static rates over a period of time, in a sense a snapshot that determines the dynamics within the Entrepreneurial Ecosystem. Nonetheless, our hypothesis is that as the **ecosystem evolves and entrepreneurs gain experience as well as depending on the availability of resources or the business environment, the dynamics of the ecosystem change over time** (as was captured by the reinforcing and balancing loops in Figure 4.6). Therefore we modified the findings of CB insights to reflect these point (as shown in Table 4.8-9).

Table 4.9: Adapted Survival, Failure and Exit Rate and Average Residency Time at each firm stage to be affected by the “Survival Effect”

Stage of Firms	Survival Percentage	Exit Percentage	Failure Percentage	Period (Average Residency Time) (Years)
Seed	0.6*Survival Effect	0	1-Survival Percentage Seed	1
Early	0.47*Survival Effect	0.35	1-Survival Percentage Early-Exit Percentage Early	3.41
Growth	0.20*Survival Effect	0.22	1-Survival Percentage Growth-Exit Percentage Growth	3.08
Late	0.33*Survival Effect	0.11	1-Survival Percentage Late-Exit Percentage Late	1.08

4.16 Effect to the Survival Rate

The construct that reflects the Adapted Survival, Failure and Exit Rate explained in Table 4.9 is pictured in Figure 4.10. Whereas the model equations connecting the variables are described in Table 4.10.

Figure 4.10: Reinforcing and Diminishing Effects of the Survival Rate of firms

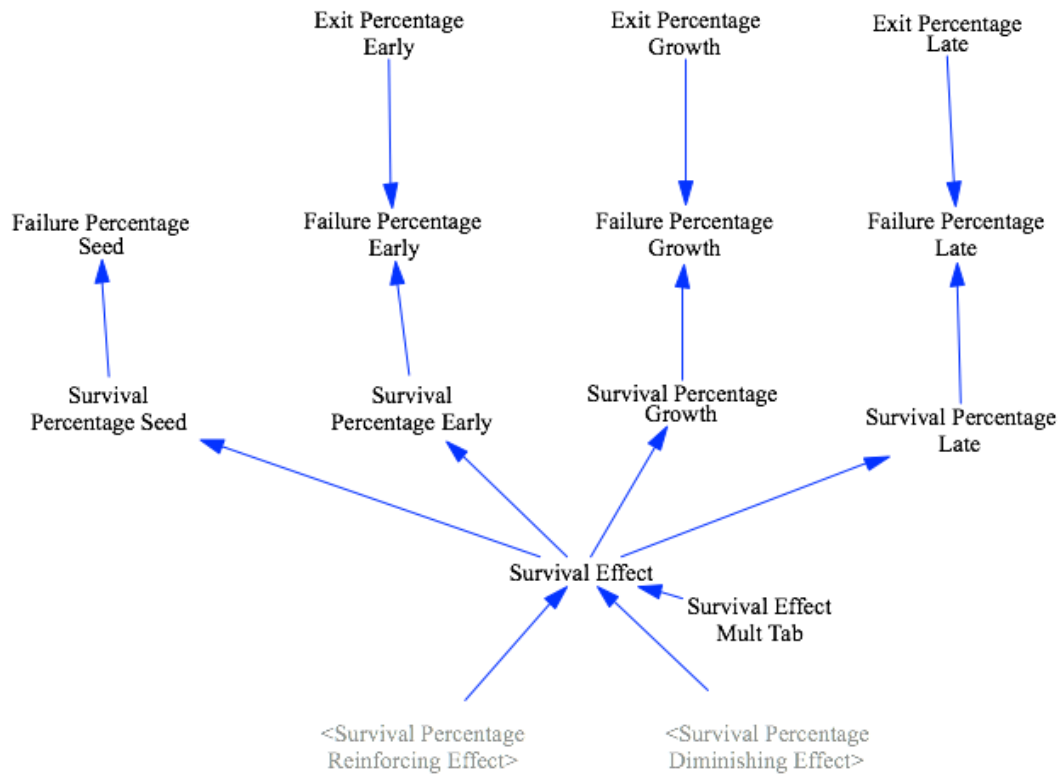


Table 4.10: Survival Effect Equation Definitions

Parameter	Equation
Survival Effect	Survival Effect Mult Tab(Survival Percentage Reinforcing Effect*Survival Percentage Diminishing Effect)
Survival Effect Mult Tab	[(0,0)-(10,10)],(0,0.75),(2,1.25)
Survival Percentage Reinforcing Effect	Reinforcing Survival Mult Tab(Reinforcing Effect)
Reinforcing Survival Mult Tab	[(-1,0)-(100,100)],(-1,0),(1,1),(3,3)
Survival Percentage Diminishing Effect	Survival Percentage Diminishing Effect Mult Tab(Diminishing Effect)
Survival Percentage Diminishing Effect Mult Tab	[(0,0)-(10,10)],(0,0),(1,1)

Table 4.11: Survival Effect Mult Tab

Input	Output
0	0.75
2	1.25

The survival effect construct is assumed to have an effect of either 25% above or below the regular Survival Effect: meaning the different reinforcing and diminishing loops according to the environmental conditions and availability of resources can increase or decrease the survival rate at each stage by 25% (Table 4.11-13).

Table 4.12: Reinforcing Survival Mult Tab

Input	Output
-1	0
1	1
3	3

Table 4.13: Survival Percentage Diminishing Effect Mult Tab

Input	Output
0	0
1	1

4.17 Diminishing Mechanisms

Startups need a number of resources to succeed and scale, namely access to: funding, human capital, markets/customers, support organizations (mentors, accelerators) and a supportive community. However, the relative importance and dynamic needs of these resources has not been explored before. Following the World Economic Forum's findings [as explained in Chapter 4] we hypothesize that there are three resources that are vital for the development of an Entrepreneurial Ecosystem: access to Funding to fuel the growth of the startups, access to

Human Capital that can work for the startups, and access to Customers for the product or service that the startups provide. Whilst other resources may be complementary, but not necessarily vital for startup success.

We estimate that at each of the stages, firms will require of the three key resources (funding, human capital and customers) at different rates. In Tables 4.14, 4.15, 4.16 we describe in further detail the requirement rate (resource/year) of the firms at each stage as well as the supporting equations for all variables here described. An important consideration is that this model is industry and business model agnostic, as is the Entrepreneurial Ecosystem. Therefore the rate of requirement of resources is currently an average across industries and business models. Once adapting the model to a local ecosystem, it would be advisable to adapt the resource requirement parameters to match those observed within the region. For example a Entrepreneurial Ecosystem that is capital intensive in nature (for example an ecosystem with a high proportion of high capital requiring startups) or human capital lean (for example an ecosystem with a high proportion of software oriented startups), or customer centric (for example an ecosystem with a high proportion of B2C startups), in those cases the observed resource requirements would vary from those described below.

In general, the average total resource requirements for all firms in the ecosystem can be calculated by:

$$\text{Resource Requirements in the Ecosystem} = \Sigma(\text{Number of firms in that stage}) * (\text{Average resource needs in that stage})$$

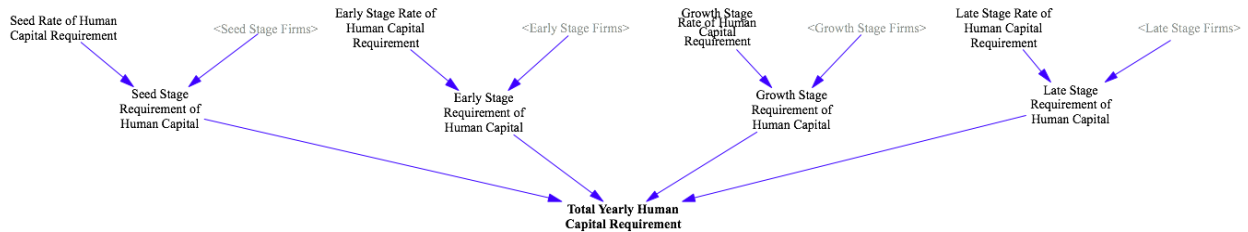
4.17.2 Requirement of Funding

At each stage, the requirement of capital is different; as firms scale in size, they require additional capital to operate and continue expanding. The Average Funding Requirement by Stage of Firms is shown in Table 4.14.

Table 4.14: Assumed Average Funding Requirement by Stage of Firms (Source: CB Insights, n.d.)

Stage of Firms	Funding Requirement (\$ / year)
Seed Stage Requirement of Funding	0,69 M
Early Stage Requirement of Funding	4.33 M
Growth Stage Requirement of Funding	27.82 M
Late Stage Requirement of Funding	161.67 M

Figure 4.11: Funding requirements in an Entrepreneurial Ecosystem according to firm size



The total capital requirement within the ecosystem is calculated by taking into account the number of firms in each stage as well as the average funding requirements at that stage, as detailed below and captured in the construct shown in Figure 4.11.

$$\text{Total Yearly Funding Requirements} = \Sigma(\text{Number of firms in that stage}) * (\text{Average funding requirements at that stage})$$

$$\text{Total Yearly Funding Requirements} = (\text{Seed Stage Requirement of Funding}) + (\text{Early Stage Requirement of Funding}) + (\text{Growth Stage Requirement of Funding}) + (\text{Late Stage Requirement of Funding})$$

$$\text{Total Yearly Funding Requirements} = (\text{Seed Stage Firms} * \text{Seed Stage Rate of Funding Requirement}) + (\text{Early Stage Firms} * \text{Early Stage Rate of Funding Requirement}) + (\text{Growth Stage Firms} * \text{Growth Stage Rate of Funding Requirement}) + (\text{Late Stage Firms} * \text{Late Stage Rate of Funding Requirement})$$

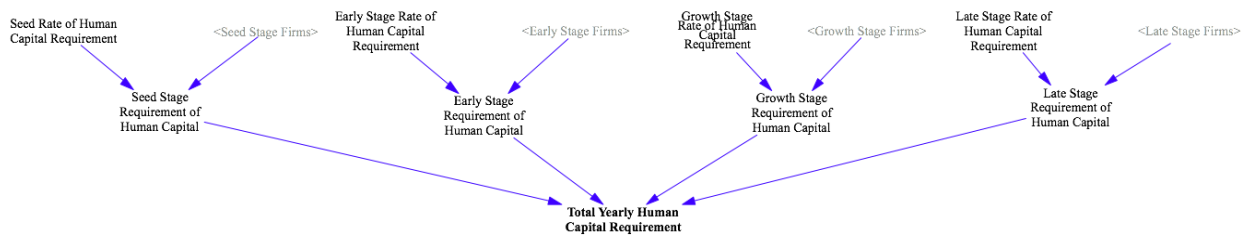
4.17.3 Requirement of Human Capital

At each stage, the requirement of human capital is different; as firms scale in size, they require additional employees to operate and continue expanding. The Average Human Capital Requirement by Stage of Firms is shown in Table 4.15.

Table 4.15: Assumed Average Human Capital Requirement by Stage of Firms (Source: Redbord, M., 2017)

Stage of Firms	Human Capital Requirement (new jobs / year)
Seed Stage Rate of Human Capital Requirement	5
Early Stage Rate of Human Capital Requirement	15
Growth Stage Rate of Human Capital Requirement	50
Late Stage Rate of Human Capital Requirement	100

Figure 4.12: Human Capital Requirements in an Entrepreneurial Ecosystem according to firm size



The total human capital requirement within the ecosystem is calculated by taking into account the number of firms in each stage as well as the average human capital requirements at that stage, as detailed below and captured in the construct shown in Figure 4.12.

$$\text{Total Yearly Human Capital Requirements} = \Sigma(\text{Number of firms in that stage}) * (\text{Average human capital requirements at that stage})$$

$$\text{Total Yearly Human Capital Requirements} = (\text{Seed Stage Requirement of Human Capital}) +$$

(Early Stage Requirement of Human Capital) + (Growth Stage Requirement of Human Capital)
+ (Late Stage Requirement of Human Capital)

Total Yearly Human Capital Requirements = *(Seed Stage Firms*Seed Stage Rate of Human Capital Requirement) + (Early Stage Firms*Early Stage Rate of Human Capital Requirement) + (Growth Stage Firms*Growth Stage Rate of Human Capital Requirement) + (Late Stage Firms*Late Stage Rate of Human Capital Requirement)*

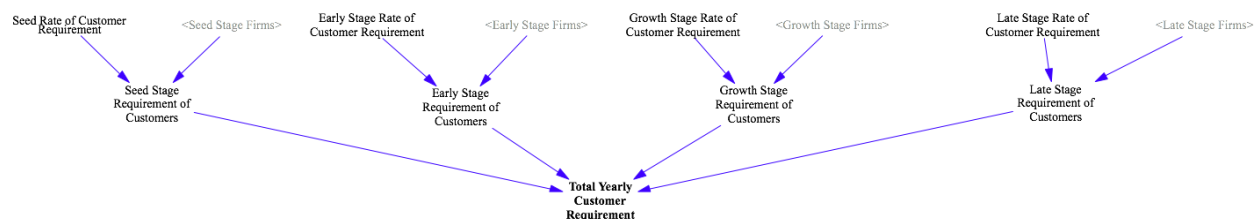
4.17.4 Requirement of Customers

At each stage, the number of customers being served is different; as firms scale in size, they have a larger capacity to serve additional customers. The Average Customer Requirement by Stage of Firms is shown in Table 4.16.

Table 4.16: Assumed Average Customer Requirement by Stage of Firms (Source: Assumed from the stakeholder interviews)

Stage of Firms	Customer Requirements
Seed Stage Rate of Customers Requirement	100
Early Stage Rate of Customers Requirement	1000
Growth Stage Rate of Customers Requirement	50,000
Late Stage Rate of Customers Requirement	500,000

Figure 4.13: Customer requirements in an Entrepreneurial Ecosystem according to firm size



The total customer requirement within the ecosystem is calculated by taking into account

the number of firms in each stage as well as the average customer requirements at that stage, as detailed below and captured in the construct shown in Figure 4.13.

$$\text{Total Yearly Customer Requirements} = \Sigma(\text{Number of firms in that stage}) * (\text{Average customer requirements at that stage})$$

$$\text{Total Yearly Customer Requirements} = (\text{Seed Stage Requirement of Customers}) + (\text{Early Stage Requirement of Customers}) + (\text{Growth Stage Requirement of Customers}) + (\text{Late Stage Requirement of Customers})$$

$$\text{Total Yearly Customer Requirements} = (\text{Seed Stage Firms} * \text{Seed Stage Rate of Customers Requirement}) + (\text{Early Stage Firms} * \text{Early Stage Rate of Customers Requirement}) + (\text{Growth Stage Firms} * \text{Growth Stage Rate of Customers Requirement}) + (\text{Late Stage Firms} * \text{Late Stage Rate of Customers Requirement})$$

4.17.4 Entrepreneurial Ecosystem's carrying capacity

With this in mind, we expect that each regional Entrepreneurial Ecosystem, according to the availability of the abovementioned resources, will be able to support a certain number of startups, which we will call an **Entrepreneurial Ecosystem's carrying capacity**. If:

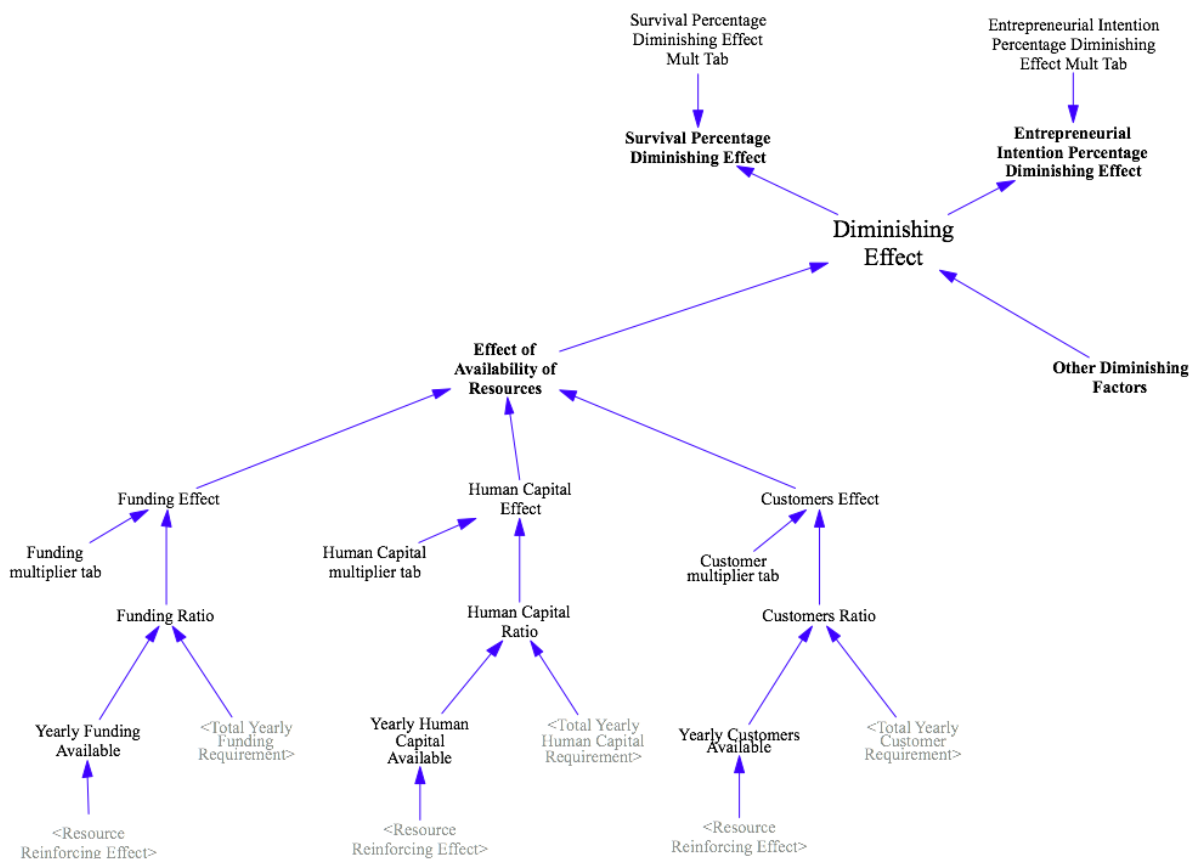
- Total Yearly Funding Requirements > Yearly Funding Available and/or
- Total Yearly Human Capital Requirements > Yearly Human Capital Available and/or
- Total Yearly Customer Requirements > Yearly Customers Available,

the startup success will be compromised as there is a limiting factor (the total needs exceeds the available resources, as described in the Causal Loop Diagram B1 in Table 4.4). In this case the ecosystem will reach its capacity limit, and further growth of the ecosystem will be **limited**, therefore the Startup survival rate will be negatively affected, until the resource availability is higher than the resource requirements once again.

4.17.6 Effect of Availability of Resources Construct

This has been integrated into the model within the “Effect of Availability of Resources Construct” (Figure 4.14). The diminishing effect is a function of the availability of resources versus the requirement of resources, being negatively influenced if not enough resources are present. This diminishing effect affects both the survival of firms as well as the Entrepreneurial Intention.

Figure 4.14: Diminishing Effects of the Entrepreneurial Ecosystem



As can be seen from Figures 4.14b and 4.14c, there is a direct correspondence between the diminishing mechanisms mentioned in the Entrepreneurial Ecosystem Causal Loop Diagram, and the Entrepreneurial Ecosystem System Dynamics Model. Each of the highlighted model parts, labelled A-D, has a direct correspondence.

Figure 4.14b: Diminishing Effects of the Entrepreneurial Ecosystem - correspondence between CLD and SD model

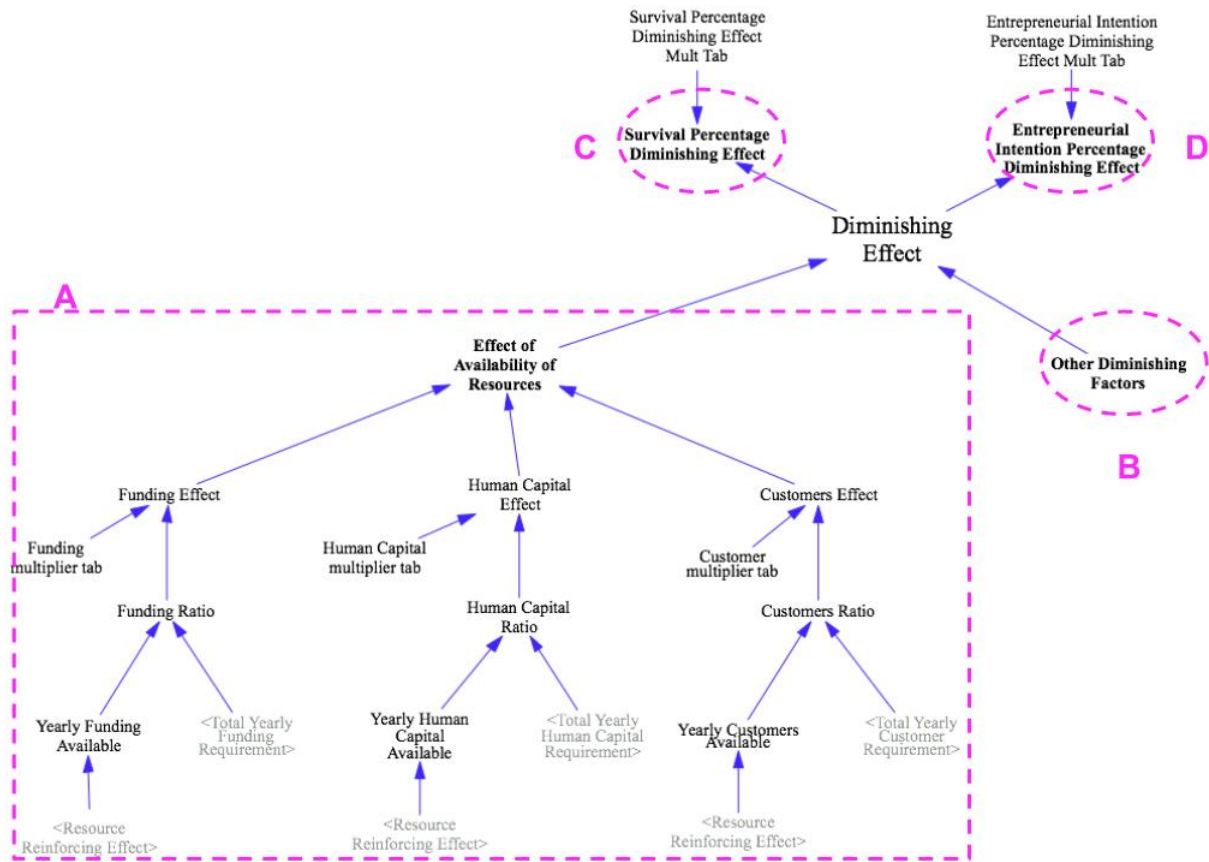
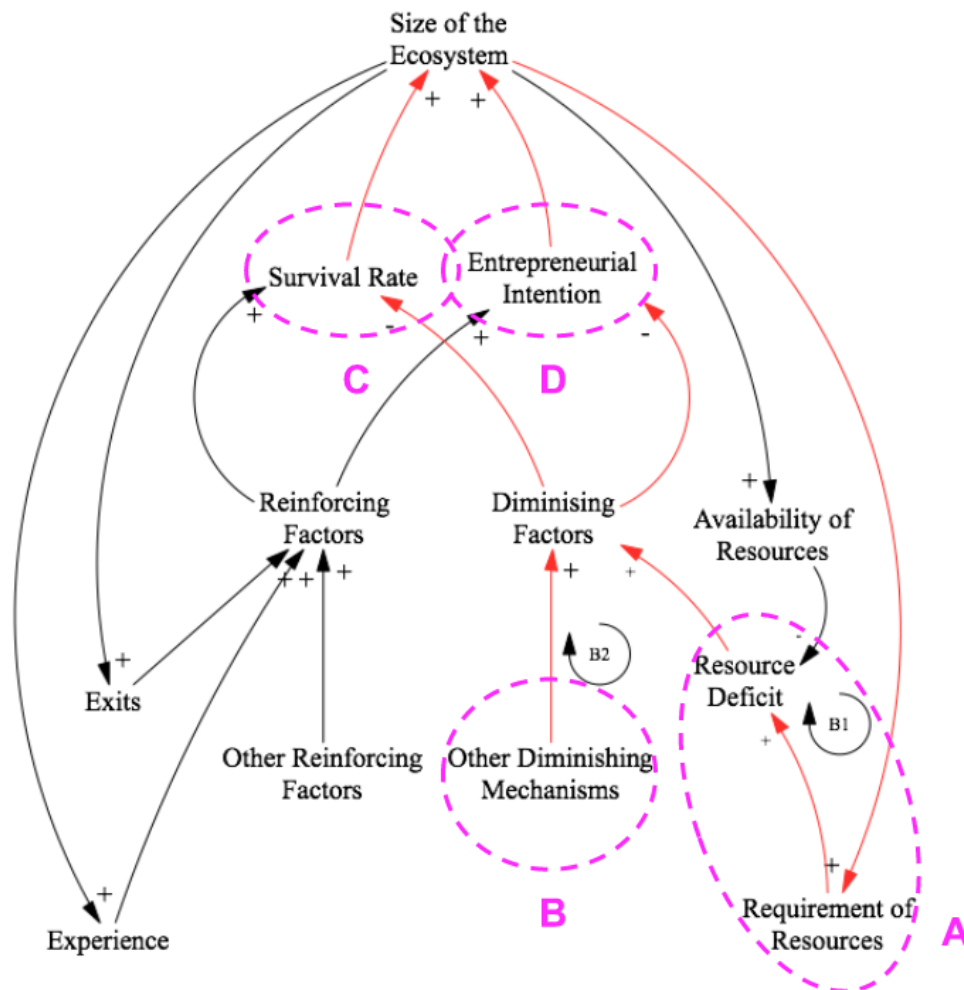


Figure 4.14c: Diminishing Effects of the Entrepreneurial Ecosystem - correspondence between CLD and SD model



The three Resource Availability-Requirement constructs are built as Multiplier Tab functions, following the example of Jay Wright Forrester in his renown Urban Dynamics Model (as shown in Figure 4.14 in the Funding Effect, Human Capital Effect and Customers Effect) (Forrester, J. W., 1997). The selection of this construct is such that in the future it is very easy to adapt to the sensitivity of the local ecosystem (for example it could be possible that in an ecosystem access to funding had a much larger impact in the survival rate than did access to customer, due to for example a large and easily accessible local, as shown in Table 4.17 for each individual region). In this case, the Multiplier Tab construct could be easily adapted to reflect this reality. Nonetheless, for the time being for the Generic Ecosystem Model, the sensitivity of

the three resources is set to be the same, according to the findings of the World Economic Forum in which the most important resources were consistently found to be Access to Markets (60%), Human Capital Workforce (62%) and Funding and Finance (59%).

Table 4.17: Most important Pillars for the growth/success of their company according to entrepreneurs in Entrepreneurship Ecosystems Globally (Foster et al., 2013)

Pillar	US - Silicon Valley	US - Other Cities	North America	Europe	Aus/NZ	Asia	MEA	South/ Central America and Mexico	Average Score
Accessible Markets	44%	59%	53%	59%	74%	65%	68%	57%	60%
Human Capital Workforce	63%	70%	67%	64%	41%	67%	59%	63%	62%
Funding and Finance	64%	62%	63%	49%	56%	56%	55%	63%	59%
Mentors/Advisers/ Support Systems	35%	24%	29%	23%	33%	27%	14%	22%	26%
Regulatory Framework/ Infrastructure	10%	11%	11%	21%	19%	27%	14%	33%	18%
Education and Training	10%	14%	12%	17%	15%	23%	18%	9%	15%
Major Universities as Catalysts	17%	9%	13%	9%	7%	5%	5%	0%	8%
Cultural Support	31%	19%	24%	10%	7%	11%	32%	11%	18%

The model parameters and equations behind the effect of availability of resources can be found in Table 4.18.

Table 4.18: Parameters and Equations behind the Effect of Availability of Resources

Parameter	Equation
Effect of Availability of Resources	(Customers Effect*Funding Effect*Human Capital Effect)
Funding Effect	Funding multiplier tab(Funding Ratio)
Funding multiplier tab	$[(-1000,0)- (1000,1)], (-1000,1e-06), (-99,0.01), (-9,0.1), (-3,0.25), (-1,0.5), (0,1), (0.5,0.9), (1,0.9), (3,0.9), (3,0.9), (20,0.9), (1000,0.9)$
Funding Ratio	$(\text{Yearly Funding Available}-\text{Total Yearly Funding Requirement})/\text{Yearly Funding Available}$
Yearly Funding Available	$5e+08 * \text{Resource Reinforcing Effect}$ ((10B\$ available in the base case (1e+10)),

	5e+08 in the limiting)
Human Capital Effect	Human Capital multiplier tab(Human Capital Ratio)
Human Capital multiplier tab	$[(-1000,0)- (1000,1,1)], (-1000,1e-06), (-99,0.01), (-9,0.1), (-3,0.25), (-1,0.5), (0,1), (0.5,1.1), (1,1.1), (3,1.1), (20,1.1), (1000,1.1)$
Human Capital Ratio	(Yearly Human Capital Available-Total Yearly Human Capital Requirement)/Yearly Human Capital Available
Yearly Human Capital Available	5000*Resource Reinforcing Effect (500,000 workers available in the base case), 5000 in limited
Customers Effect	Customer multiplier tab(Customers Ratio)
Customer multiplier tab	$[(-1000,0)- (1000,1)], (-1000,1e-06), (-99,0.01), (-9,0.1), (-3,0.25), (-1,0.5), (0,1), (0.5,1), (1,1), (3,1), (3,1), (20,1), (1000,1)$
Customers Ratio	(Yearly Customers Available-Total Yearly Customer Requirement)/Yearly Customers Available
Yearly Customers Available	6e+07*Resource Reinforcing Effect (5e+09 customers available in the base case, 6e+07 customers available in the limiting.

4.17.6 Customer Effect Construct

The customer effect construct is used to test for the effect of availability of a resource on the survival rate of firms. Currently set so that if more customers are available than that required by the firms in the ecosystem, there is no effect on the survival rate, as firms can only serve certain number of clients/customers according to their current size, team members, business model and other factors. Nonetheless, if less customers are available than required, the effect will be negative, until customers become available once again, because customers are required to

bring revenue for the firms and as proof that the startups are providing a valuable product or service (Table 4.19).

As shown above the Customer Ratio = (Yearly Customers Available-Total Yearly Customer Requirement)/Yearly Customers Available

In order to understand how this effect would be on the survival according to different Availability-Requirement pair combinations, we outlined several scenarios.

- Availability = 1000, Requirement = 100, Customer Ratio = $(1000-100)/1000 = 0.9$
 - Output: All firms survive as there is a higher availability of the resource than the total requirements (Output 1)
- Availability = 100, Requirement = 50, Customer Ratio = $(100-50)/1000 = 0.5$
 - Output: All firms survive as there is a higher availability of the resource than the total requirements (Output 1)
- Availability = 100, Requirement = 100, Customer Ratio = $(100-100)/100 = 0$
 - Output: All firms survive as there is a higher availability of the resource than the total requirements (Output 1)
- Availability = 50, Requirement = 100, Customer Ratio = $(50-100)/50 = -1$
 - Output: 50% of the firms survive, as only 50% can secure enough of the required resources (Output 0.5)
- Availability = 50, Requirement = 200, Customer Ratio = $(50-200)/50 = -3$
 - Output: 25% of the firms survive, as only 25% can secure enough of the required resources (Output 0.25)
- Availability = 10, Requirement = 100, Customer Ratio = $(10-100)/10 = -9$
 - Output: 10% of the firms survive, as only 10% can secure enough of the required resources (Output 0.1)
- Availability = 10, Requirement = 1000, Customer Ratio = $(10-1000)/10 = -99$
 - Output: 1% of the firms survive, as only 1% can secure enough of the required resources (Output 0.01)

Table 4.19: Customer multiplier tab

Input	Output
-1000	1e-06
-99	0.01
-9	0.1
-3	0.25
-1	0.5
0	1
0.5	1
1	1
20	1

4.17.7 Funding Effect Construct

The funding effect construct is used to test for the effect of availability of a resource on the survival rate of firms. Currently it is set so that if the requirement and availability of funding are the same, there is no effect on the survival rate. Nonetheless, if less funding is available than required, the effect will be negative, until funding becomes availability once again. Interestingly, after our interviews with Venture Capitalists we identified that the funding available should be a “scarce” resource, meaning if too much funding is available within an ecosystem (more funding is available than that required by the firms in the ecosystem), this will have a negative effect on the survival rate of the overall firms. The reasoning behind this is that this additional funding will go to less competitive firms, that would have otherwise failed to survive. The funding allows them to continue existing for a longer period of time, but the ultimate destination of the firms will be failure, therefore we reflected this point in the Funding Effect construct.

As shown above the Funding Ratio = (Yearly Funding Available-Total Yearly Funding Requirement)/Yearly Funding Available

In order to understand how this effect would be on the survival according to different Availability-Requirement pair combinations, we outlined several scenarios (Table 4.20).

- Availability = 1000, Requirement = 100, Funding Ratio = $(1000-100)/1000 = 0.9$
 - Output: 10% less firms survive than in the equilibrium scenario (Output 0.9)
- Availability = 100, Requirement = 50, Funding Ratio = $(100-50)/1000 = 0.5$
 - Output: 10% less firms survive than in the equilibrium scenario (Output 0.9)
- Availability = 100, Requirement = 100, Funding Ratio = $(100-100)/100 = 0$
 - Output: All firms survive as there is a enough availability of the resource related to the total requirements (Output 1)
- Availability = 50, Requirement = 100, Funding Ratio = $(50-100)/50 = -1$
 - Output: 50% of the firms survive, as only 50% can secure enough of the required funding (Output 0.5)
- Availability = 50, Requirement = 200, Funding Ratio = $(50-200)/50 = -3$
 - Output: 25% of the firms survive, as only 25% can secure enough of the required funding (Output 0.25)
- Availability = 10, Requirement = 100, Funding Ratio = $(10-100)/10 = -9$
 - Output: 10% of the firms survive, as only 10% can secure enough of the required funding (Output 0.1)
- Availability = 10, Requirement = 1000, Funding Ratio = $(10-1000)/10 = -99$
 - Output: 1% of the firms survive, as only 1% can secure enough of the required funding (Output 0.01)

Table 4.20: Funding multiplier tab

Input	Output
-1000	1e-06
-99	0.01
-9	0.1
-3	0.25
-1	0.5
0	1
0.5	0.9
1	0.9

4.17.9 Human Capital Effect Construct

The Human Capital effect construct is used to test for the effect of availability of a resource on the survival rate of firms. Currently it is set so that if the requirement and availability of human capital are the same, there is no effect on the survival rate. Nonetheless, if less human capital is available than required, the effect will be negative, until human capital becomes availability once again. If more human capital is available than that required by the firms in the ecosystem, there is a positive effect on the survival rate of the firms in the ecosystem. The reasoning behind this is that in a competitive landscape (where supply of candidates is larger than demand), firms will be able to select the better candidates from the pool of applicants to join the firm, presumably making them better at operating, therefore the survival rate may be increased up to 10% from the base scenario (Table 4.21).

As shown above the Human Capital Ratio = (Yearly Human Capital Available-Total Yearly Human Capital Requirement)/Yearly Human Capital Available

In order to understand how this effect would be on the survival according to different Availability-Requirement pair combinations, we outlined several scenarios.

- Availability = 1000, Requirement = 100, Human Capital Ratio = $(1000-100)/1000 = 0.9$

- Output: 10% more firms survive as there are better candidates joining the firms (Output 1,1)
- Availability = 100, Requirement = 50, Human Capital Ratio = $(100-50)/1000 = 0.5$
 - Output: 10% more firms survive as there are better candidates joining the firms (Output 1,1)
- Availability = 100, Requirement = 100, Human Capital Ratio = $(100-100)/100 = 0$
 - Output: All firms survive as there is a enough availability of the resource related to the total requirements (Output 1)
- Availability = 50, Requirement = 100, Human Capital Ratio = $(50-100)/50 = -1$
 - Output: 50% of the firms survive, as only 50% can secure enough of the required resources (Output 0.5)
- Availability = 50, Requirement = 200, Human Capital Ratio = $(50-200)/50 = -3$
 - Output: 25% of the firms survive, as only 25% can secure enough of the required resources (Output 0.25)
- Availability = 10, Requirement = 100, Human Capital Ratio = $(10-100)/10 = -9$
 - Output: 10% of the firms survive, as only 10% can secure enough of the required resources (Output 0.1)
- Availability = 10, Requirement = 1000, Human Capital Ratio = $(10-1000)/10 = -99$
 - Output: 1% of the firms survive, as only 1% can secure enough of the required resources (Output 0.01)

Table 4.21: Human Capital multiplier tab

Input	Output
-1000	1e-06
-99	0.01
-9	0.1
-3	0.25
-1	0.5
0	1
0.5	1,1
1	1,1
20	1,1

4.17.9 Additional Diminishing Mechanisms

Additional diminishing mechanism are considered as an external output as seen on Figure 4.7. This could refer to the ease of starting, running and exiting a business, which can have a negative impact on both the percentage of firms that survive and on entrepreneurial intention. The equations governing this construct are described in Table 4.22 and outlined in Figure 4.14.

Table 4.22: Parameters and Equations behind the Effect of Diminishing Factors

Parameter	Equation
Diminishing Factors	$(\text{Ease of Starting a Business} + \text{Ease of Running a Business} + \text{Ease of Exiting a Business})/3$
Ease of Starting a Business	From 0 - 1: according to the ease
Ease of Running a Business	From 0 - 1: according to the ease
Ease of Exiting a Business	From 0 - 1: according to the ease
Diminishing Effect	Effect of Availability of Resources*Diminishing Factors
Survival Percentage Diminishing Effect	Survival Percentage Diminishing Effect Mult Tab(Diminishing Effect)
Survival Percentage Diminishing Effect Mult Tab	$[(0,0)-(10,10)],(0,0),(1,1)$
Entrepreneurial Intention Percentage Diminishing Effect	Entrepreneurial Intention Percentage Diminishing Effect Mult Tab(Diminishing Effect)
Entrepreneurial Intention Percentage Diminishing Effect Mult Tab	$[(0,0)-(10,10)],(0,0),(1,1)$

Both the Survival Percentage Diminishing Effect and the Entrepreneurial Intention Percentage Diminishing Effect currently follow a direct relationship. However the model is built so that in the future, when modeling a specific regional ecosystem, the effect can be easily modulated to the effect seen within the regional Entrepreneurial Ecosystem (Table 4.23-24).

Table 4.23: Survival Percentage Diminishing Effect Mult Tab

Input	Output
0	0
1	1

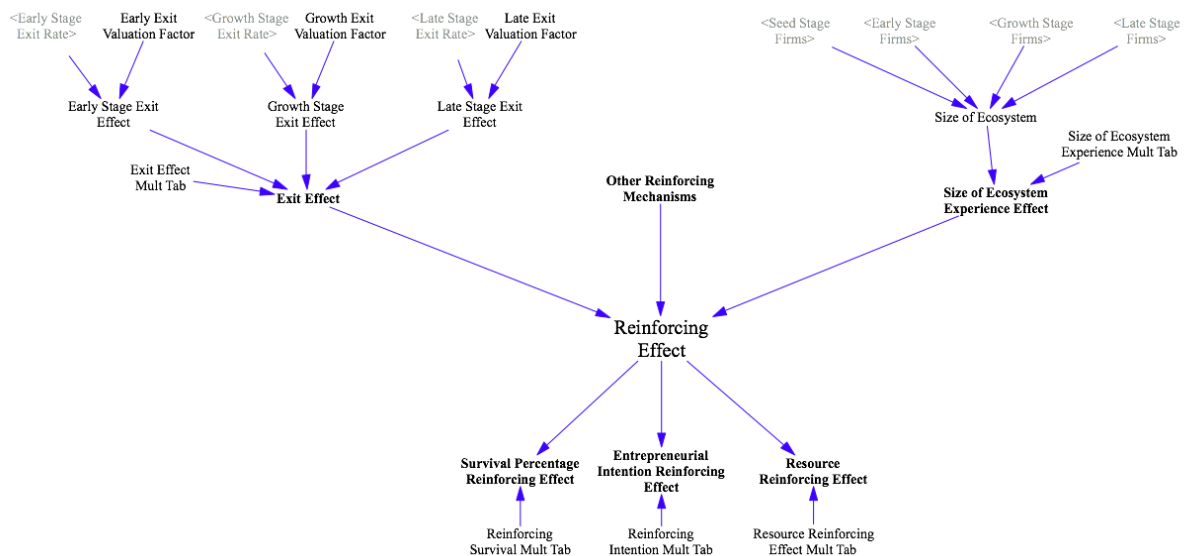
Table 4.24: Entrepreneurial Intention Percentage Diminishing Effect Mult Tab

Input	Output
0	0
1	1

4.18 Reinforcing Mechanisms

As shown in Figure 4.6, there are several positive reinforcing mechanisms taking place in the development of the Entrepreneurial Ecosystem, that have been captured in the reinforcing effect construct shown in Figure 4.15. The first component of the construct is the effect of exits, previously described in loops R2 and R5 in Figure 4.6. The effect of the is a function of the startup's funds raised at the time of the exit (which itself will in part determine the valuation at exit), as a proxy to calculate the value created prior to exiting and thus the overall effect in the ecosystem (in a nutshell firms that exit at an early stage with few employees, little money raised will have less of a ripple effect in the ecosystem). The Average Total Funds raised by each firm according to their stage can be found in Table 4.25.

Figure 4.15: Reinforcing Effects of the Entrepreneurial Ecosystem



As can be seen from Figures 4.15b and 4.15c, there is a direct correspondence between the reinforcing mechanisms mentioned in the Entrepreneurial Ecosystem Causal Loop Diagram,

and the Entrepreneurial Ecosystem System Dynamics Model. Each of the highlighted model parts, labelled A-F, has a direct correspondence.

Figure 4.15b: Reinforcing Effects of the Entrepreneurial Ecosystem - correspondence between CLD and SD model

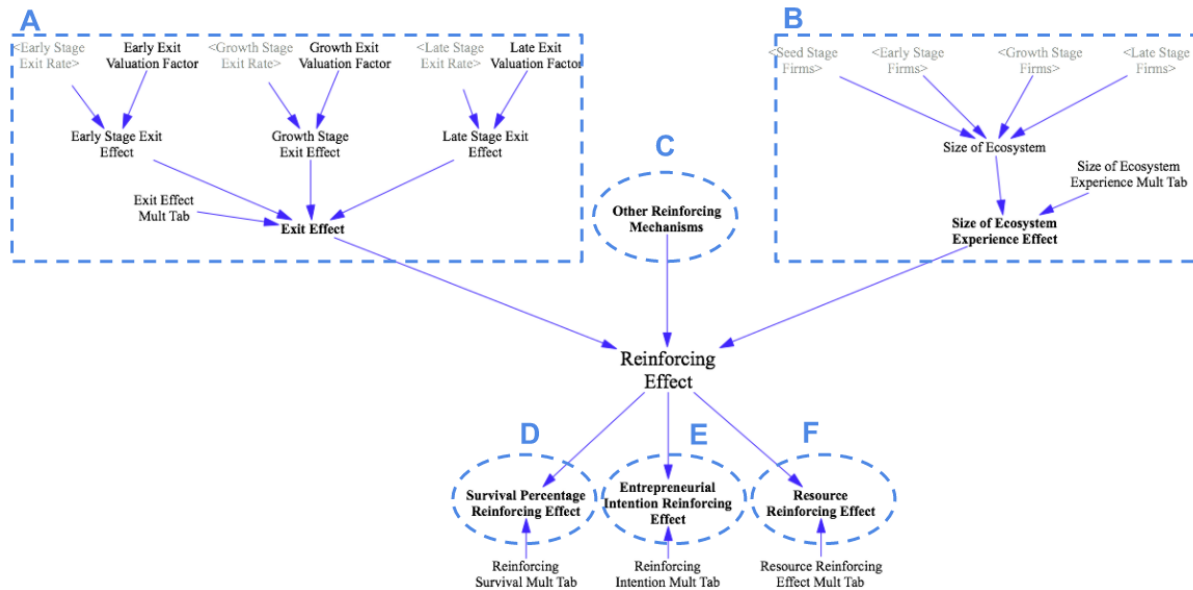


Figure 4.15c: Reinforcing Effects of the Entrepreneurial Ecosystem - Correspondence
between CLD and SD model

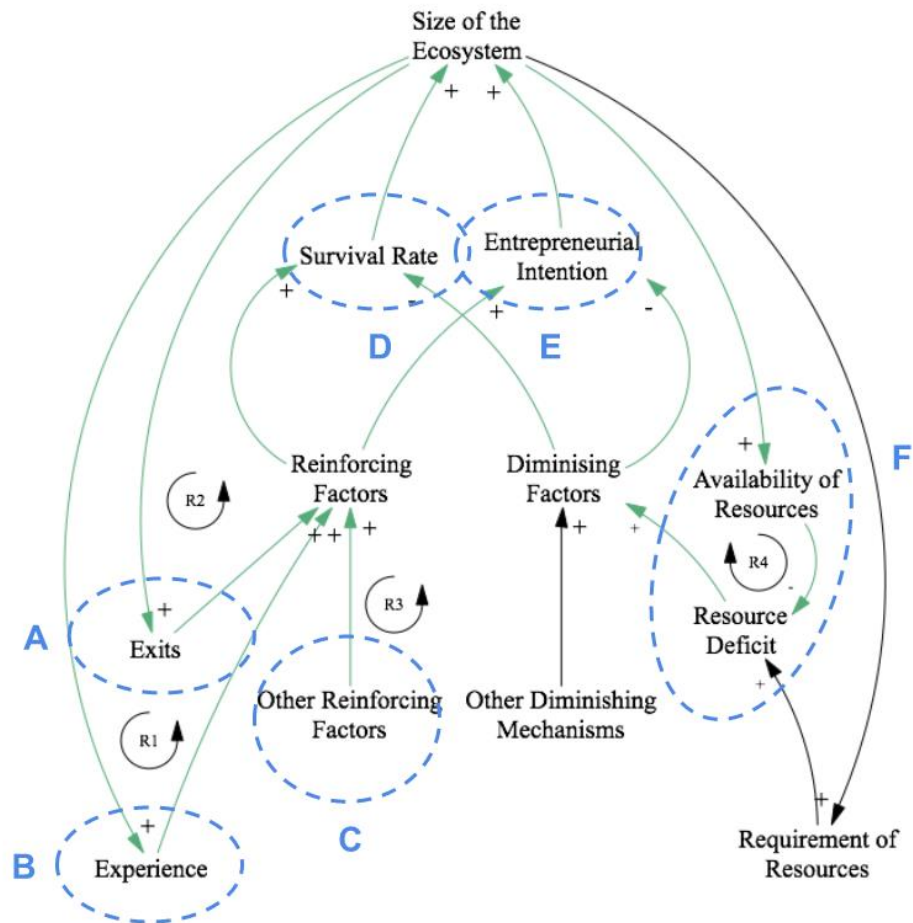


Table 4.25: Average Total Funds per Stage of Firms

Stage	Average Funds Raised per Stage (M\$)	Average Total Funds Raised (M\$)	Exit Valuation Factor
Seed	0,69	0,69	0,69
Early	14.78 (\$4,2M + \$10,58M)	15.47	15.47
Growth	85.68 (\$22.82M + \$62.86M)	101.15	101.15
Late	174.6	275.75	275.75

The model parameters and equations behind the reinforcing effects construct can be found in Table 4.26.

Table 4.26: Reinforcing Effects Constructs in the Entrepreneurial Ecosystem

Parameter	Equation
Exit Effect	Exit Effect Mult Tab(Early Stage Exit Effect+Growth Stage Exit Effect+Late Stage Exit Effect)
Exit Effect Mult Tab	$[(-1000,-1000)-(20000,1000)],(-1000,0),(0,0),(500,0.1),(1000,0.2),(10000,1),(20000,2)$
Early Stage Exit Effect	Early Stage Exit Rate*Early Exit Valuation Factor
Early Exit Valuation Factor	15.47
Early Stage Exit Rate	Early Stage Firms*Exit Percentage Early
Growth Stage Exit Effect	Growth Stage Exit Rate*Growth Exit Valuation Factor
Growth Exit Valuation Factor	101.15
Growth Stage Exit Rate	Growth Stage Firms*Exit Percentage Growth
Late Stage Exit Effect	Late Stage Exit Rate*Late Exit Valuation Factor
Late Exit Valuation Factor	275.75
Support Organizations	From 0 - 1: according to the availability
Informal Networks	From 0 - 1: according to the availability
Size of Ecosystem	(Seed Stage Firms+Early Stage Firms+Growth Stage Firms+Late Stage Firms)
Size of Ecosystem Effect	Size of Ecosystem Mult Tab(Size of Ecosystem)
Size of Ecosystem Mult Tab	$[(0,0)-(5000,10)],(0,0),(500,0.1),(1000,0.25),(2000,0.5),(3000,0.75),(5000,1)$
Reinforcing Effect	$1+((\text{Exit Effect}+\text{Other Reinforcing Mechanisms}+\text{Size of Ecosystem Effect})/3)$
Survival Percentage Reinforcing Effect	Reinforcing Survival Mult Tab(Reinforcing

	Effect)
Reinforcing Survival Mult Tab	$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3)$
Entrepreneurial Intention Reinforcing Effect	Reinforcing Intention Mult Tab(Reinforcing Effect)
Reinforcing Intention Mult Tab	$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3)$
Resource Reinforcing Effect	Resource Reinforcing Effect Mult Tab(Reinforcing Effect)
Resource Reinforcing Effect Mult Tab	$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3)$

4.18.1 Effect of exits

Small exits have individually little to no effect on the overall dynamics of the ecosystem (as we are looking from the macro perspective of the ecosystem): this is so because early stage startups have a smaller influence circle, smaller impact on the overall ecosystem, smaller returns for the entrepreneurs and investors, smaller effect on employment generation, little media attention... Even so, cumulatively, many early stage startup exits may trigger a positive effect. Nonetheless, very large exits can trigger a difference in the whole ecosystem (particularly exits of >1B dollars), influencing the overall dynamics of the ecosystem, and all factors above described. There are well described examples of such cases in the literature, such as the exit of Skype in both Estonia and Sweden, or that of Rocket Internet in Berlin. Therefore the distribution of how exits affect growth is highly skewed towards large exits (Table 4.27).

Table 4.27: Exit Effect Mult Tab

Input	Output
-1000	0
0	0
500	0.1
1000	0.2
10000	1
20000	1

4.18.2 Effect of experience

As mentioned on loop R1, Figure 4.6, the larger the size of the ecosystem, the more positive spillover effects (Table 4.28).

Table 4.28 Size of Ecosystem Mult Tab

Input	Output
0	0
500	0.1
1000	0.25
2000	0.5
3000	0.75
5000	1

4.18 Other Reinforcing Mechanisms

The reinforcing constructs (Reinforcing Survival, Reinforcing Intention and Resource Reinforcing) are built so that there is a positive effect related to the magnitude of the Reinforcing Effect (calculated by the construct: $1 + ((\text{Exit Effect} + \text{Other Reinforcing Mechanisms} + \text{Size of$

Ecosystem Effect)/3)). The value of this construct thus ranges between 1-2. Whereas the Diminishing effect construct ranges from 0-1. As the survival effect is calculated by multiplying the reinforcing effect times the diminishing effect, the possible range is from 0-2. In case of a value of 0, the survival effect is reduced by 25%, whereas if the survival effect is 2, the survival effect is 25% more (Tables 4.29-31).

Table 4.29: Reinforcing Survival Mult Tab

Input	Output
-1	0
1	1
3	3

Table 4.30: Reinforcing Intention Mult Tab

Input	Output
-1	0
1	1
3	3

Table 4.31: Resource Reinforcing Effect Mult Tab

Input	Output
-1	0
1	1
3	3

4.19 Simplifications of the Model

The current model has many simplifications to reduce the complexity of the output and to help in deriving the understanding that the model may bring, once applied to a regional economic area. The current simplifications are outlined below, as well as the modifications suggested once

the model is adapted to a specific geographical region to support the development of the regional Entrepreneurial Ecosystem.

Stage of Firms

The model takes into consideration firms across industries and stages from seed, early, growth and late stage. It is worth noting, that the model does not take firms prior to this stage (idea and pre-seed firms), as at this stage an entrepreneur may be working for a corporate or another firm at the time, they have not raised any funding, are not serving customers and may not be registered or traceable. Therefore in our system, only firms that raise seed stage capital (from FFF, angels, VCs, banks, or even bootstrapped/self-financed) are taken into consideration. It is also important to note that not all entrepreneurs are able to raise a seed round, therefore if we consider startups at their inception/idea stage startups, the survival rate would be even smaller, than the one found on this study.

Initial Number of Firms in the Ecosystem

Currently the initial conditions taken for the ecosystem are that at time 0, there is no presence of firms in the ecosystem. This is a simplification to visualize how firms and the Entrepreneurial Ecosystem develop over time, and as such their resource requirements change over time. Therefore the initial conditions on the model are set to be:

- Initial number of Seed Stage firms = 0
- Initial number of Early Stage firms = 0
- Initial number of Growth Stage firms = 0
- Initial number of Late Stage firms = 0

In the future, when adapting the model to a regional location, together with the regional stakeholders we would work to understand the current firm distribution across the different stages in the ecosystem, and set the initial number of firms to reflect this.

Availability of Resources

Currently the availability of resources (funding, human capital, and customers), has been set to different constants, to help visualize how the availability of resources can impact the development of a Entrepreneurial Ecosystem. In the future, when building we would like to correlate the availability of resources to those historically observed. In this way we can see how supply and demand can affect the development of the ecosystem.

Resource Requirements

The current resource requirements by firms has been fixed for the firms at each stage. The capital requirements, were used following CBinsights study previously described. Whereas the human capital and customer requirements are derived from conversations with ecosystem stakeholders (entrepreneurs, Venture Capitalists and Accelerators) that work closely with startups at each stage and are aware of the average resource requirements.

Maturation, Exit and Failure Rates

Currently the rates of maturation, exit and failure have been adapted from those discovered by CB insights and the conversations with Entrepreneurial Ecosystem stakeholders, as explained earlier in this Chapter. It is worth noting that the below rates (maturation, exit and failure) may be different at the regional ecosystem level as later explained. Therefore when building the specific model for a regional ecosystem, these rates can be adapted to those observed in the particular geographical location.

Startup Creation Rate

The startup creation rate is currently taken to ramp up to reach a constant rate. Obviously, the rate of creation of companies varies year over year and will depend on the entrepreneurial intention of the population, and other macroeconomic conditions (such as availability of established employment or funding). Entrepreneurial intention is an endogenous variable that is

affected by both reinforcing and diminishing factors as later explained. We will also explore different scenarios, for example, a dry spell in which companies are not created for a period of time and how that may affect the ecosystem, or one in which in a particular year there is a spike in firm creation.

Requirement of Resources by Stage of Firms

Currently, we have made no distinction between the resources required at each stage of firms, pooling all total resources required by firms at different stages into one. As the resources are pooled into one, and then the resource requirements are compared to the availability of resources, the impact across firms at different stages is the same. Nonetheless with data on the specific availability of funding at different stages (seed funding, or growth/late stage funding) this availability could affect the survival rate at a specific stage.

Exits

Our model considers that there are no exits at the seed stage level, as the entrepreneurs are still working to build their product or service. However exits may occur at all other stages of firms (early, growth or late). The later the stage of the exit, the larger the subsequent effect it may have in the ecosystem.

Customers

Our model considers that customers are not geographically bounded, startups can service customers outside of the ecosystem and even across borders, especially by leveraging online platforms.

Weights of Parameters

As the contribution of each reinforcing and diminishing feedback mechanism is currently unknown we had to assign equal weights to each parameter, which was a necessary simplification.

Other Considerations

Timescale: we will consider a timeframe of 25 years within our model, as it takes around 10 years for a company to pass through all phases of the lifecycle of a company.

The DT is set to be 0.25, meaning calculations will be done 4 times per year.

At this point considering average distribution and requirements of all firms in the region. The future, it would be interesting to create a combination of agent base modeling (have the startups themselves as the unit of value creation with their specific resource requirements), and aggregate these requirements in our current ecosystem model.

It is important to note that the output scale is dependent on the quality and quantity of data, nonetheless, the behaviour and relationship between the variables is already important, regardless on the magnitude of the y-axis.

4.20 Validation of the System Dynamics Model

The purpose of testing the validity of the model, is to compare the model output to an empirical reality to corroborate or refute the model (Senge & Forrester, 1980).

Forrester and Senge stated that "There is no single test which serves to 'validate' a system dynamics model. Rather, confidence in a system dynamics model accumulates gradually as the model passes more tests and as new points of correspondence between the model and empirical reality are identified" (Senge & Forrester, 1980, p.209).

Many others after have also emphasized this same point, reaching the consensus that validation of a System Dynamics model is achieved throughout the iterative development of a model by a continuous cycle of confidence building tests (Barlas & Carpenter, 1990; Richardson & Pugh III, 1981; J. D. Sterman, 1984). Building confidence is vital for a model to serve its

intended use, but there is no one test that credits or discredits a model, but rather a series of steps that help build confidence in our model and its output. Each test is not an end in itself, but rather a step towards confidence building.

As Sterman pointed out, confidence and validity should not be equated to the absolute truth. Therefore the usefulness and validity of our model are necessarily tied to the purpose of the model. As Richardson and Pugh stated "...it is meaningless to try to judge validity in the absence of a clear view of model purpose" (Richardson & Pugh III, 1981, p.310). Therefore the vital first step before achieving validity is to clarify the purpose of our model.

4.20.1 Model Purpose

As outlined before, the purpose of the model is twofold, improving our understanding and guiding of actions, especially those of policy-makers.

With these clear purposes and goals in mind, we proceeded to seek validation of our model. Achieving "validity" of our model, will mean that we can use with confidence the model for its intended purpose.

Our model, and no model for that purpose, can claim the absolute truth, but we hope that the model is suitable for the abovementioned purpose and is consistent with reality (Stephan, 1992). The first step is the validation of the model, in order to establish more confidence in the soundness and usefulness of the model (Senge & Forrester, 1980). In this way we hope to see if the model behaves plausibly and in a way similar to the parameters seen in the real world.

Throughout the literature, tests have been collected to help build confidence in System Dynamics Models. We went through the "core tests" in model structure and model behaviour tests (Table 4.32):

Table 4.32: Confidence Building Tests, according to Senge and Forrester (1980) (Senge & Forrester, 1980)

Tests of Model Structure	
a	1. Structure Verification
a	2. Parameter Verification
a	3. Extreme Conditions
a	4. Boundary Adequacy
a	5. Dimensional Consistency
Tests of Model Behaviour	
a	1. Behaviour Reproduction
	2. Behaviour Prediction
a	3. Behaviour Anomaly
	4. Family Member
	5. Surprise Behaviour
	6. Extreme Policy
	7. Boundary Adequacy
a	8. Behaviour Sensitivity
Tests of Policy Implications	
a	1. System Improvement
	2. Changed-Behavior Prediction
	3. Boundary Adequacy
a	4. Policy Sensitivity

a Core Tests

4.20.3 Model Structure Tests

Richardson and Pugh also discuss model validity by posing the questions: "Is the model suitable for its purposes and the problem it addresses?" (Richardson & Pugh III, 1981, p.312).

The purpose of our study is **not** to create a decisive/definite/conclusive model of the Entrepreneurial Ecosystem, as this will require the input from other researchers and stakeholders and a better understanding of the development of Entrepreneurial Ecosystems globally. But rather, our goal is to create a **tool** that brings a **better understanding** to the important processes that occur in the **development** of Entrepreneurial Ecosystems, as a vital **first step** to be able to **guide future development**.

Secondly, the purpose behind this model is to help guide policy makers better understand the development and reinforcing and balancing mechanisms that take place in the development of the Entrepreneurial Ecosystem, and thus allow them to **designing more effective policies** to support entrepreneurs and the development of the Entrepreneurial Ecosystem.

Structure Verification Testing

The initial test focuses on comparing the structure of the model to that of the real system it is representing, and for the model to not contradict the real system. This is important because the structure of the model will determine the behaviour of the system, therefore we must make sure that all elements in the model should have real world counterparts and all important factors in the real world, to be reflected in our model (Shreckengost, 1985). To address this point we reviewed the Entrepreneurial Ecosystem literature and included all relevant factors, and designed our model to structurally follow the literature and to have a level of aggregation that matches other research (for example, the aggregation of startup according to 4 stages).

Parameter Verification Testing

Secondly, we ensured that the model parameters we were using could be verified against values in the real system and correspond conceptually and numerically to them. All parameters in our model fell in the plausible range in the real world, and were consistent and reasonable to the supporting data that exists in the Entrepreneurial Ecosystem literature. As explained before, the groups are heterogenous in their composition in having firms from different industries or business models, yet it makes sense to aggregate into the 4 different stages of firms as all firms considered go through the process of fundraising that is comparable across firms.

Extreme Conditions Testing

Thirdly, we next tested the behaviour of the model in extreme conditions. For example if the startup creation rate is set to 0, the startup number must fall to 0 too, and the “aging chain” should fall to 0 after the appropriate number of years have passed.

Boundary Adequacy Testing

Fourthly, we considered if the model aggregation was appropriate or not and if the model included all relevant structures in the Entrepreneurial Ecosystem. The model boundaries depend on the purpose of our model. Initially, our purpose is to explain the generic behaviour of the development of an Entrepreneurial Ecosystems (not one case study replicating the features of a local Entrepreneurial Ecosystem).

In our case, we are not modeling each individual’s firm behaviour, as we are not interested in the specific dynamics, but rather the aggregate to the ecosystem. This constitutes the appropriate level of detail for the purpose of the model. In the future, it would be ideal to combine the firm level behaviour, potentially through an Agent Based Model together with the macro perspective achieved by System Dynamics. Figure 4.4 defines the boundaries and explanation of which are the endogenous, exogenous and excluded factors.

Dimensional Consistency Testing

Fifth, we checked for dimensional consistency within the model, to make sure they all of the units and dimensions were consistent throughout the model, rates, relations and equations. We also checked that no variable was introduced to make sense of the dimensions, but that would have little significance in the real world.

After building confidence in our model structure, we proceeded to build confidence in the behaviour of our model.

4.20.3 Model Behaviour Tests

Behaviour Reproduction Testing

The ultimate validation and verification method of a System Dynamics Model is achieved if the model is able to reproduce the historical behaviour of the system being modeled. We

compared the behaviour of the model to that of the system being modeled, in this case the development of the Estonian Entrepreneurial Ecosystem. In our case, we had historical time series data available, and compared the model output to this historical data. In the case of Estonia, over a 10 year development period, the ecosystem reached a size of ~300 firms, whereas our generic model reached a comparable size with a similar growth curve. As can be seen, the modeled output of our system highly resembles the historical dynamics of the Startup Ecosystem. The fact that the historical and the modeled development of the ecosystem highly resemble each other is considered as the biggest confidence building mechanism for the verification of our model. In a sense, the fact that the model behaviour and dynamics closely mirrors historical data, allows us to trust our model and be able to pursue different testing scenarios and extract insights that would have otherwise been unachievable.

Nonetheless, it is important to note that the model does not exactly replicate the historical behaviour as there are certain simplifications and assumptions in order to create the model.

Figure 4.16: Historical Aggregate Number of Deals the Estonian Entrepreneurial Ecosystem (Source: Gruner, M, n.d)

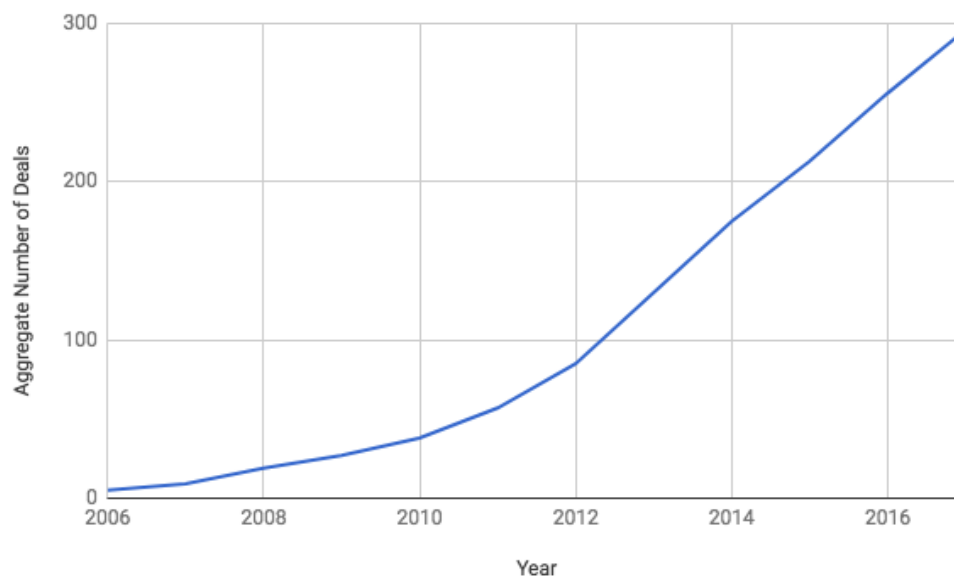
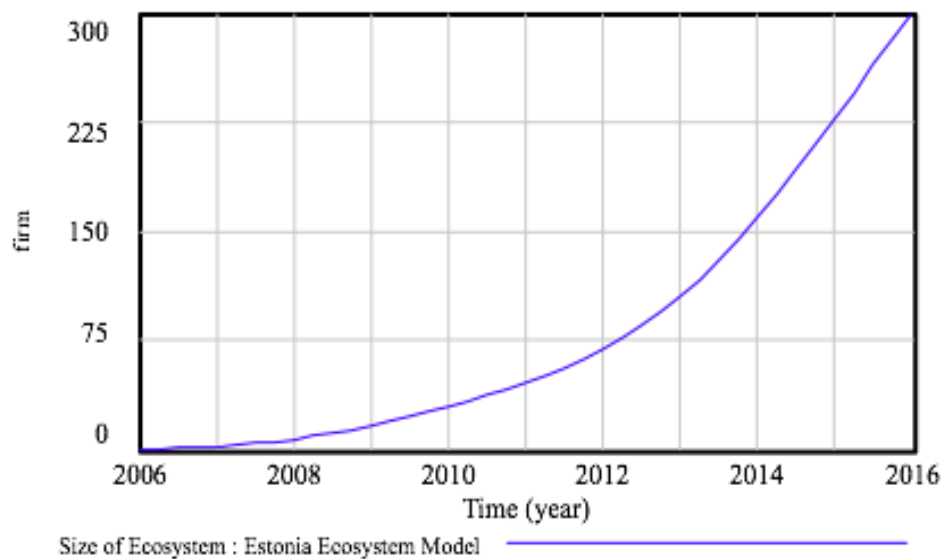


Figure 4.17: Modeled output of our model, total number of firms in the Estonian
Ecosystem



Anomalous Behaviour Testing

In cases where the model did not replicate the behaviour of the real system, we looked back and corrected the model process in an iterative manner, to fix these issues.

Behaviour Sensitivity Testing

Small, reasonable and plausible changes in the parameter values should not produce radical changes in behaviour. As this was the case, confidence in the model again is increased. We also confirmed the robustness and comprehensiveness of the model via its application to several scenarios, as described in Chapter 5.

Behaviour Prediction Testing

The model was used to predict how the system would behave if various policies of interest were implemented (ease/burdening of funding: incentives or disincentives, human capital availability: immigration burdening and easing and education/training (startups often don't have the capital to train), customers (facilitate/burden imports), as described in Chapter 5.

4.21 Reference Mode

The combination of these variables will allow us to compare different ecosystems across the world, as well as identify if they are performing according to the policy-maker's needs (of employment, wealth or innovative product generation). These variables will help us realize our model's validity and insights' importance from our simulations. They will be the basis of our reference mode and will serve for us to compare the behaviour of our model to the reference mode to check if the simulations reflect the real behavior of the Entrepreneurial Ecosystems.

We are now ready to graph these most important variables over time as a reference mode. The reference mode uses historical information to track the dynamics of a particular problem (historical reference mode), as well as hypothesized behaviour (hypothesized reference mode). The historical behaviour then helps the modeler in building a model that is accurate and valid for the problem of study. In our case, availability of high quality, precise information on startups is one of our study's limitations. As they are privately owned companies, the records are more difficult to find and accuracy is sometimes lacking. Often firms have failed already, yet they still appear in the records, as the founders have not informed the database curators, or keep their online presence, or often, startups may operate without registering, or be mistakenly labelled as an SME. Another issue is that there is no centralised mechanism that gathers information, with coverage worldwide (they tend to be regionally focused), therefore not ideal.

The choice of a time horizon in which to plot our reference mode is very important. In our case we know that the average time from a newly created firm to growth is around 8.57 years (From Table 4.9: $1+3.41+3.08+1.08$), as well as for a Entrepreneurial Ecosystem to develop it requires several generations of these successful firms, reinvesting and giving back into the ecosystem. In that case we have set the time horizon for our models to be 25 years. Allowing for enough time to see the development of the Entrepreneurial Ecosystem, yet not long enough that our predictions become inaccurate.

Once our model has been carefully **explained and validated** and it is **able to explain observed historical trends**, we will now use it as an instrumental tool to understand how different scenarios may affect the development of the Entrepreneurial Ecosystem. Therefore the following chapter will explore how a variety of scenarios and policy making decisions can

support or hinder the development of the Entrepreneurial Ecosystem, and value creation within the region.

Chapter 5: Results of the Dynamic Development of the Entrepreneurial Ecosystem

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5.1. Capacity Limit

One of the most interesting questions that we would like to address is that of capacity limit, or capacity planning. First is how to calculate the current **carrying capacity** of an Entrepreneurial Ecosystem. According to the current level of resources, how many startups can be supported. Will the capacity limit be reached, and if so when will it be reached?

The desire of policymakers is to **maximize the positive impact** that entrepreneurship can have in a region. Therefore, the **capacity limit** is one of the keys to understanding what **future hurdles** startups in the ecosystem might experience. In this way we can also **identify** which is the **limiting factor**, and thus **devise actions** that can **expand the carrying capacity** of the Entrepreneurial Ecosystem. In this way, policy-makers would **not merely behave reactively** to the symptoms, but rather would **anticipate** and **evaluate** the **current limits to growth** and would **take actions to alter the root cause of the problem before it becomes problematic**.

Second is to identify which is the **limiting factor** to the current capacity. Which of the necessary components is limiting the ability to support a larger number of startups. In this lies the **key to better resource allocation**. No matter how much excess of other resources there are, if one of the key components necessary by a startup is limiting, there will be a negative impact in further ecosystem growth. Therefore ecosystem stakeholders and governments could **most efficiently** support the development of the ecosystem by addressing these gaps.

If we have Regional Data of the Entrepreneurial Ecosystem, such as number of firms and resources over a period of time, we can build a model that adheres to the particular regional Entrepreneurial Ecosystem dynamics, and we can estimate future resource needs and assess

if/when the capacity limit will be reached.

5.2. Scenarios being Explored

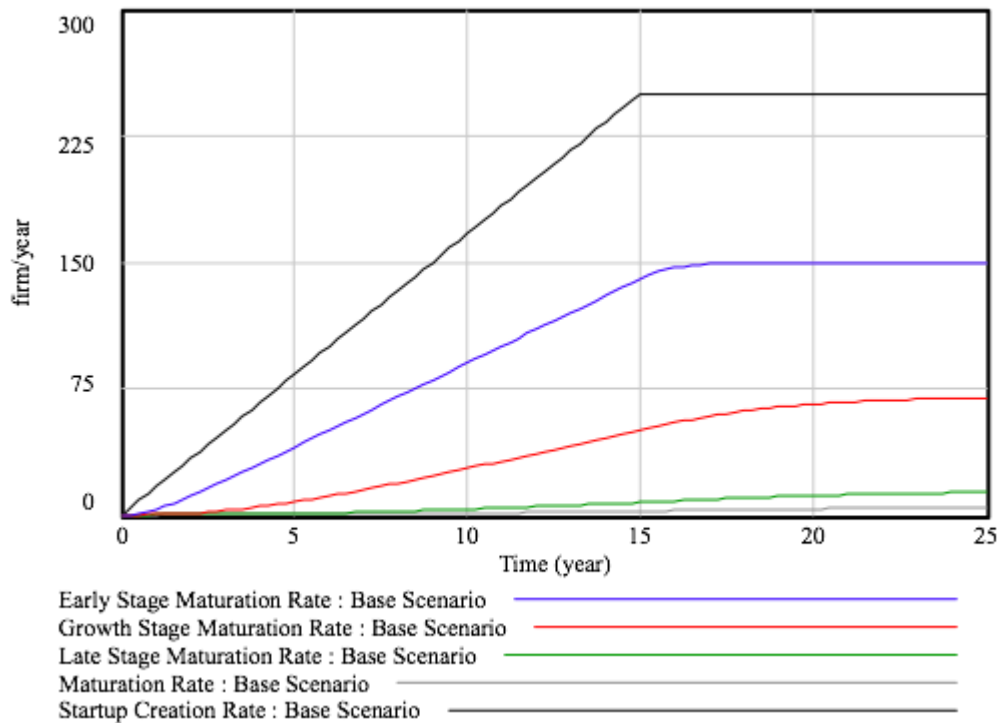
Currently, we have built a **generic** model of an Entrepreneurial Ecosystem, to **elicit systems thinking amongst Entrepreneurial Ecosystem stakeholders and policy-makers**. In doing so we will consider different scenarios, in order to understand more deeply the contribution of the firms at each stage to the value and dynamics of the ecosystem. The scenarios are:

- a. Base Case Scenario
- b. Limited Resource Scenario (Limited funding, human capital available and customers available)
- c. Effect of Increased Availability of Resources Scenario
- d. Reinforcing Effect Scenario
- e. Balancing Effect Scenario
- f. Entrepreneurial Intention Effect Scenario
- g. Drought in Firm Creation Scenario
- h. Spike in Firm Creation Scenario
- i. Regional Ecosystems

5.2.1. Base Case Scenario

The base case scenario serves to understand the dynamics of the model, in it, startups have access to “unlimited” access to resources (funding, human capital and customers), meaning the availability of resources will always be higher than the aggregate needs of the startups in the ecosystem. In this way we can see the development of the ecosystem when the limits to growth are not reached.

Figure 5.1: Firm Creation Rate in a Newly Developing Entrepreneurial Ecosystem



In Figure 5.1, we can clearly see the effects of the “aging chain” of the Entrepreneurial Ecosystem model; in terms of startup lifecycle and delay between each of the stages. For simplification purposes, we have not considered there to be any pre-existing firms (of any stage) at time = 0, meaning the ecosystem is starting from scratch.

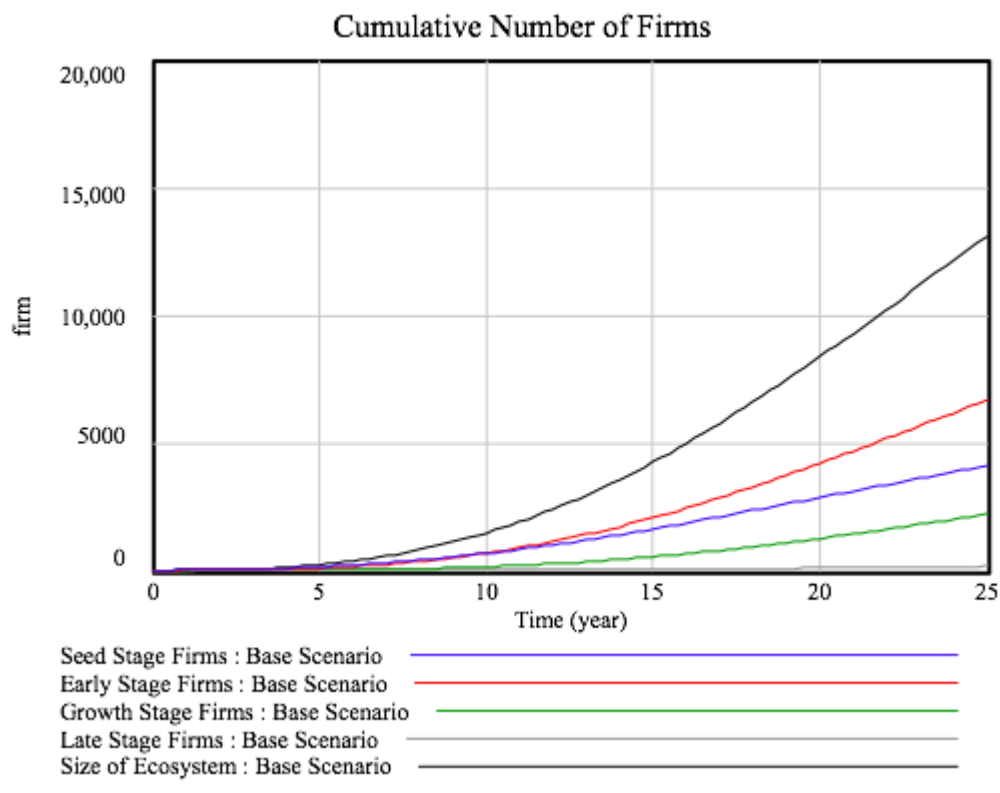
Initially, seed stage firms are created in the ecosystem (the assumed rate is a ramp up from 0 to 250 firms/year over a 15 year period). As it takes seed stage firms around 1 year to mature to become early stage firms (Table 5.6), 3.41 years to become growth stage firms, and 3.08 more years to become late stage firms, we can clearly see this delay in the appearance of each of these types of firms.

If we remember, the survival rate at each stage is <1 , as only a fraction of firms succeed to mature to the next stage. This effect on the survival rate can also be seen clearly in the smaller size of the peak of early, growth and late stage firms respectively.

Figure 5.1 shows the yearly creation and maturation rate of startups by stage, whilst in Figure 5.2 we can see the cumulative amount of firms at each stage over the years. As we can see, Entrepreneurial Ecosystems take certain time to gain momentum, and reach certain size. The

Entrepreneurial Ecosystem Report (by Startup Genome), claims that an ecosystem reaches the expansion phase when it reaches a size of 2000 startups. According to our model, this could take a little over 10 years (with the current values and all simplifications considered)(Figure 5.2), if the ecosystem starts from scratch (number of seed stage, growth stage and late stage firms is 0 at time = 0). Although the actual value, ~10 years, may or may not be completely accurate, what is relevant is that an Entrepreneurial Ecosystem will require several generations of startups, their successes and failures to reach significance, and that this will take place in a timeframe closer to the **decades rather than years**.

Figure 5.2: Cumulative number of firms by stage in a newly developing Entrepreneurial Ecosystem



Another interesting observation is that the overall size of the ecosystem is due predominantly to the presence of seed stage and early stage firms, and to a much lesser extent, growth and late stage firms, as explained by the survival rates of less than 1, at each of the successive stages of firms. However, as we will now see, even though in a grand scale it is

difficult to see the number of late stage firms relative to the total size of the ecosystem. Nonetheless the value creation and resource requirement of growth and late stage firms is significant as we will now observe (Figures 5.4, 5.6, and 5.8).

One counterintuitive finding is that although the creation rate of seed stage firms is higher than the creation rate of early stage firms (Figure 5.1), cumulatively there are more early than seed stage firms (Figure 5.2). The explanation to this phenomenon, is that Seed Stage firms are only within this state for a short period of time (Average Seed Residency = 1 year), whereas the Early Stage period is much longer, (Average Early Residency = 3.41 years).

Understanding the firm distribution within an Entrepreneurial Ecosystem is important to understand the requirement of resources as well as which type of firms are responsible for the value generation within the region.

The funding requirement of late stage firms, around year 7 becomes higher than that of seed stage firms (Figure 5.3) despite the much smaller number of firms (Figure 5.1).

Growth Stage Firms are cumulatively the main requirers of funding within the Entrepreneurial Ecosystem, whereas Early and Late Stage Firms follow (Figure 5.4). Nonetheless Seed Stage firms despite being the most numerous, only are responsible for a small part of the funding raised (Figure 5.4).

Figure 5.3: Requirement of Funding by Firm Stage in a Newly Developing Entrepreneurial Ecosystem

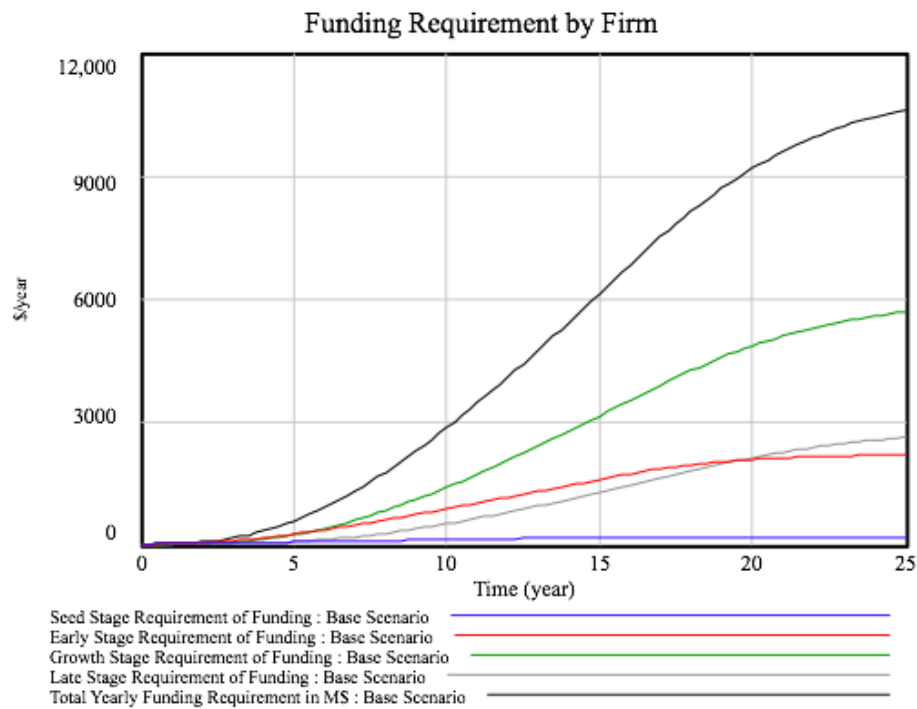
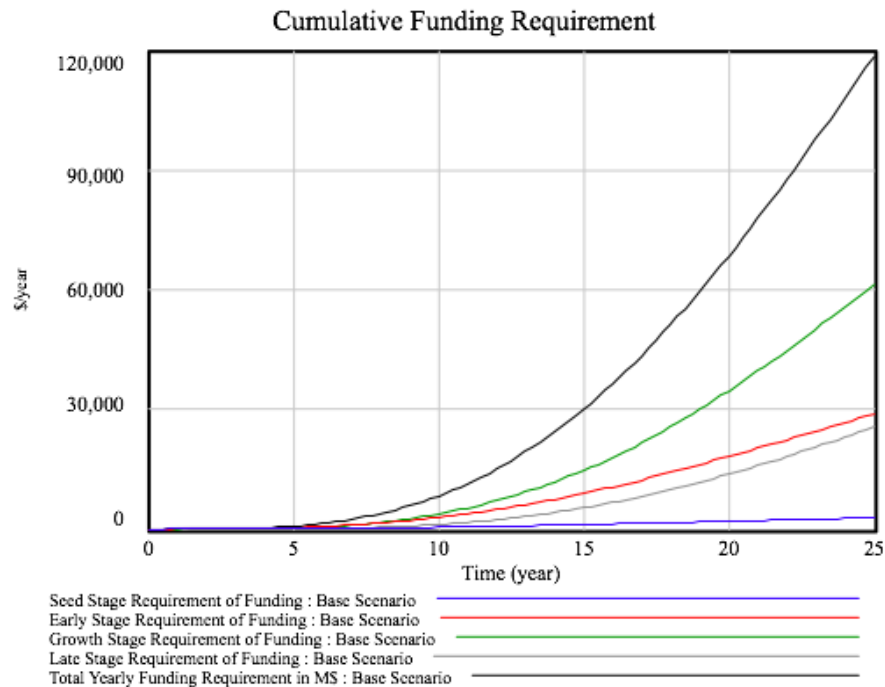


Figure 5.4: Cumulative Requirement of Funding by Firm Stage in a Newly Developing Entrepreneurial Ecosystem



Human capital requirement within this context equates to direct employment generation

by the firms within the ecosystem. In the first decade of the development of an Entrepreneurial Ecosystem, the Early Stage firms will be the main firm type responsible for employment generation in a new Entrepreneurial Ecosystem (Figure 5.5), whereby from the second decade, Growth Stage become the main employment contributors. Late stage firms only marginally contribute to the number of jobs created, starting from the second decade of development despite each Late Stage firm employing a larger amount of people, their overall low number within an ecosystem make their employment generation only marginal. Seed stage firms on the other hand are the most numerous type of firm, yet are only employing few employees each, therefore also having a marginal contribution to employment generation.

Figure 5.5: Requirement of Human Capital by Firm Stage in a Newly Developing Entrepreneurial Ecosystem

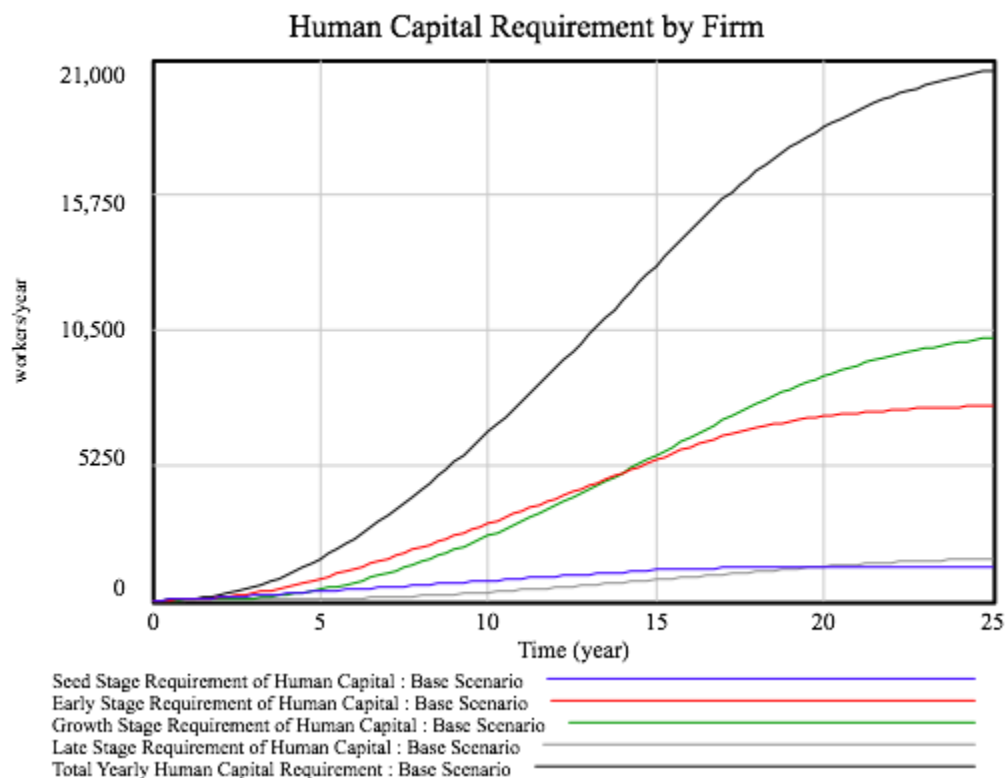
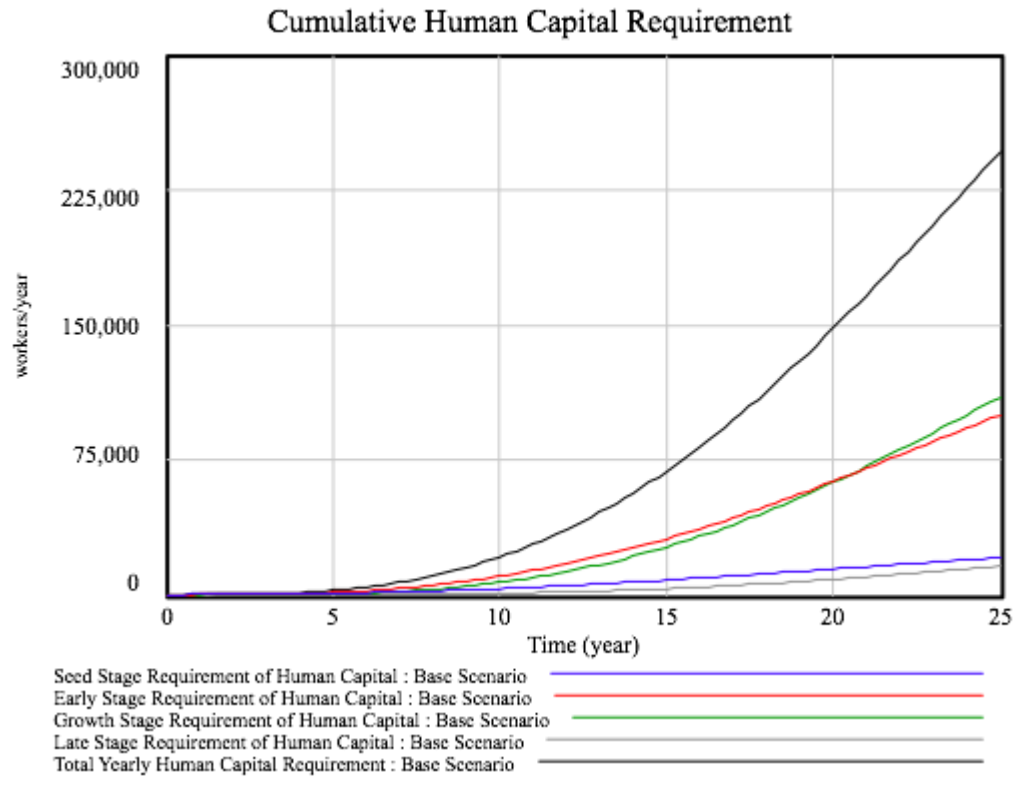


Figure 5.6: Cumulative Requirement of Human Capital by Firm Stage in a Newly
Developing Entrepreneurial Ecosystem



Customer requirement equates to the number of customers that are being serviced by startups (number of people that are either buying or using the product or service provided by a startup). Lastly, in case of customer requirements, seed and early stage firms have a much smaller scale of impact in this level, with almost imperceptible number of customers being served compared to growth and late stage firms (Figure 5.7-8). Understandably, one individual can be a customer for many startups as well as a repeat customer over the course of the year, and with the increased connectivity globally startups can service clients outside of their geographical region, therefore it is not alarming that the collective number of customers being reached is in the millions (Figure 5.7-8).

Figure 5.7: Requirement of Customers by Firm Stage in a Newly Developing
Entrepreneurial Ecosystem

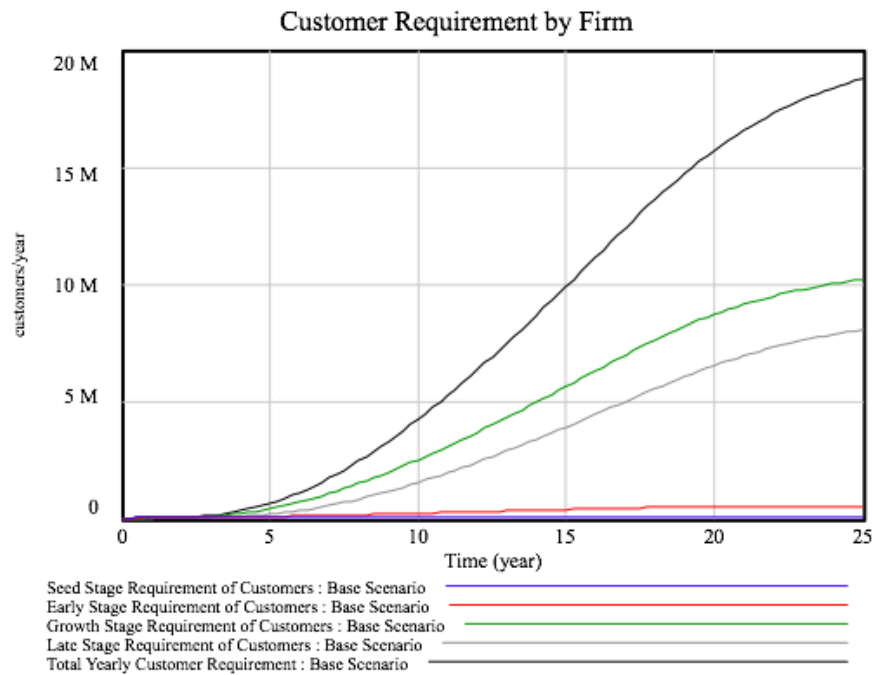
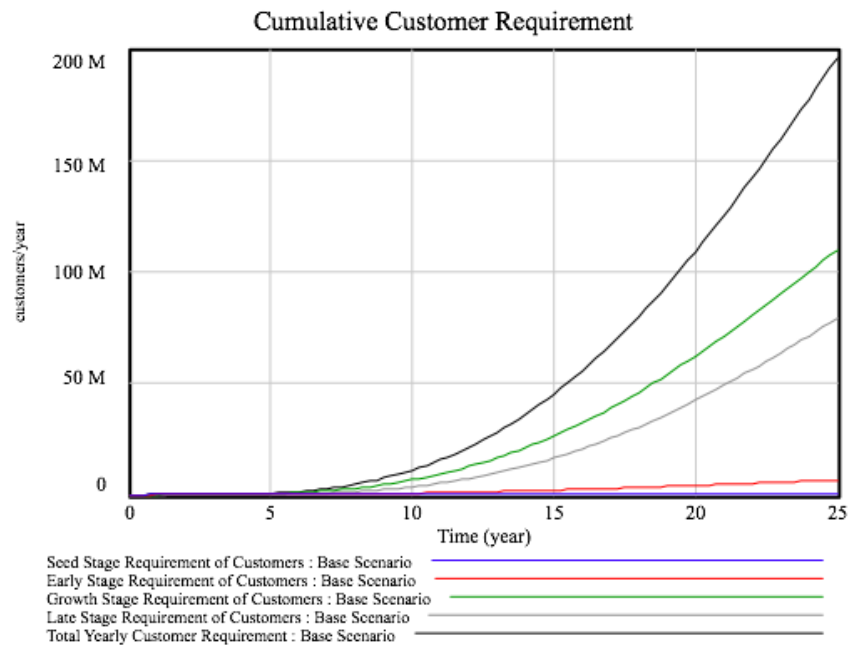


Figure 5.8: Cumulative Requirement of Customers by Firm Stage in a Newly Developing
Entrepreneurial Ecosystem



As we can see from figures 5.2, 5.4 and 5.6 even though Growth Stage and Late Stage firms form a small part of the number of firms in an Entrepreneurial Ecosystem, they are responsible for a disproportionately large amount of the resource requirements and value creation (jobs and valuation) within an Entrepreneurial Ecosystem.

Although simple, figures 5.2, 5.4 and 5.6 are important for policy-makers to understand the contribution of each stage firms to their region. Depending on the goal of the development of the Entrepreneurial Ecosystem, and what constitutes success, policy-makers can assess which stage firms contribute the most to their area of interest (employment creation, development of products/services for a large customer base, future revenue by tax...).

Now that the Base case working of our model is understood, we will proceed to explore how the varying scenarios might affect the development of the Entrepreneurial Ecosystem and the value being created within the region.

5.2.2. Limited Resource Scenarios

Next we explored how the limited availability of resources (funding, human capital or customers) can affect the development and value creation within the Entrepreneurial Ecosystem. In the Limited Resource Availability Scenario we limited the availability of the resource to approximately 50% of the maximum resource requirement in the base case scenario, whereas in the Very Limited Resource Scenario we limited the availability of the resource to approximately 25% of the maximum resource requirement in the base case scenario (Table 5.1).

Table 5.1: Resource Availability in the Limiting Scenarios

Resource	Base Scenario Maximum Requirement	Limited Resource Scenario	Very Limited Resource Scenario
Funding	~\$11,000M	\$5000M	\$2500M
Human Capital	~21,000 people	10,000 people	5,000 people
Customers	~20M customers	10M customers	5M customers

Next we explored what would be the differences between the three scenarios, one with plentiful availability of resources (Base Scenario: in green, as described in the section above), and two other in which the amount of resources is initially sufficient to support all firms within the ecosystem, yet as the Entrepreneurial Ecosystem develops and the requirements for resources increase, the availability of resources becomes less than the requirements from the growing number of startups (Limited Resources Scenario: in blue and Very Limited Resources Scenario: in brown). In this case, as the resources are necessary for success, startups that are unable to secure funding will either fail or leave the ecosystem in look for the resources elsewhere. In this case we will see a decrease in the number of firms in the ecosystem.

The graphs below show how the distribution of firms at each stage (seed (Figure 5.10), early (Figure 5.12), growth (Figure 5.14), and late (Figure 5.16)), differ over time and across both scenarios (sufficient and limited availability of resources), as well as how the total number of firms in the ecosystem differs over time (Figure 5.18). As can be seen from Figures below, initially the number of firms follows the same dynamics as in the base case scenario, as there are enough resources available to support the development of all firms within the ecosystem, however from Time = ~13 years, the resources become limiting and thus certain firms are unable to secure the resources they need to continue growing and thus fail or have to leave the ecosystem. This results in an equilibrium with a smaller number of firms than in the base case scenario, as the ecosystem has reached its “carrying capacity”.

Figure 5.10: Number of Seed Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

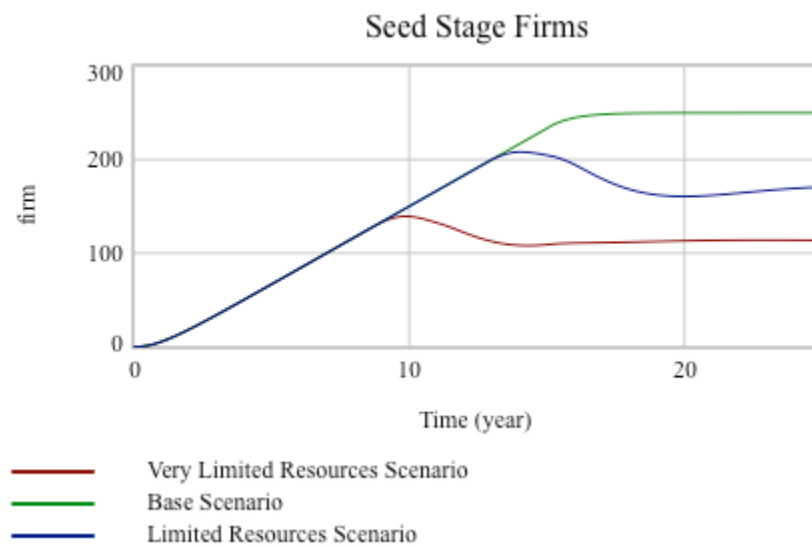
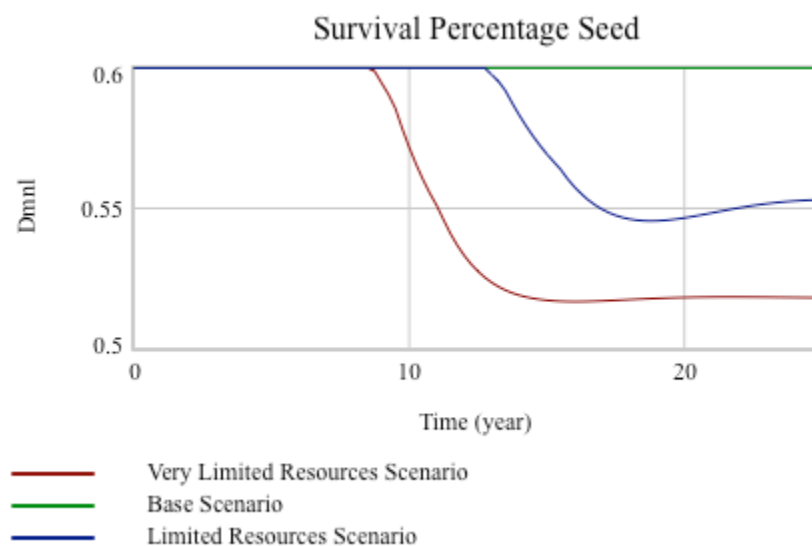


Figure 5.11: Survival Percentage of Seed Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources



In the base case scenario, the Survival Rate is set to a constant, calculated from real world observations by Cbinsights data as previously explained. As the base case scenario is not affected by reinforcing and diminishing mechanisms, and the resource availability is more than the requirement, there is no further negative effect, and the survival rate mirrors the observed data. Nonetheless, in the limited scenarios, the survival rate is affected to the extent that a

percentage of firms would not be able to be supported, being proportional to the lack of resources.

Figure 5.12: Number of Early Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources.

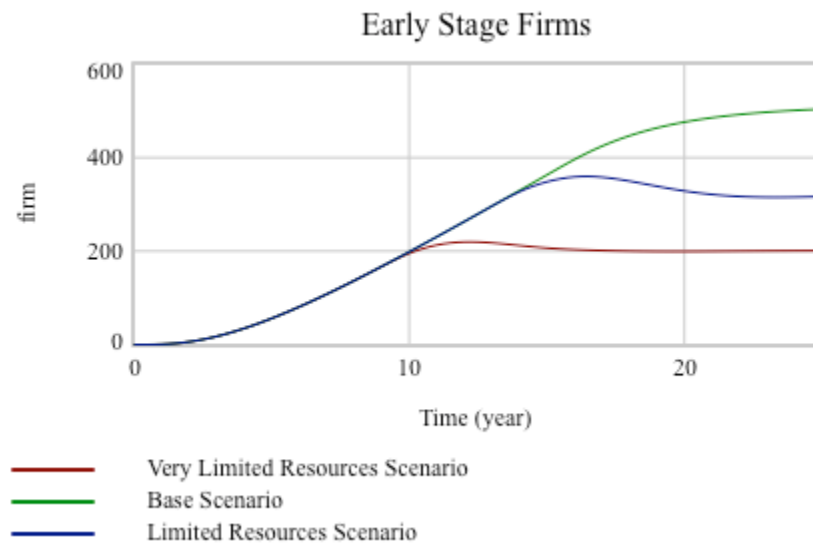


Figure 5.13: Survival Percentage of Early Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

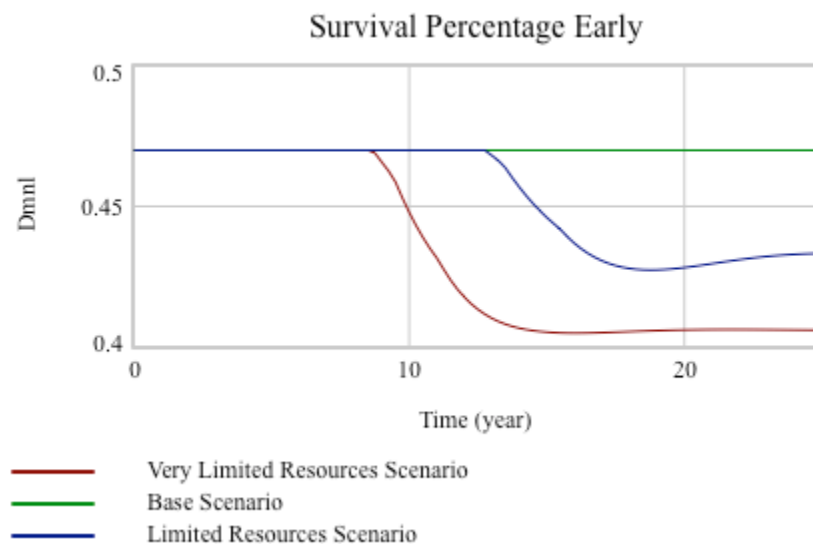


Figure 5.14: Number of Growth Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

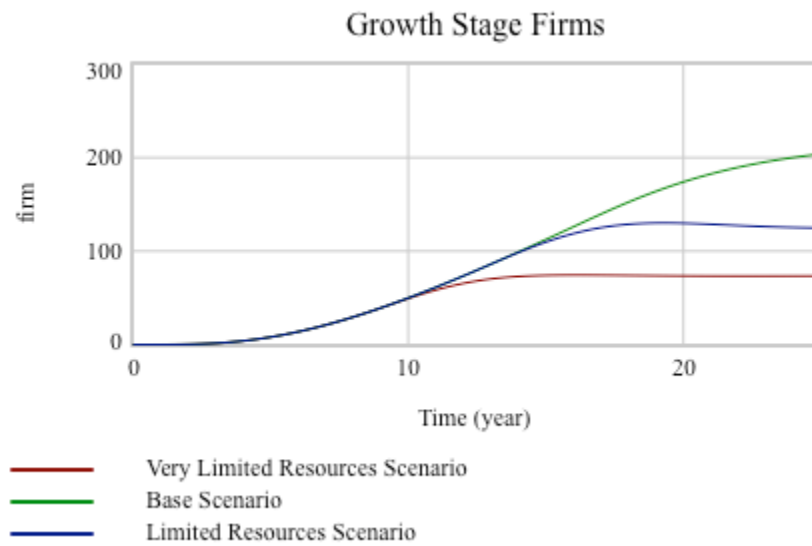


Figure 5.15: Survival Percentage of Growth Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

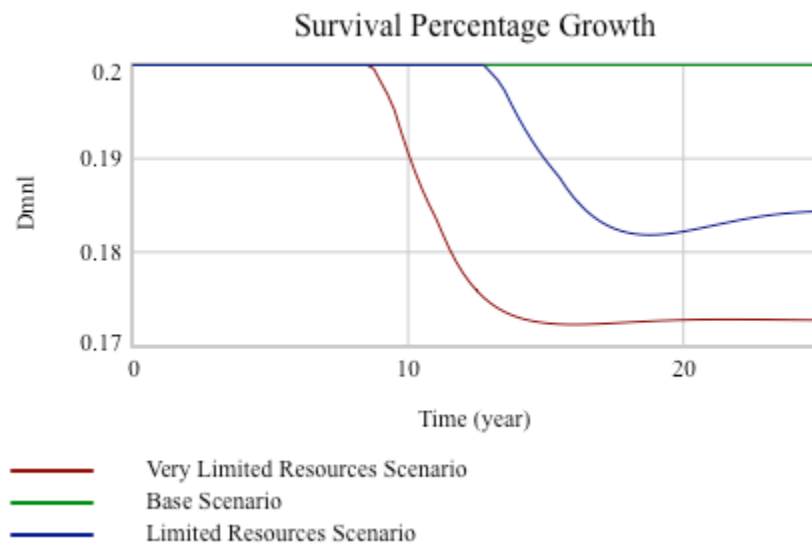


Figure 5.16: Number of Late Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

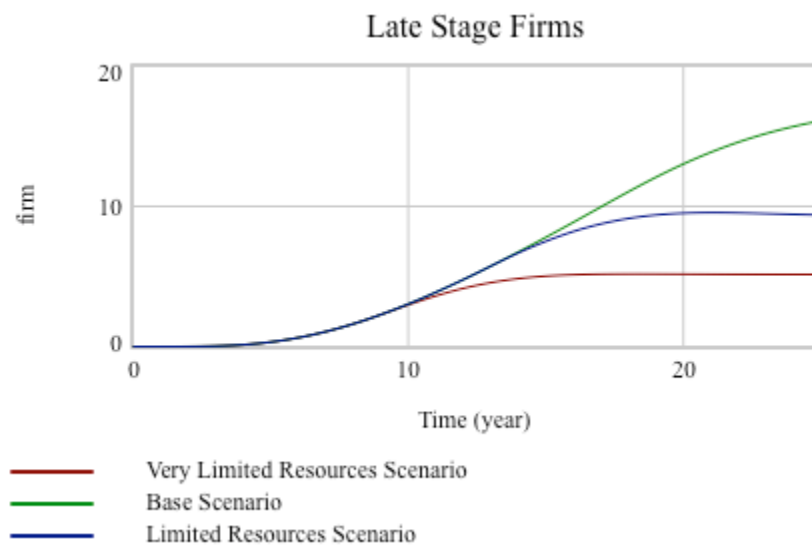


Figure 5.17: Survival Percentage of Late Stage Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

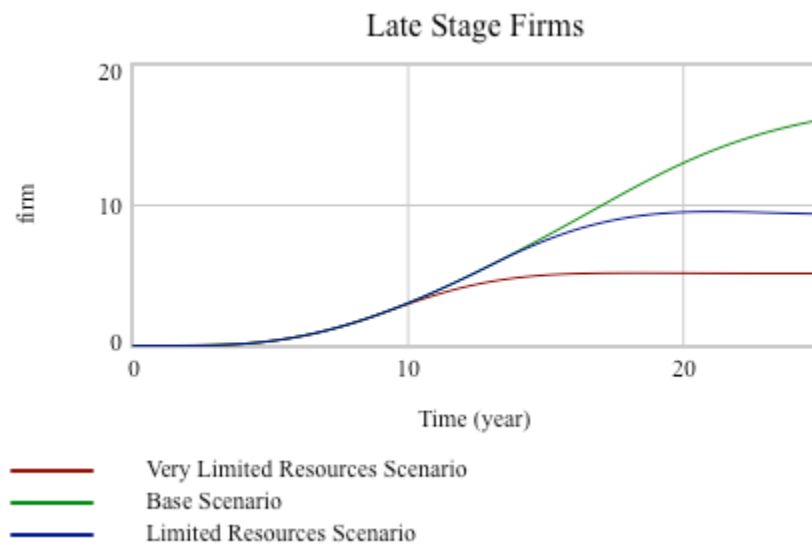
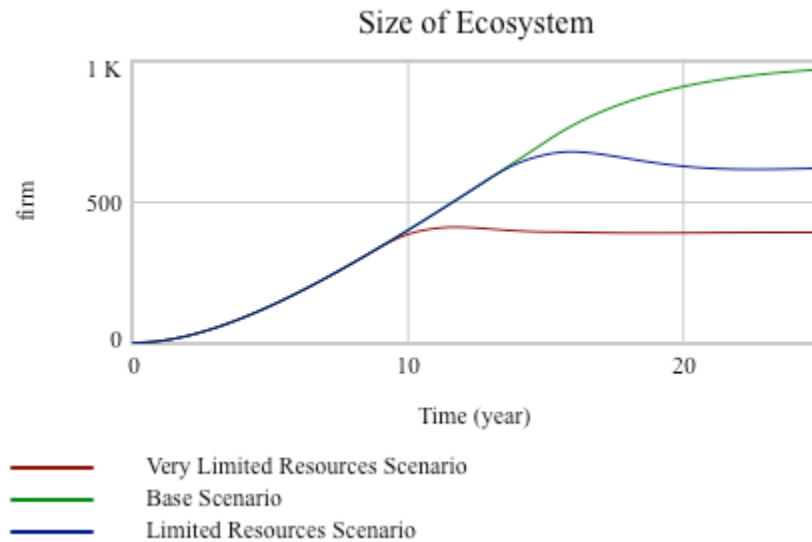
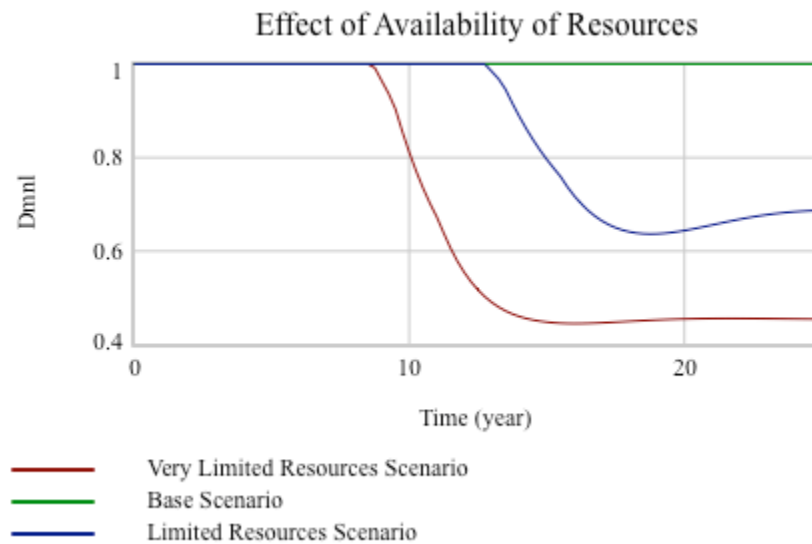


Figure 5.18: Total Number of Firms in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources



As can be seen from Figure 5.19, the behaviour of the model in the Limited and Very Limited Resource scenarios, is driven by the lack of availability of sufficient resources to support all firms within the ecosystem. In the case of the Base case scenario, as can be seen in Figure 5.19, all resources in this scenario are plentiful (the supply is larger than the demand). In the Very Limited Resources Scenario, as there are less resources available, the diminishing effect comes into play earlier (around year 9), as there are not enough resources available to meet the increasing demands by the number of firms within the ecosystem (Figure 5.19). In the Limited Resources Scenario, the lack of resources becomes a limiting factor from year ~13 (Figure 5.19).

Figure 5.19: Effect of the Availability of Resources in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources



As we previously saw, the Diminishing Effect construct is composed of two main factors, the resource availability and the Other Diminishing Factors (such as the business climate, ease of doing business in the region...). In the case of the Base Scenario, as resources are plentiful and the business environment is supportive of entrepreneurs, there is no Diminishing effect. In the Limited and Very Limited Resources scenarios, again the business environment is supportive of entrepreneurs, however as explained, demand for resources becomes higher than the supply, thus having a Diminishing Effect (Figure 5.20) and negatively affecting the Survival Rate (Figure 5.21). For simplification purposes, in neither scenario, Base or Limited, is there a reinforcing effect (Figure 5.22).

Figure 5.20: Diminishing Effect in the Base and Limited Resource Availability Scenarios

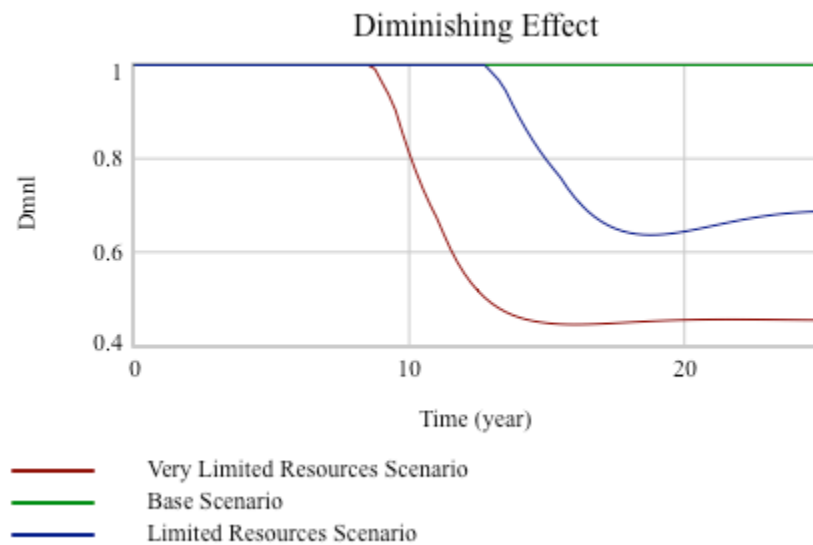


Figure 5.21: Survival Effect in the Base and Limited Resource Availability Scenarios

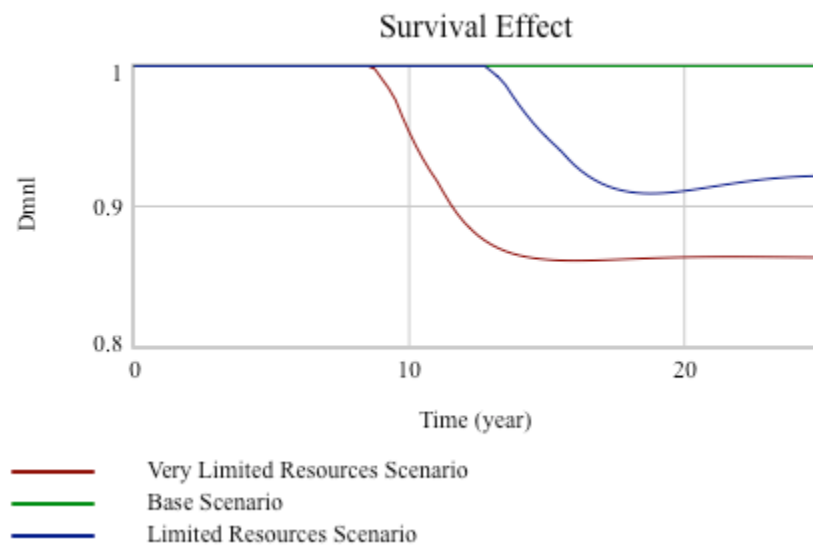


Figure 5.22: Reinforcing Effect in the Base and Limited Resource Availability Scenarios

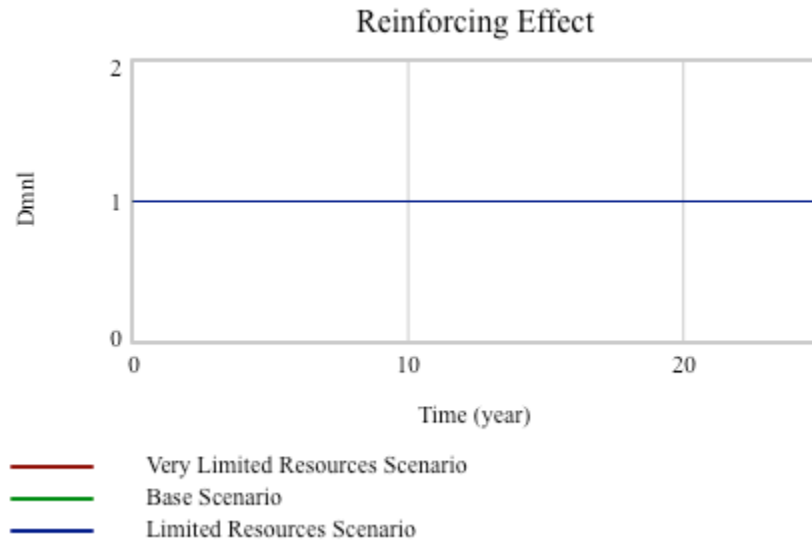


Figure 5.23: Breakdown of the Effect of the Availability of Resources in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources

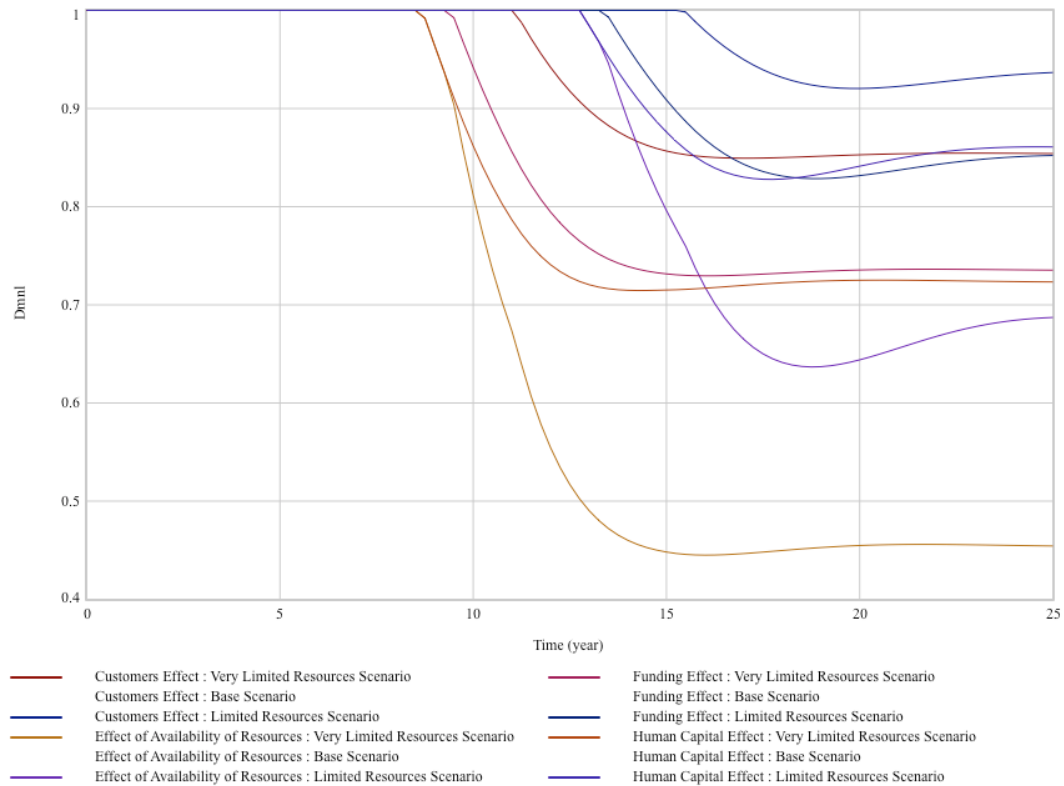
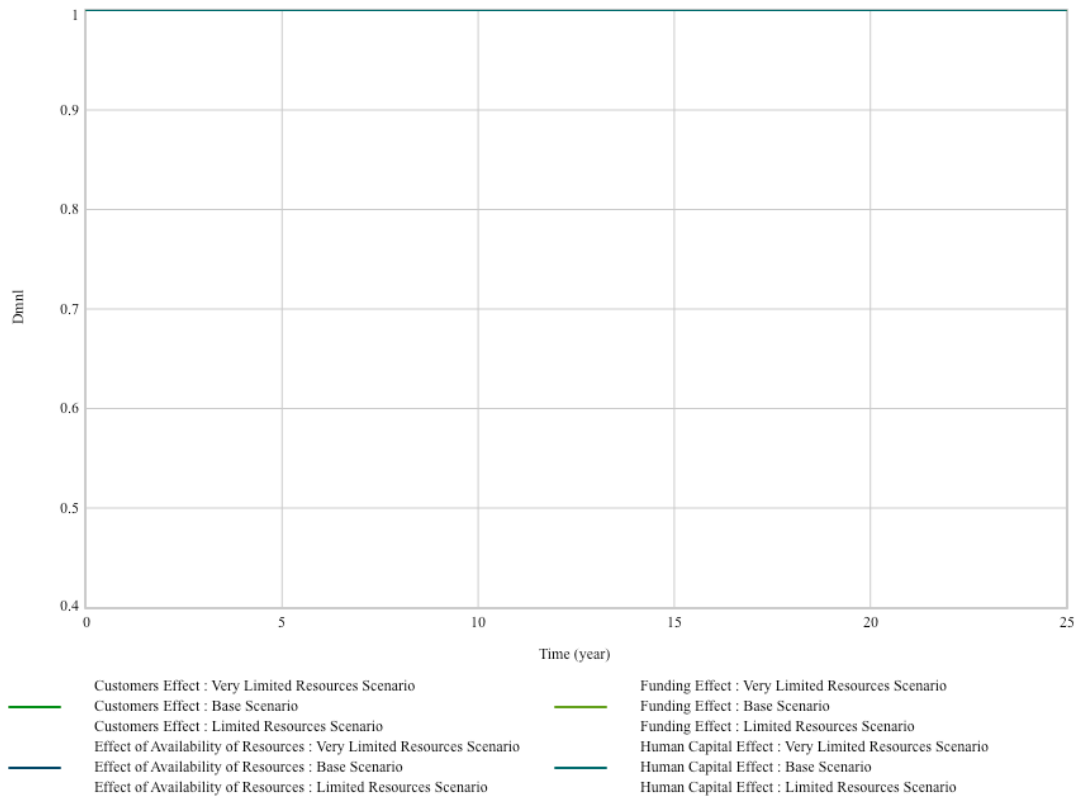


Figure 5.24: Breakdown of the Availability of Resources in an Entrepreneurial Ecosystem with Sufficient and Limited Availability of Resources



Figures 5.34 and 5.24 show the functioning of the “Effect of Availability of Resources” construct. In the Limited and Very Limited Resources Scenario, once the demand for resources is larger than the supply, the value df drops from 1, proportionally to the resource deficit (Figure 5.24). Whereas Figure 5.24 shows the case in the Base Scenario, in which the supply is larger than the demand, thus the value remains at 1.

As can be seen from Figure 5.25 the effect over time of not having sufficient resources to support the growth of the ecosystem is highly significant. In the limited scenarios, although for the first 5 years the growth is the same, once resources become a limiting factor the pace of development of the ecosystem is highly constrained. This obviously also affects the value creation within the region (Figure 5.26), employment generation (Figure 5.27), and serving customers with innovative products and services (Figure 5.28).

Figure 5.25: Cumulative Size of the Ecosystem in the Base and Limited Resources Scenarios

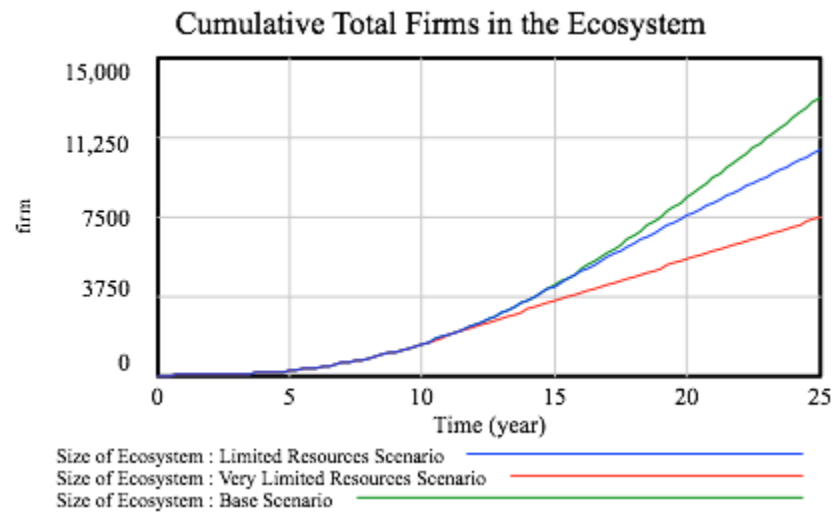


Figure 5.26: Cumulative Total Funding in the Ecosystem in the Base Limited Resources Scenarios

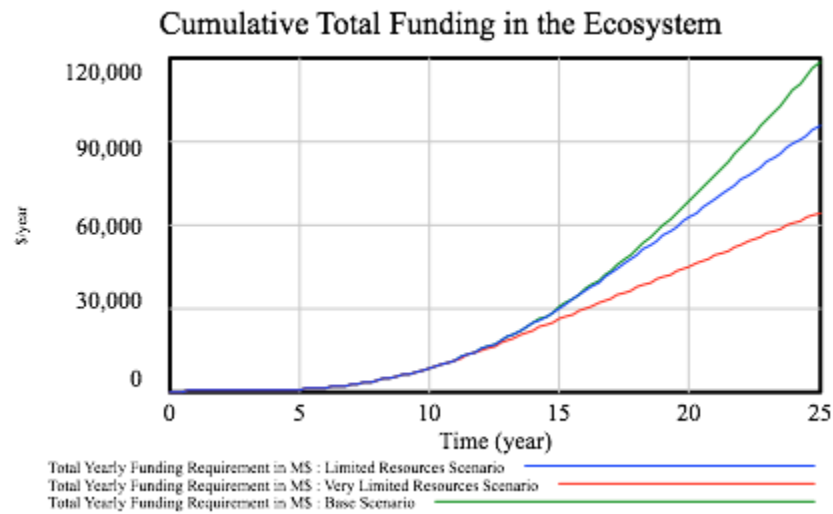


Figure 5.27: Cumulative Total Customers in the Ecosystem in the Base Limited Resources Scenarios

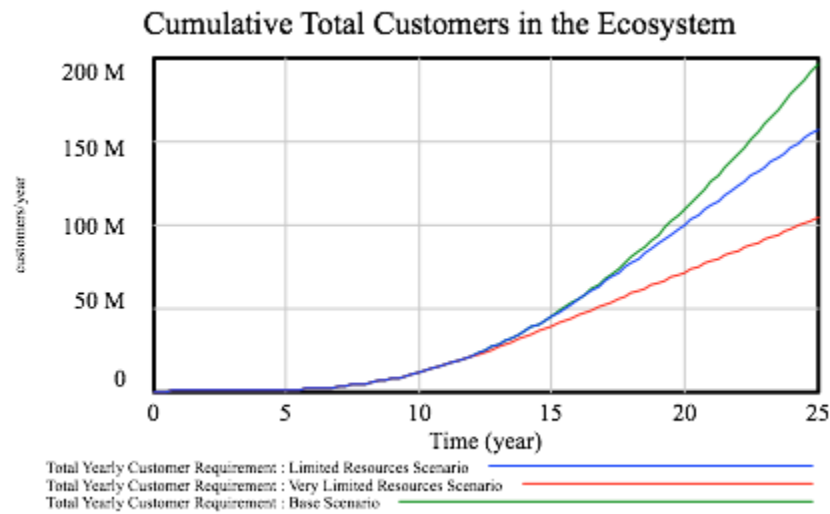
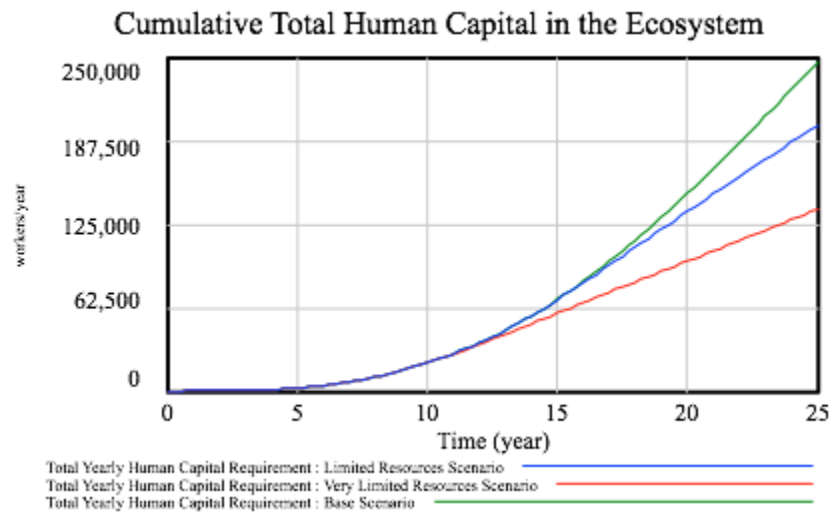


Figure 5.28: Cumulative Total Human Capital in the Ecosystem in the Base Limited Resources Scenarios



Entrepreneurial Ecosystems are important for startup's success and the positive socio economic implications that they may have in the region. However, we need a better understanding on the dynamics behind a Entrepreneurial Ecosystem development, in order to better support them. Policy-makers and Entrepreneurial Ecosystem stakeholders often face dilemmas as to how to create a more supportive environment with their limited resources.

Calculating the capacity limit of regional Entrepreneurial Ecosystems and identifying the limiting factor can be a very powerful tool to guide the actions of policymakers in their attempt to expand the ecosystem's carrying capacity. This could serve as a tool for better and more efficient resource allocation, long-term planning and stakeholder coordination for collective intervention.

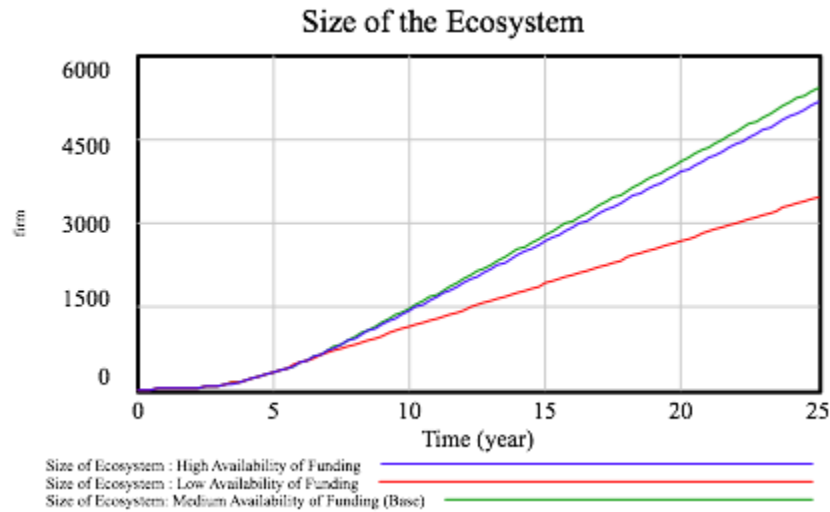
Once the model is adapted to the regional area accounting for the local resource requirements, stage of development of the ecosystem (current number of firms per stage), it would be possible to estimate in the short-term what would be the future resource requirements and if the capacity limit would be being achieved some time in the future. If this is the case, it would be possible to understand which of the resources is causing this limited growth in the ecosystem and thus allocate efficiently the public resources to try and revert this situation (for example by providing incentives to bring investors to the region, by attracting further talent to the region by easing the employment law or increasing access to customers by favouring exports, to name a few).

5.2.3 Effect of Increased Availability of Resources Scenario

5.2.3.1 Effect of Increased Availability of Funding Scenario

Next, we explored how the varying availability of funding affects the development of an Entrepreneurial Ecosystem. Figure 5.43 shows three scenarios, one in which the Availability of Funding is: Low, Medium, and High.

Figure 5.29: Varying availability of funding affecting the development of a Entrepreneurial Ecosystem

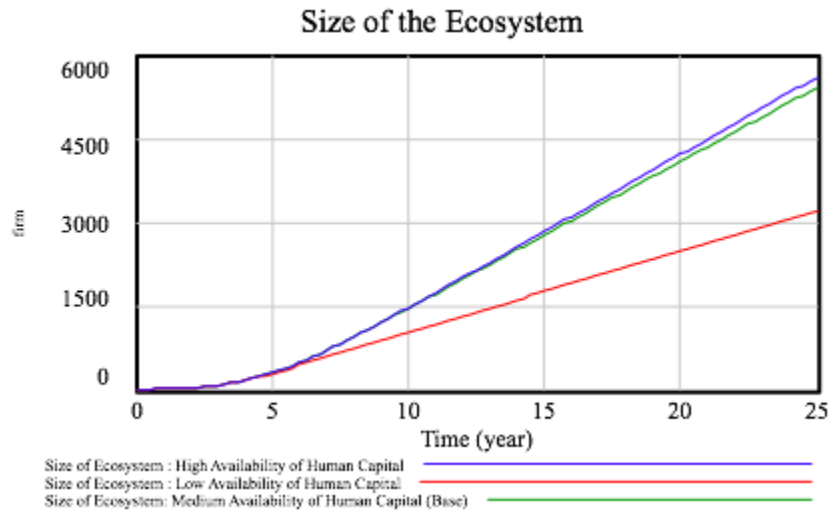


In the Low Availability scenario, a significant number of firms cannot secure enough funding to propel their continued growth, and consequently the development in size of the ecosystem is highly restricted (Figure 5.29). In the Medium case scenario, the amount of funding available is adapted to the requirement of funding needed by the firms within the ecosystem, therefore the ecosystem develops at the fastest rate seen amongst these three scenarios. Nonetheless, to the surprise of some, an ecosystem with high availability of funding, may not result in a faster development of the ecosystem (Figure 5.29). The reason behind this is that funding should be a competitive resource, and firms should up to a certain extent struggle to find funding. If there is an excess of capital within a region, it will end up being invested in firms that would have otherwise not been able to secure funding in a scenario with less funding available. These firms will continue to exist for certain period of time, but will often prolong a “Chronicle of a Death Foretold”, trapping the resources within a firm that is not necessarily providing an innovative product or service.

5.2.3.2 Effect of Increased Availability of Human Capital Scenario

Next, we explored how the varying availability of Human Capital affects the development of a Entrepreneurial Ecosystem. Figure 5.30 shows three scenarios, one in which the Availability of Human Capital is: Low, Medium, and High.

Figure 5.30: Varying availability of human capital affecting the development of a
Entrepreneurial Ecosystem

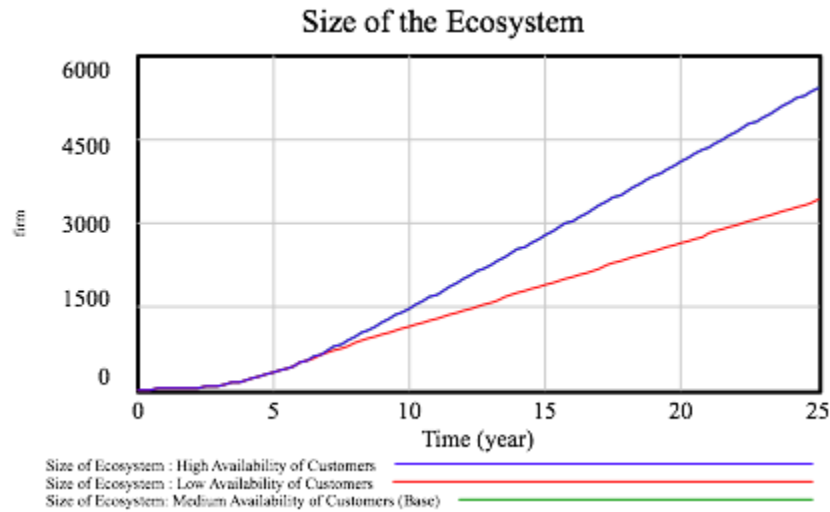


In the Low Availability scenario, a significant number of firms cannot hire enough people to propel their continued growth, and consequently the development in size of the ecosystem is highly restricted. In the base case scenario, the amount of human capital available is adapted to the requirement of human capital needed by the firms within the ecosystem, therefore the ecosystem develops at a fast rate. Nonetheless, an ecosystem with high availability of human capital results in a faster development of the ecosystem (Figure 5.30). The reason behind this is that firms will be able to select amongst the pool of talent and will become more competitive than they would have otherwise been.

5.2.3.3 Effect of Increased Availability of Customers Scenario

Finally, we explored how the varying availability of Customers affects the development of a Entrepreneurial Ecosystem. Figure 5.31 shows three scenarios, one in which the Availability of Customers is: Low, Medium, and High.

Figure 5.31: Varying availability of customers affecting the development of a
Entrepreneurial Ecosystem



In the Low Availability scenario, a significant number of firms cannot sell their products or services to propel their continued growth, and consequently the development in size of the ecosystem is highly restricted. In the base and high availability case scenario the development of the ecosystem is the same as firms can only serve certain number of customers according to their stage of development (Figure 5.29). Therefore additional presence of customers is not driving further growth.

5.2.4. Reinforcing and Diminishing Effect Scenarios

The following section explores how the reinforcing and diminishing mechanisms explained previously in Figure 5.5, affect the development and value creation in the entrepreneurial ecosystem over time. The only difference between the three models are:

- **Base Case:** no reinforcing or diminishing mechanisms in place.
- **Reinforced:** reinforcing mechanisms in place, no diminishing mechanisms.
- **Diminished:** no reinforcing mechanisms in place, diminishing mechanisms in place.

As can be seen from the Figures below, the base case scenario has an intermediate output, whereas the Reinforced Scenario has a larger output, and the Diminished Scenario has a reduced output. As explained earlier in this chapter, the reinforcing and diminishing mechanisms affect

the survival rate of the firms at each stage, as can be seen in Figures 5.30, 5.32, 5.34 and 5.36.

Figure 5.32: Seed Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

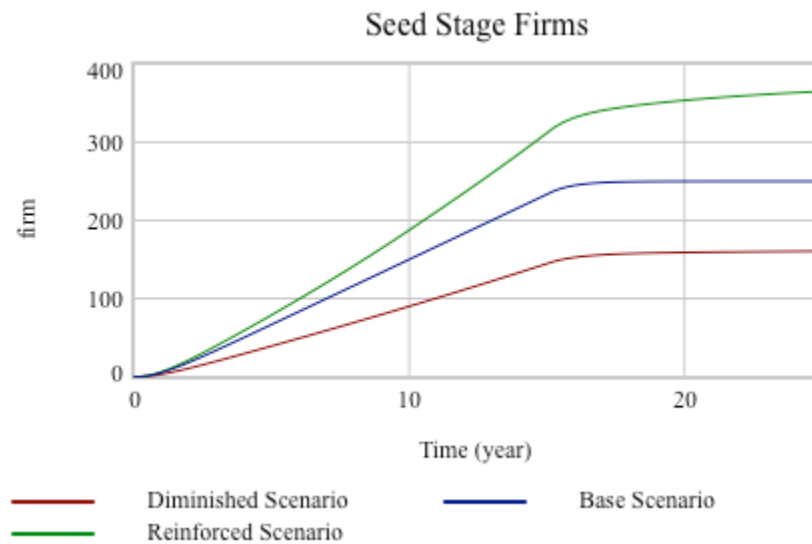


Figure 5.33: Survival Rate of Seed Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

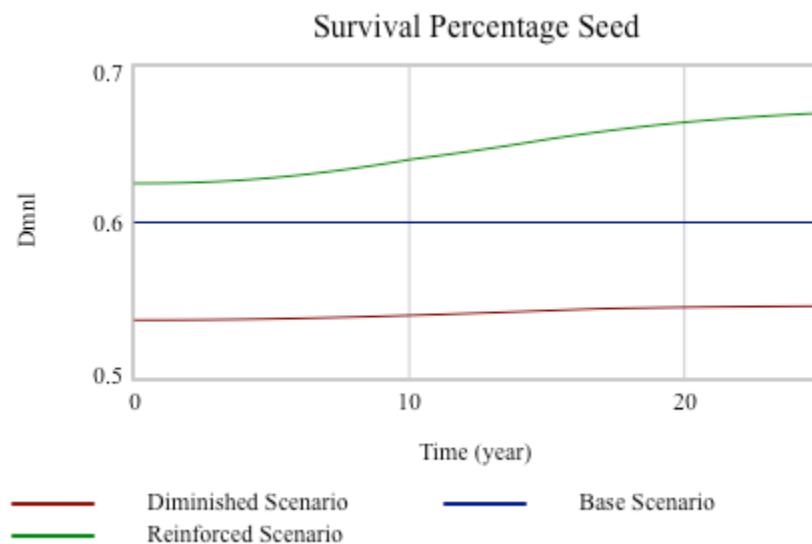


Figure 5.34: Early Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

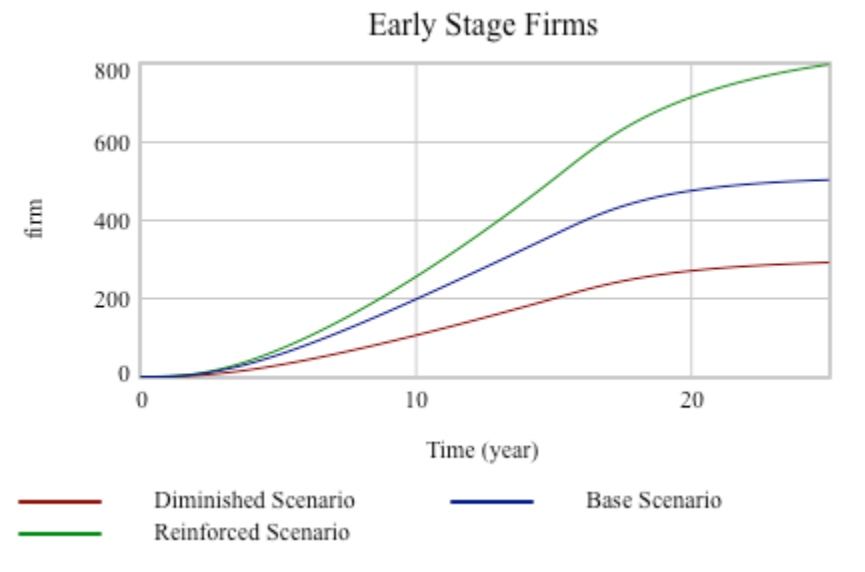


Figure 5.35: Survival Percentage of Early Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

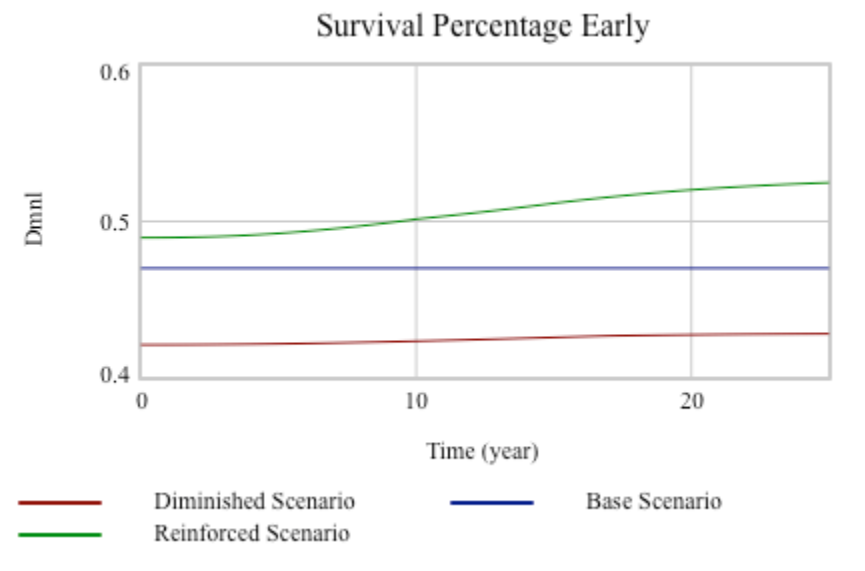


Figure 5.36: Growth Stage Firms in the Ecosystem in the Base, Reinforced and Diminished case scenarios.

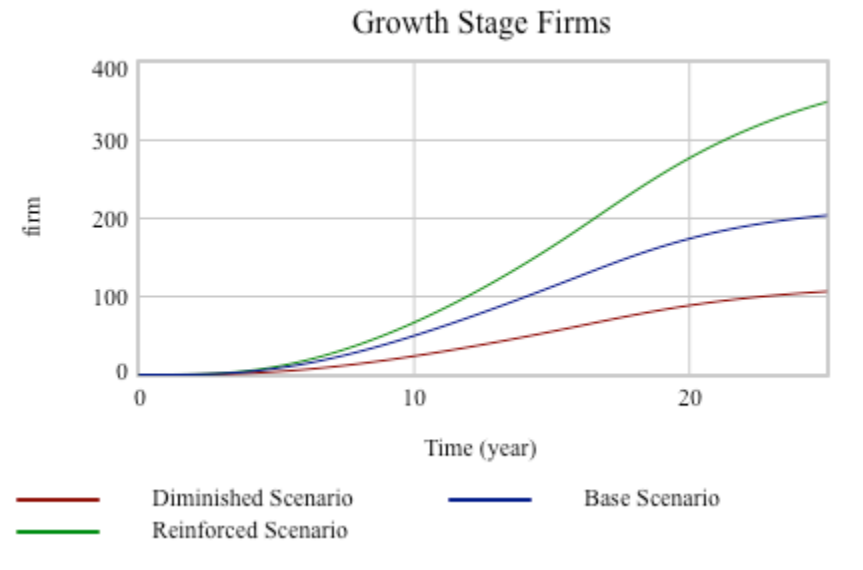


Figure 5.37: Survival Percentage Growth Stage Firms in the Ecosystem in the Base, Reinforced and Diminished case scenarios.

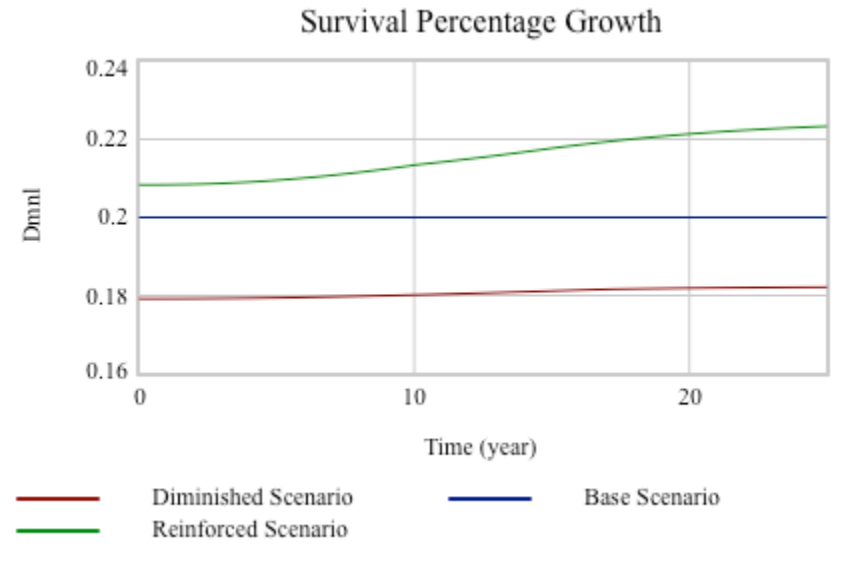


Figure 5.38: Late Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

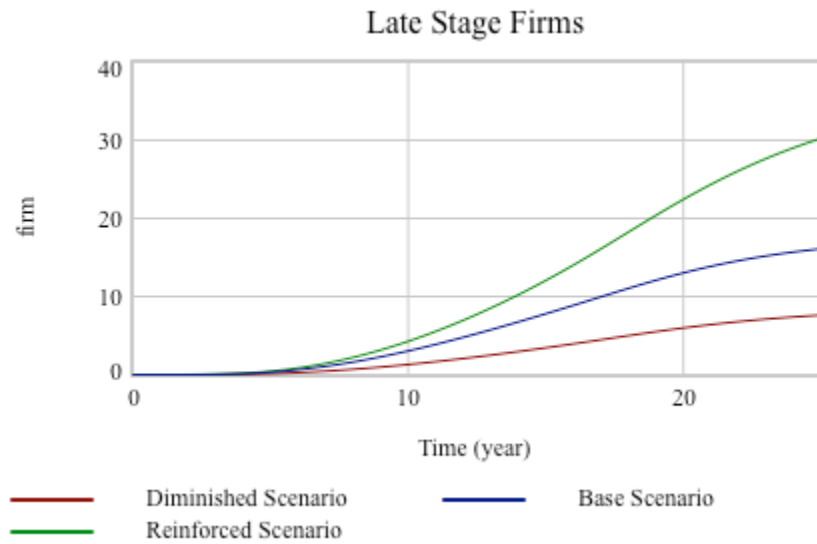


Figure 5.39: Survival Percentage Late Stage Firms in the Ecosystem in the Base, Reinforced and Diminished Scenarios

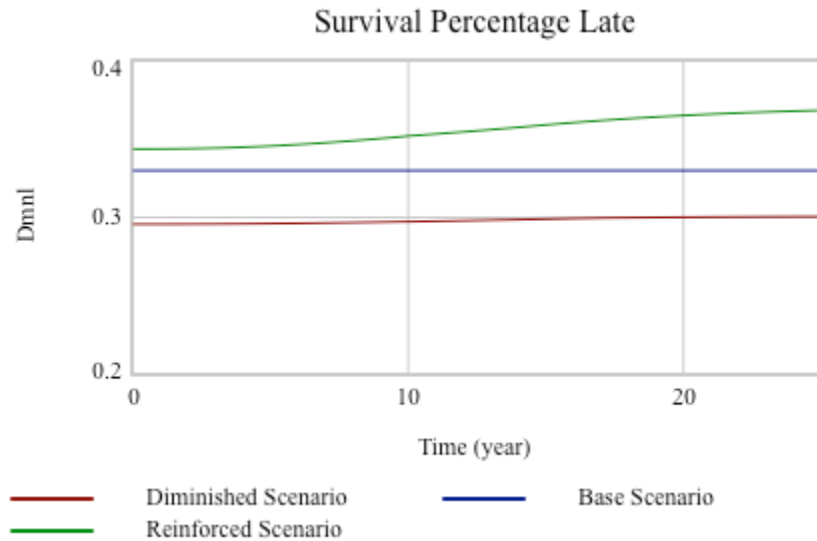


Figure 5.40: Total Number of Firms in the Ecosystem in the Base, Reinforced and Diminished case scenarios.

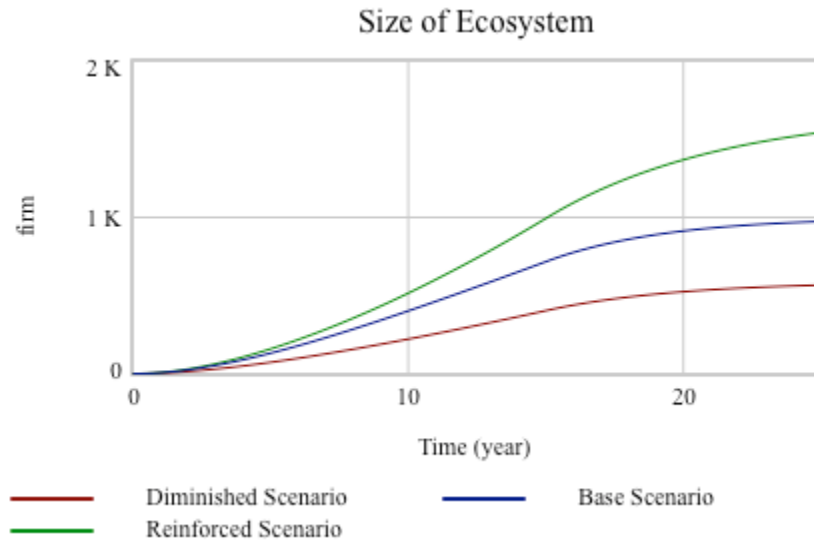


Figure 5.41: Startup Creation Rate in the Ecosystem in the Base, Reinforced and Diminished Scenarios

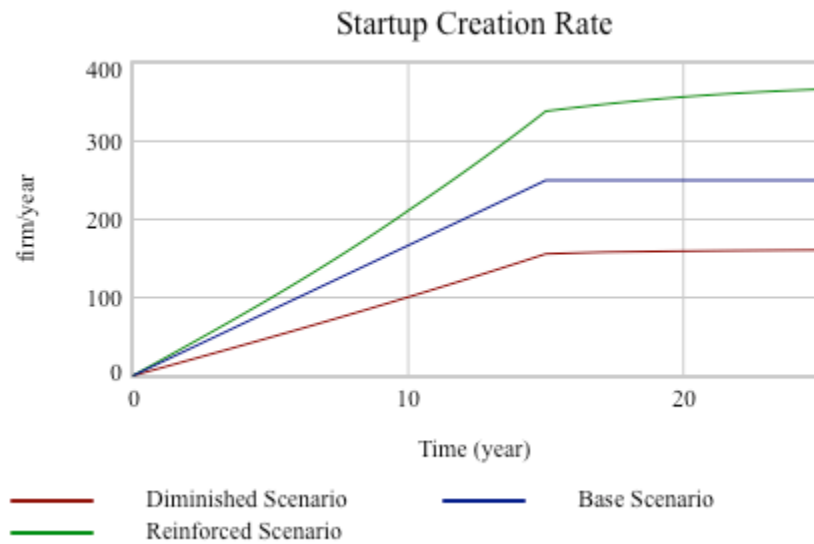


Figure 5.42: Diminishing Effect in the Ecosystem in the Base, Reinforced and Diminished Scenarios

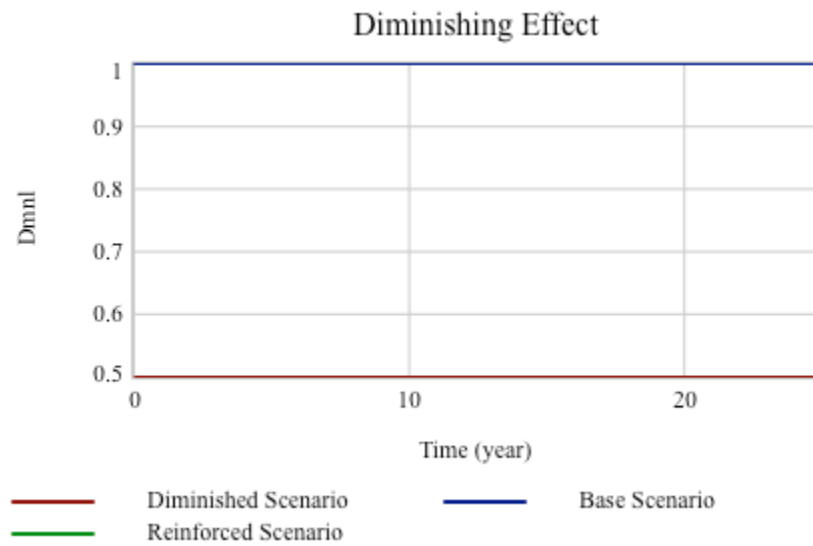


Figure 5.43: Reinforcing Effect in the Ecosystem in the Base, Reinforced and Diminished Scenarios

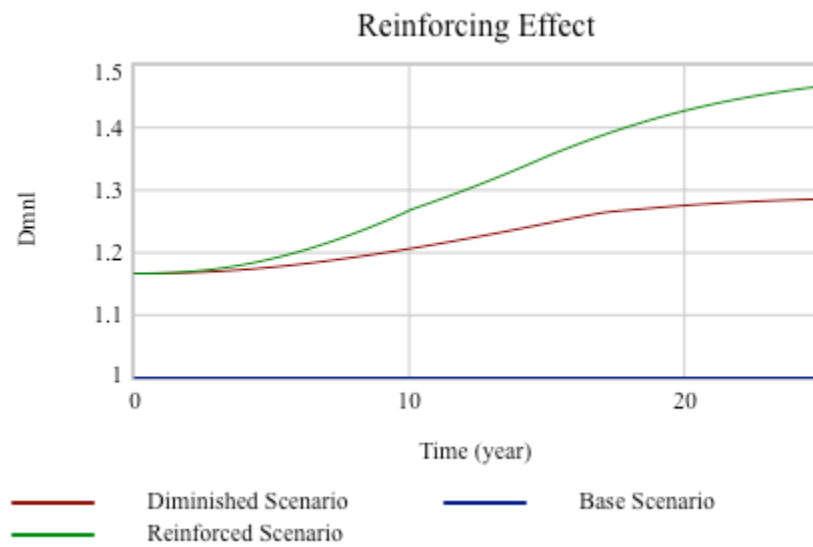
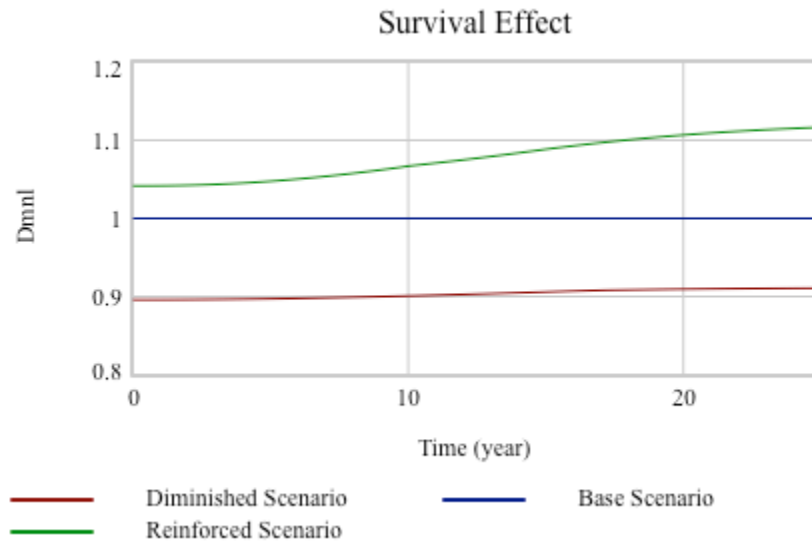
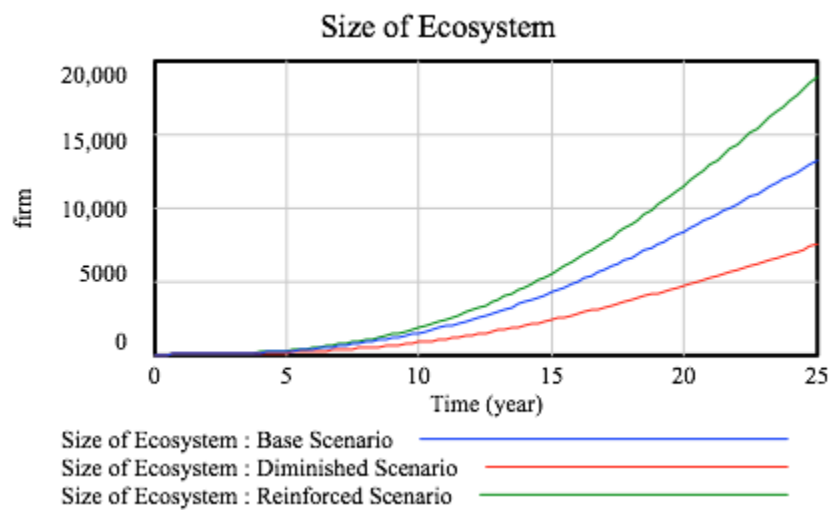


Figure 5.44: Survival Effect in the Ecosystem in the Base, Reinforced and Diminished case scenarios.



As can be seen in Figure 5.45, the overall effect of the Diminishing and Reinforcing mechanisms taking place within the Entrepreneurial Ecosystem can have highly significant effects within the development of the ecosystem, and thus the value creation generated over time.

Figure 5.45: Cumulative Size of the Ecosystem in the Base, Reinforced and Diminished case scenarios.



5.2.5. Effect of Entrepreneurial Intention

Another of the scenarios we tested would be what is the implication in the long-term development of an ecosystem depending on the entrepreneurial intention. As can be seen from Figure 5.46, the rate of development of an ecosystem, with all other factors being the same, takes place at a much slower rate with a lower entrepreneurial intention and at a faster rate with a higher entrepreneurial intention. In the first decade, the difference in development is less pronounced. However as the different reinforcing mechanisms (exits, mentorship, role models...) take place, the reinforcing effects will be more pronounced in an ecosystem with a higher entrepreneurial intention, leading to an event faster growth.

Table 5.1b Firm Creation Rate in the Entrepreneurial Intention Scenarios

Scenario	Firm Creation Rate
Reinforcing Effect	[(0,0)-(25,500)],(0,0),(15,250),(25,250)
Low Entrepreneurial Intention Scenario	[(0,0)-(25,500)],(0,0),(15,150),(25,150)
High Entrepreneurial Intention Scenario	[(0,0)-(25,500)],(0,0),(15,350),(25,350)

Figure 5.46 is **highly significant to understand the importance of Entrepreneurial Intention** that we have studied in the first part of this thesis. In a sense, the Entrepreneurial Ecosystem can only grow if new firms being created in the ecosystem, and entrepreneurial intention is the best predictor that has been found in the literature to predict future entrepreneurial behaviour. Therefore this is one of the key feature to understand the development, or not, of an entrepreneurial ecosystem.

Figure 5.46: Effect of Entrepreneurial Intention in the Development of the Ecosystem

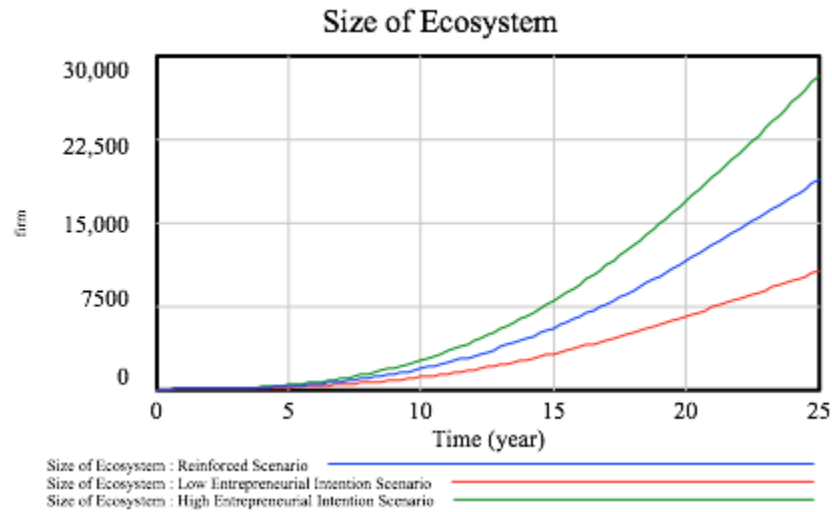
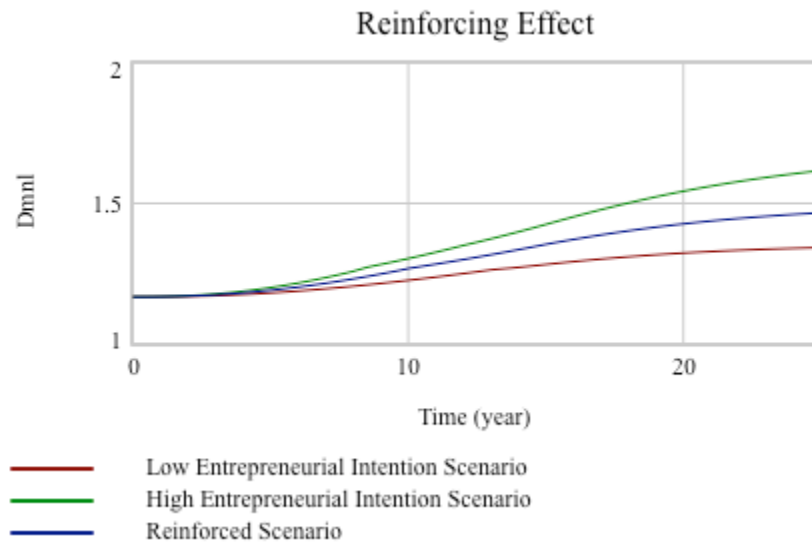


Figure 5.46b: Reinforcing Effect of Entrepreneurial Intention in the Development of the Ecosystem



5.2.6. Drought in firm creation

Another of the scenarios we tested, was what would happen in the case of a “drought” in the number of firms created, meaning a period in which the number of firms stated was significantly reduced. In the two scenarios, all variables were kept constant except for the “Local

Population Starting Companies” variable, which is reduced to 100 firms/year between years 16-18 in the Drought scenario (Figure 5.47).

- In the Reinforced scenario the values are set to be: [(0,0)-(25,500)],(0,0),(15,250),(25,250).
- In the drought scenario the values are set to be: [(0,0)-(25,500)],(0,0),(15,250),(16,100),(17,100),(18,100),(19,250),(25,250).

As can be seen from Figure 5.48, the reduced creation of firms within a certain period of time (Figure 5.47), has long standing effect in the Size of the Ecosystem achieved.

Figure 5.47: Startup Creation Rate in the Reinforced and Drought Scenarios

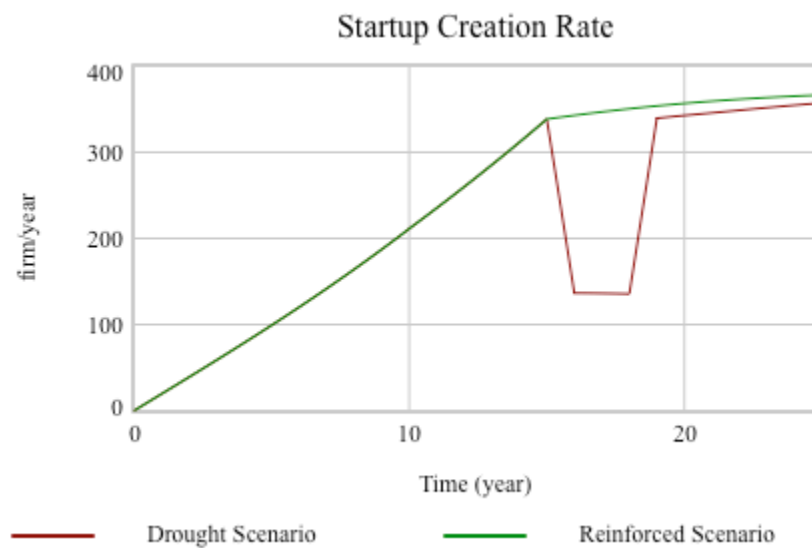
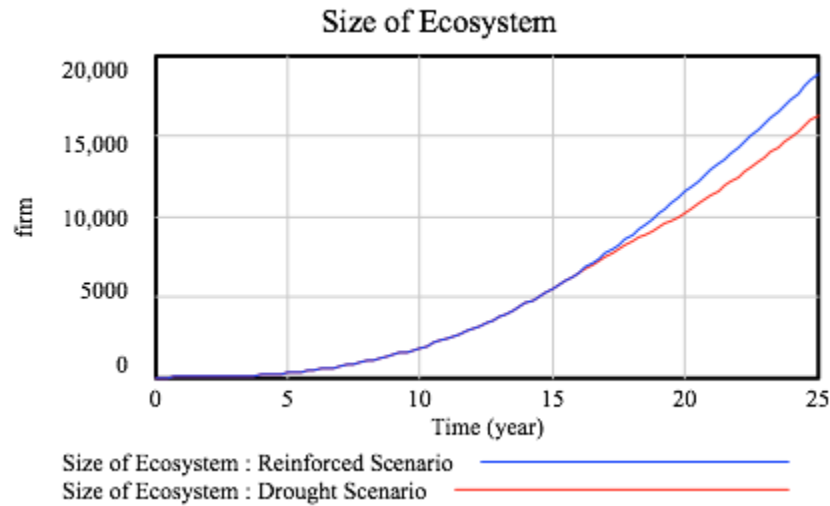


Figure 5.48: Cumulative Size of the Ecosystem in the Reinforced and Drought Scenarios



5.2.7. Spike in firm creation

Another of the scenarios we tested, was what would happen in the case of a “spike” in the number of firms created, meaning a period in which the number of firms stated was significantly increased. In the two scenarios, all variables were kept constant except for the “Local Population Starting Companies” variable, which is increased to 200 firms/year between years 6-8 in the Spike scenario (Figure 5.49).

- In the Reinforced scenario the values are set to be: $[(0,0)-(25,500)], (0,0), (15,250), (25,250)$.
- In the Spike scenario the values are set to be: $[(0,0)-(25,500)], (0,0), (15,250), (16,400), (17,400), (18,400), (19,250), (25,250)$.

As can be seen from Figure 5.50, the increased creation of firms within a certain period of time (Figure 5.49), has long standing effect in the Size of the Ecosystem achieved.

Figure 5.49: Startup Creation Rate in the Reinforced and Spike Scenarios

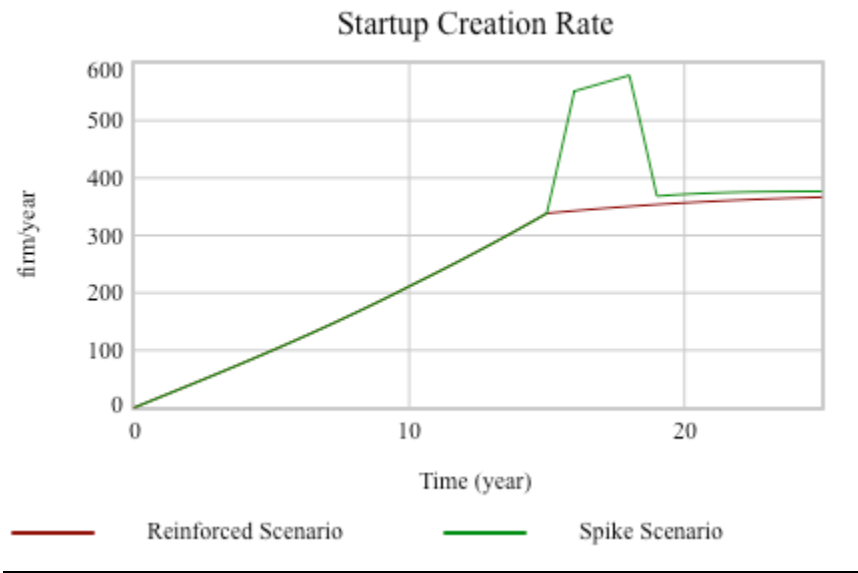
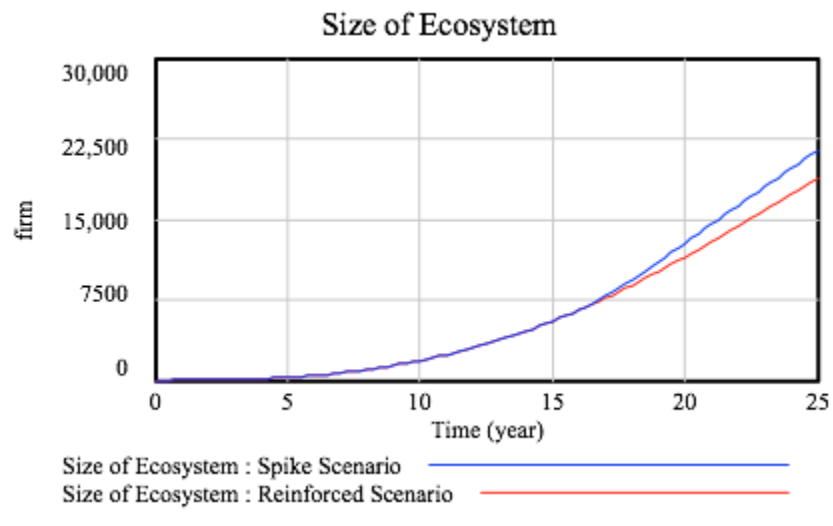


Figure 5.50: Cumulative Size of the Ecosystem in the Reinforced and Spike Scenarios



5.2.8. Regional Ecosystem Models

The main value proposition of our thesis, has been to create a generic Entrepreneurial ecosystem model that can help improve the understanding of how the ecosystem develops and how value is created within the region, by testing a variety of potential scenarios and analysing how the ecosystem develops accordingly.

However, aside from the generic insights that the generic model of the ecosystem generates, we wanted to expand the value proposition of this thesis one step further, by creating models that mirror the development of a specific Entrepreneurial Ecosystem by adapting the model parameters to those naturally occurring in the ecosystem and using historical data to show how the ecosystem developed over time. This can allow us to identify regional strengths, bottlenecks and extract further learnings from the development of various Entrepreneurial Ecosystems that can be applied for the future development of other regions.

In order to create these regional models, we once again used two of the most trusted data sources for startup research, CB insights and the Startup Genome ecosystem report. From the CB insights report we could extract the regional dynamics (Failure, Survival and Exit Rates at each of the 4 stages), outlined below. As well as the historical number of firms created in the ecosystem, when available, gathered by both Crunchbase and PWC.

As we previously mentioned, high quality data availability is one of the limiting factors of the entrepreneurial literature, even more so finding data that is comparable across geographies, as the data tend to be locally gathered and therefore present biases in the definition of firm taken or defining characteristics of startups. Fortunately for us, CB Insights, one of the leading data platforms providing information of privately owned companies, released an article with some insights into the survival, failure and exit rates as well as timing and amount of money raised by startups in eight different Entrepreneurial Ecosystems (Silicon Valley, Boston, New York, Los Angeles, United Kingdom, Germany, India and China). Not only is it the first time that there are insights into the performances of companies within an ecosystem, these insights are comparable across geographies allowing us to contrast how different ecosystems perform. The CB insights team have used their private platform to analyze company performances between 2008-2014 and extract insights into the dynamics of the ecosystem. However, it is worth noting, that CB insights data coverage is especially good in United States, being able to extract conclusions for several

ecosystems there (Silicon Valley, Boston, New York, and Los Angeles). Whereas in other countries its coverage is less good, showing results aggregated by country rather than by specific ecosystem (United Kingdom, Germany, India and China). However as previously described Entrepreneurial Ecosystems are regionally bound, so for these 4 countries we used the country-wide rates and modeled the countries' most prominent ecosystem: London, Berlin, Bangalore and Beijing respectively.

In order to be able to use CB insights data, we needed to re-assign the stages of firms: Seed Stage (1st Round of Funding), Early Stage (2nd and 3rd Rounds of Funding), Growth Stage (4th and 5th Rounds of Funding), and Late Stage (6th Round of Funding). In addition, the data CB Insights provided for each stage was as a percentage of the total number of firms in the cohort, whereas for our model, we adapted these percentages as per the previous cohort (following our aging chain model type) (as shown in Table 5.2).

Table 5.2: Likelihood of raising each round of funding by region (2008-2014) (percentage of original seed funded firms that receive subsequent funding)(Source: CB Insights, 2017)

Funding Round		Boston	New York	Silicon Valley	Los Angeles	Germany	United Kingdom	China	India
Seed	1st	NA	NA	NA	NA	NA	NA	NA	NA
Early	2nd	68	65	63	58	54	53	52	45
	3rd	37	39	39	32	18	25	23	22
Growth	4th	12	22	19	13	9	7	6	7
	5th	4	11	7	6	4	3	1	2
Late	6th	1	3	3	1	3	2	0	1

In addition, the distribution of total exits is very different across Entrepreneurial Ecosystems, with the lowest being in China (7% of total firms exiting at any stage), and the highest being New York (with 36% of all firms exiting at any stage) (Table 5.3). It was a little surprising to see that despite the Chinese firms raising and the fastest the largest amount of funding at early stages, they experienced the lowest percentage of exits. This is probably a limitation from the data source, as the study followed a cohort of firms over a period of time

(2018-2014), and it is possible that firms within this cohort exit at a later point in time. In that sense, it will be interesting to revisit the model with updated rates in the future, once updated rates are available.

Only Silicon Valley, New York and Los Angeles experienced exits at the late stage (past the 6th round of funding, Series E), whereas the other entrepreneurial ecosystems had no exits at such a late stage.

Table 5.3: Percentage of Firms that Exited by Funding Stage across Entrepreneurial Ecosystems (%)(Source: CB Insights, 2017)

Entrepreneurial Ecosystem	Percentage of Firms that Exited by Funding Stage (%)					TOTAL Amount of Firms that Exited (%)
	2nd Funding Round	3rd Funding Round	4th Funding Round	5th Funding Round	6th Funding Round	
Silicon Valley	13	10	6	2	0.4	31.4
Boston	9	11	6	2	0	28
New York	16	11	7	1	1	36
Los Angeles	12	4	4	1	2	23
United Kingdom	11	8	4	1	0	24
Germany	14	11	3	1	0	29
China	3	2	0	2	0	7
India	7	2	1	3	0	13

We adapted CB insights findings to fit our entrepreneurial ecosystem model (as shown in Tables 5.4, 5.5 and 5.6), and used this data to build regional models.

Table 5.4: Rates of Failure, Survival and Exit across Stages (Seed, Early, Growth and Late) in different Entrepreneurial Ecosystem. (Source: Adaptation from CB Insights, 2017)

Ecosystem	Failure Rate Seed Stage (%)	Survival Rate Early (%)	Early Stage Exit Rate (%)	Survival Rate Growth (%)	Failure Rate Early Stage (%)	Growth Stage Exit Rate (%)	Survival Rate Late (%)	Failure Rate Growth (%)	Late Stage Exit Rate (%)	Late Stage Survival Rate (%)	Late Stage Failure Rate (%)
General	40	60	35	47	18	22	20	58	11	33	56
Silicon Valley	24	76	30.3	51.3	18.4	20.5	18	61.5	6	43	51
Boston	23	77	26	48	26	21.6	10.8	67.6	0	25	75
New York	19	81	33	48	19	21	28	51	9	27	64
Los Angeles	30	70	23	46	31	15.6	18.8	65.6	33	17	50
United Kingdom	36	64	30	39	31	20	12	68	0	67	33
Germany	35	65	38	28	34	22	22	56	0	75	25
China	45	55	9	42	49	9	4	87	0	0	100
India	48	52	17.3	42.3	40.4	18	9	73	0	50	50

The data also allows us to see the average time between rounds (Table 5.5). Here we can see that Chinese firms are the fastest to raise Early Stage funding (Series A and B), 2.7 years after their initial seed round, whereas German firms take 5.2 years to do so, almost twice as slow as Chinese firms. However, according to CB insights data, there were no Chinese firms within their database between 2008-2014 that raised Series E round. Across the United States, it seems that the timing for fundraising is fairly universal, with companies raising their early round 3.3-3.6 years after the initial seed investment, the growth round 2.3-3.1 years after the early rounds, whereas the late stage funding comes 0.9-1.3 years later. Interestingly, although

European firms (German and United Kingdom firms) take the longest to raise their early rounds of funding (typically 5.0-5.2 years after the seed round), the growth and late stage fundraising happens in line with the global average 3.1-3.2 years after for the growth and 0.9-1.2 years after for the late stage funding.

Table 5.5: Average years between funding rounds by region (2008-2014) (in years) (Adapted from source: CB Insights, 2017)

Funding Round		Boston	New York	Silicon Valley	Los Angeles	Germany	United Kingdom	China	India
Seed	1st	NA	NA	NA	NA	NA	NA	NA	NA
Early	2nd	3.6	3.5	3.4	3.3	5.2	5.0	2.7	3.5
	3rd								
Growth	4th	3.0	3.1	2.9	2.3	3.1	3.2	2.1	2.1
	5th								
Late	6th	1.1	1.3	0.9	0.9	0.9	1.2	NA	1.6

In terms of amount of investment, Chinese firms largely outperformed others in their size of investment at the seed, early and growth stage, however none of the firms considered in the CB insights portfolio raises Series E funding (Table 5.6). From the entrepreneurial ecosystems in the United States, the seed, early and growth rounds were fairly similar, but to our surprise, firms in Los Angeles raised an average of 200M\$ at the late stage, followed by firms in Boston raising 153M\$ at the late stage. Whereas firms in Silicon Valley, raised a smaller 70M\$ at the late stage.

Table 5.6: Median round size by region (2008-2014) (in million USD)(Adapted from source: CB Insights, 2017)

Funding Round	Boston	New York	Silicon Valley	Los Angeles	Germany	United Kingdom	China	India
Seed	0.7	0.8	0.7	0.8	0.8	0.8	1.3	0.5
Early	11.8	13.8	17	15.9	14.8	9	39	17
Growth	54.5	55	65	77.5	44.7	30	177.8	47.2
Late	153	52.5	70	200	32.6	76.1	NA	57

Whereas from the Startup Genome Ecosystem report we found the current number of firms within each of the Entrepreneurial Ecosystems (as of 2016). This proved to be very relevant, as it allowed us to make certain assumptions (for example in the number of firms created per year (in cases where no historical data was available), or the reinforcing and diminishing mechanisms that were necessary in order to reproduce the historical data.

Table 5.7: Aggregate Number of Firms by Ecosystem (Source: Startup Genome, 2017)

Ecosystem	Startup Output (2016) - Total number of firms within the Entrepreneurial Ecosystem
Silicon Valley	14128
Boston	3408
New York	7030
Los Angeles	4170
London	5136
Berlin	2098
Beijing	6000

Bangalore	2040
Estonia	600

In order to build the models we needed to make certain assumptions. As described before, the model is unable to capture macroeconomic phenomenon, as could be the Dot-com bubble and burst (occurred between 2000-2002). Therefore we will be starting the modeling of the Entrepreneurial Ecosystems from 2002-3, benefiting from the post-bubble period, in which there was a reconstruction of the Entrepreneurial Ecosystems worldwide. In addition, the historical data we will be using goes back to this period (2002-3), but there is little documented investment activity prior to this period in time. Therefore this simplification, modeling from 2002-3, seems appropriate.

Figure 5.51: Historical Venture Capital investment in the United states (Source: Fox, J., 2017)



In order to model each of the Regional Entrepreneurial Ecosystems, we made the following simplifying assumptions: the year that the ecosystems began, the Other Diminishing Factors (for example the Ease of Starting, Running and Exiting a business) and Other Reinforcing Factors (for example the presence of Support Organizations & Informal networks). This two external factors allowed us to account for any additional reinforcing or diminishing behaviour that was not yet endogenous to our model, and thus be able to explain the historical development of different ecosystems (Table 5.8).

Table 5.8: Simplifying Assumptions on the Entrepreneurial Ecosystems

Ecosystem	Year the Ecosystem Began	Other Diminishing Factors	Other Reinforcing Factors
Silicon Valley	2002	1.25	1
Boston	2003	1	1
New York	2003	1.75	1
Los Angeles	2003	2	1
London	2003	1	0.65
Berlin	2003	1	0.75
Beijing	2003	1	1
Bangalore	2003	1	0.65
Estonia	2006	1	0.45

Silicon Valley Ecosystem

In order to create the Silicon Valley regional ecosystem model we used the historical number of seed stage investments collected by PwC & CB Insights, as the “Firm Creation” rate (Table 5.9).

Table 5.9: Historical Number of Seed Stage Investments in Silicon Valley (by year)

(Source: PwC & CB Insights, 2018)

Year	Number of seed deals in the SV ecosystem	Average Amount in M\$ per Seed Investment	Amount in M\$ in Seed Investment
2002	7	9.74	1.39
2003	10	14.37	1.44
2004	23	115.65	5.03
2005	23	15.41	0.67
2006	43	43.45	1.01
2007	79	69.58	0.88
2008	93	91.16	0.98
2009	133	148.32	1.12
2010	232	164.47	0.71
2011	409	270.11	0.66
2012	567	427.80	0.75
2013	657	604.88	0.92
2014	741	833.67	1.13
2015	762	924.92	1.21
2016	607	827.49	1.36
2017	435	709.63	1.63
TOTAL	4821	5,270.65	1.09

Figure 5.52: Historical Number of Seed Stage Investments in Silicon Valley (by quarter)
(Source: PwC & CB Insights, 2018)

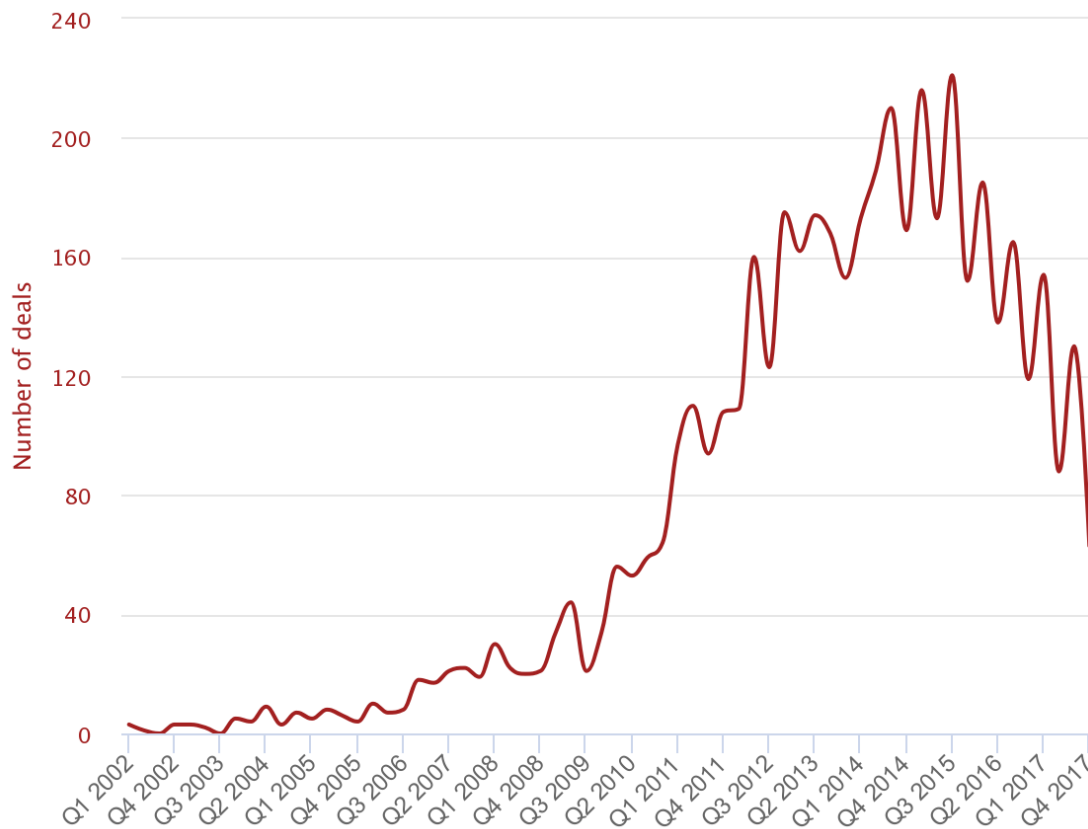
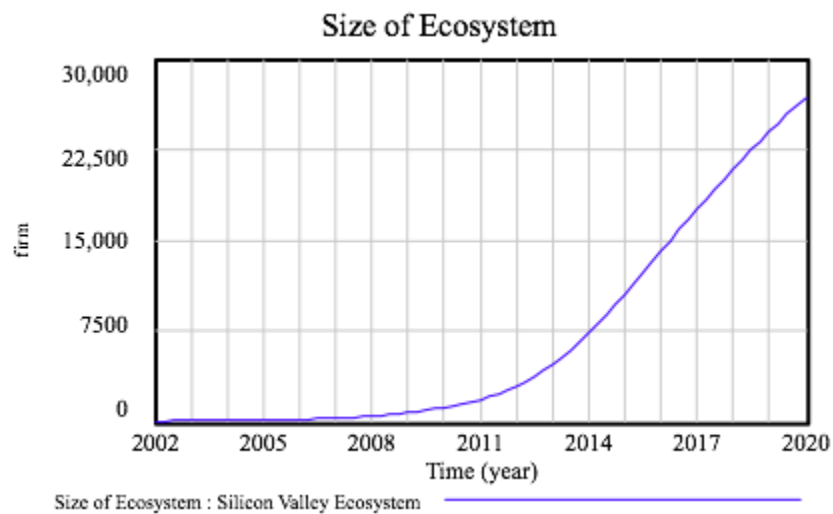


Figure 5.53: Modeled Size of the Silicon Valley Ecosystem over time



New York Ecosystem

In order to create the New York regional ecosystem model we used the historical number of seed stage investments collected by PwC & CB Insights, as the “Firm Creation” rate (Table 5.10).

Table 5.10: Historical Number of Seed Stage Investments in New York (by year)

(Source: PwC & CB Insights, 2018)

Year	Number of seed deals in the NY ecosystem	Total Amount in M\$ in seed Investment	Average amount in M\$ in Seed Investment
2002	1	9.00	9.00
2003	2	3.00	1.50
2004	2	0.21	0.11
2005	8	6.35	0.79
2006	14	4.89	0.35
2007	31	28.98	0.93
2008	38	22.62	0.60
2009	39	26.67	0.68
2010	94	74.52	0.79
2011	183	149.90	0.82
2012	258	210.92	0.82
2013	276	293.95	1.07
2014	330	350.56	1.06
2015	300	348.28	1.16
2016	270	395.74	1.47
2017	222	393.81	1.77
TOTAL	2068	2,319.40	1.12

Figure 5.54: Historical Number of Seed Stage Investments in New York (by quarter)

(Source: PwC & CB Insights, 2018)

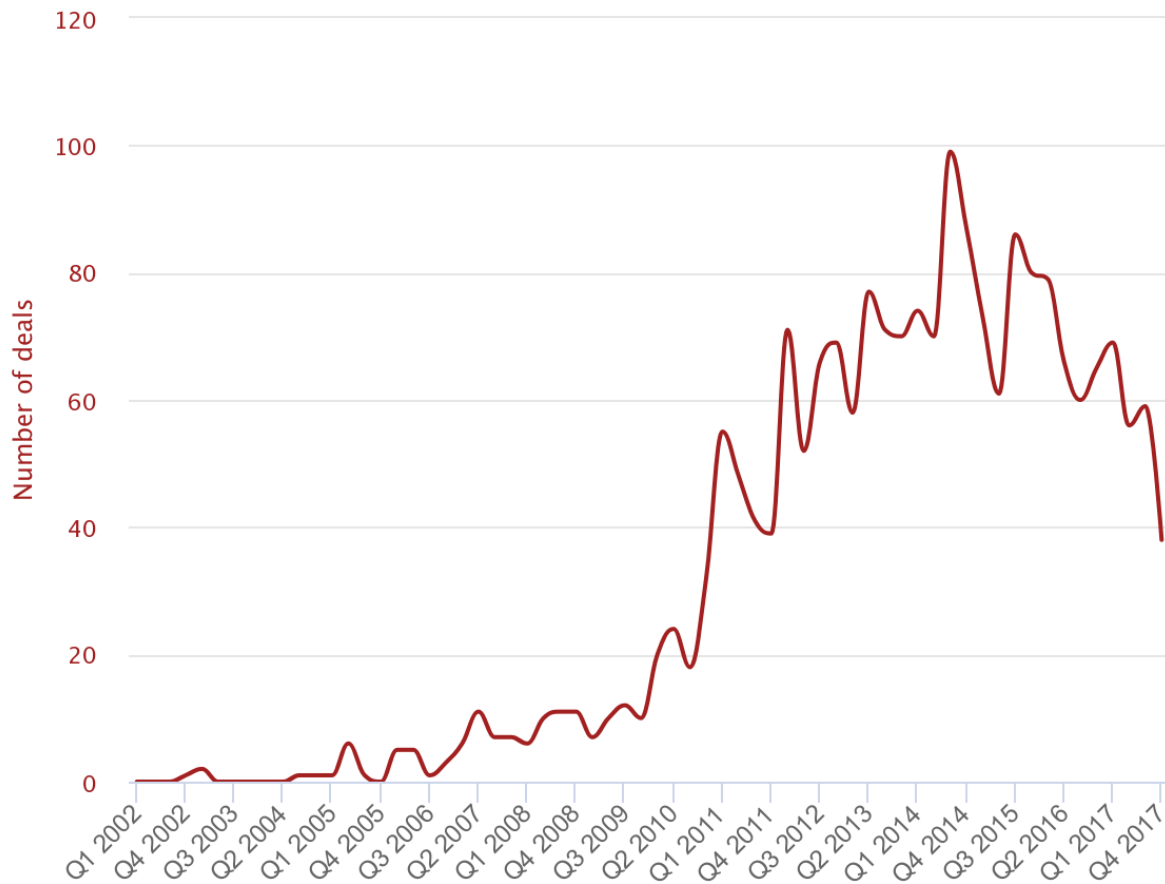
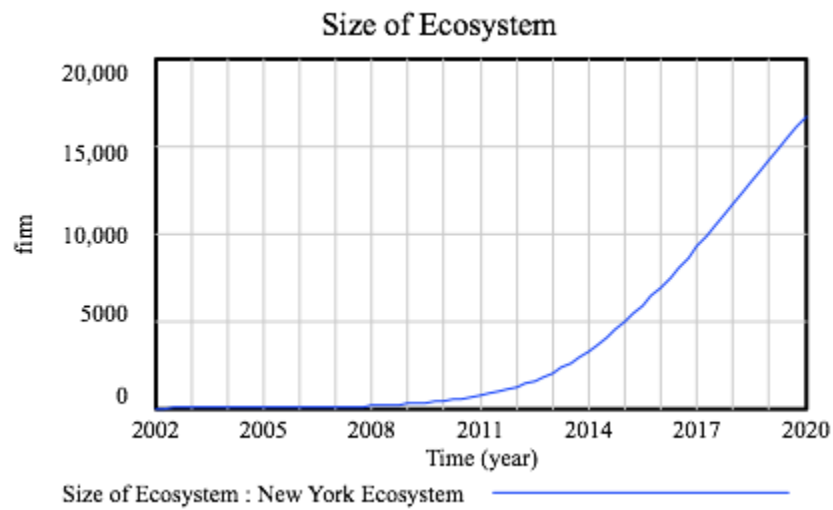


Figure 5.55: Modeled Size of the New York Ecosystem over time



Boston Ecosystem

In order to create the Boston regional ecosystem model we used the historical number of seed stage investments collected by PwC & CB Insights, as the “Firm Creation” rate (Table 5.11).

Table 5.11: Historical Number of Seed Stage Investments in Boston (by year) (New England) (Source: PwC & CB Insights, 2018)

Year	Number of seed deals in the Boston ecosystem	Total Amount in M\$ per Seed Investment	Average Amount in M\$ in Seed Investment
2002	3	1.00	0.33
2003	8	8.70	1.09
2004	7	8.75	1.25
2005	7	19.78	2.83
2006	28	28.76	1.03
2007	27	20.52	0.76
2008	30	8.73	0.29
2009	50	45.83	0.92
2010	92	54.81	0.60
2011	117	73.00	0.62
2012	148	108.90	0.74
2013	151	131.11	0.87
2014	167	174.37	1.04
2015	131	160.79	1.23
2016	135	232.72	1.72
2017	99	160.14	1.62
TOTAL	1200	1,237.91	1.03

Figure 5.56: Historical Number of Seed Stage Investments in Boston (by quarter) (New England) (Source: PwC & CB Insights, 2018)

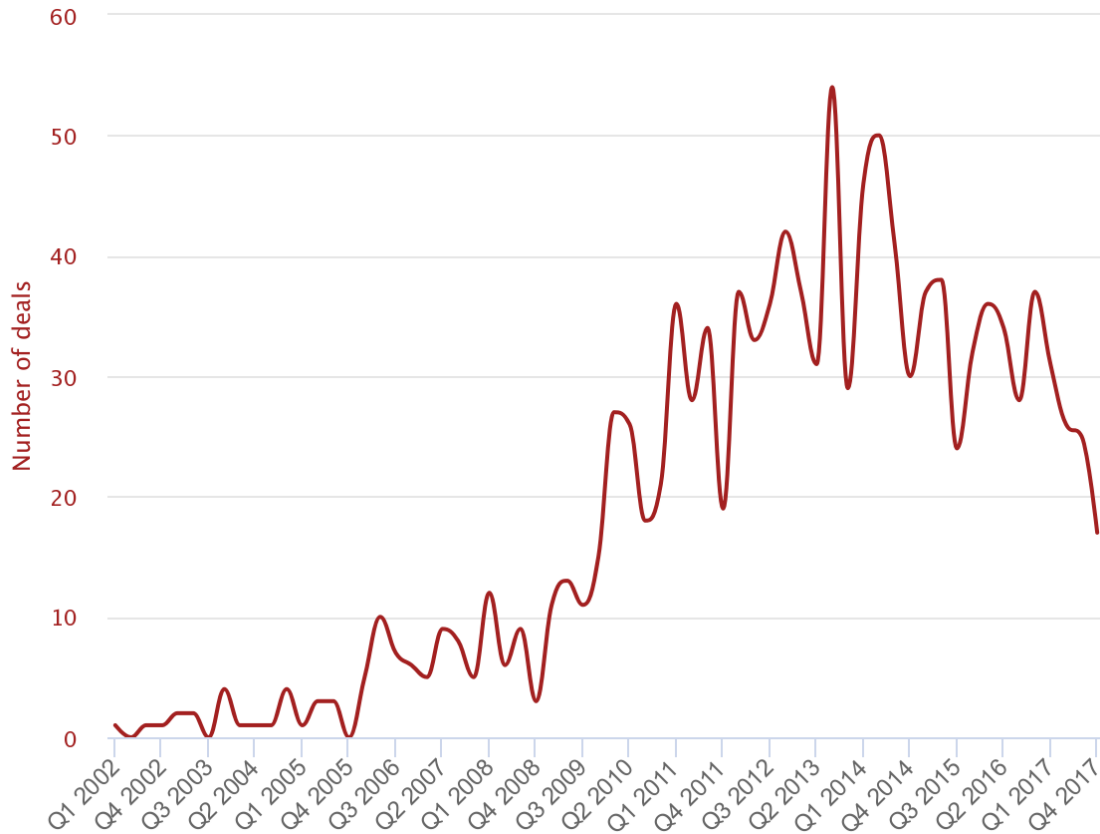
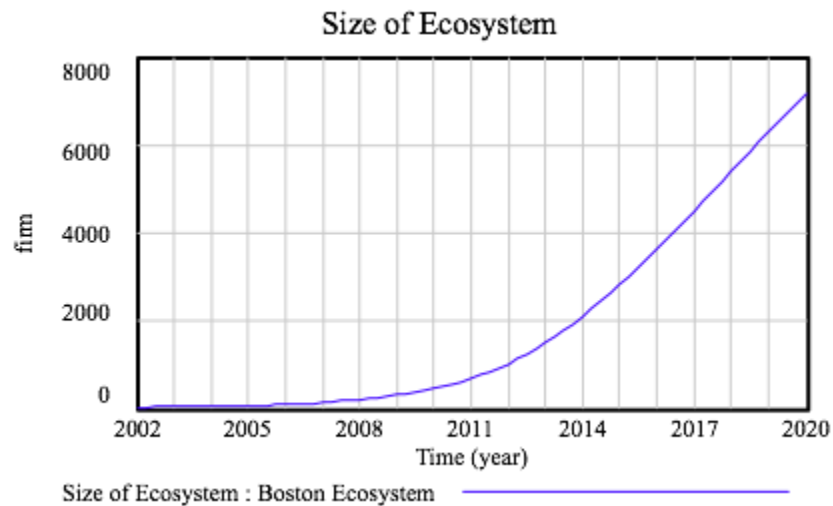


Figure 5.57: Modeled Size of the Boston Ecosystem over time



Los Angeles Ecosystem

In order to create the Los Angeles regional ecosystem model we used the historical number of seed stage investments collected by PwC & CB Insights, as the “Firm Creation” rate (Table 5.12).

Table 5.12: Historical Number of Seed Stage Investments in Los Angeles (by year)

(Source: PwC & CB Insights, 2018)

Year	Number of seed deals in the LA ecosystem	Average Amount in M\$ per Seed Investment	Amount in M\$ in Seed Investment
2002	0	0.00	0.00
2003	1	0.00	0.00
2004	3	2.10	0.70
2005	3	3.03	1.01
2006	10	106.96	10.70
2007	11	34.54	3.14
2008	11	6.03	0.55
2009	24	10.50	0.44
2010	34	33.84	1.00
2011	66	52.45	0.79
2012	111	92.11	0.83
2013	111	108.85	0.98
2014	120	142.46	1.19
2015	123	180.01	1.46
2016	107	191.78	1.79
2017	114	224.70	1.97
TOTAL	849	1,189.36	1.40

Figure 5.58: Historical Number of Seed Stage Investments in Los Angeles (by quarter)
(Source: PwC & CB Insights, 2018)

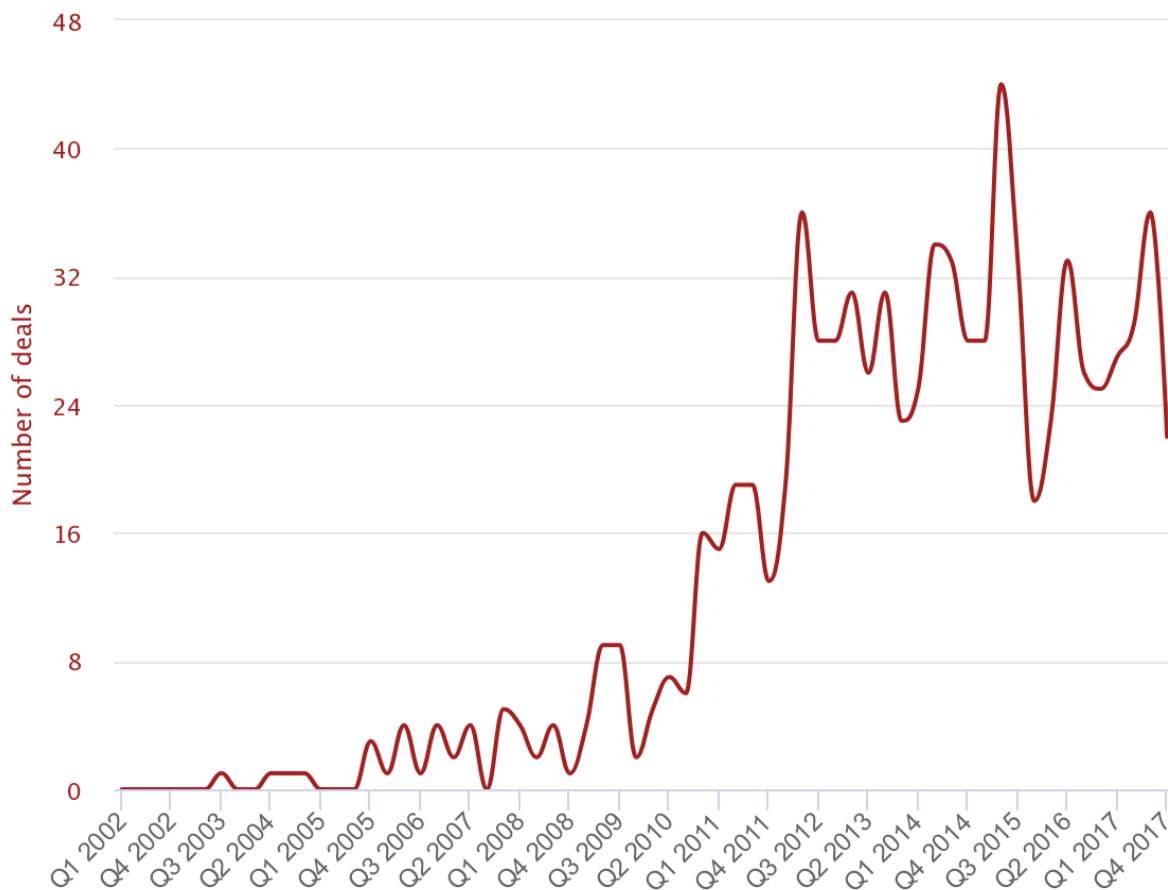
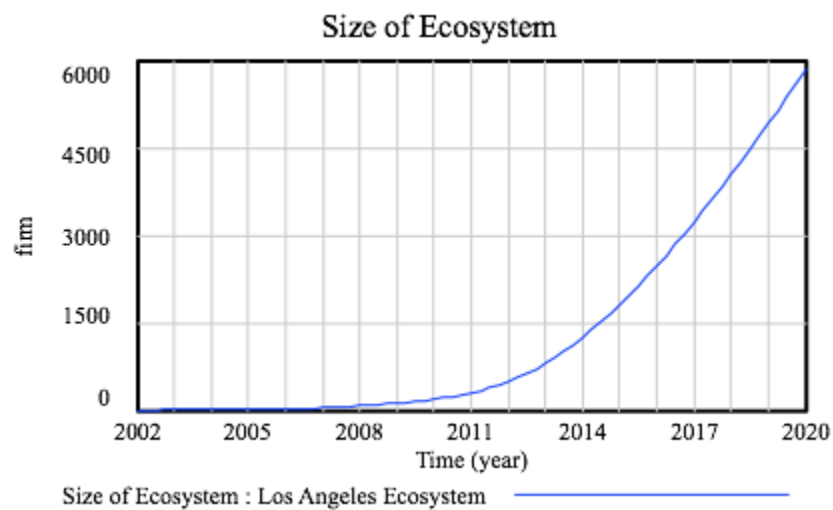


Figure 5.59: Modeled Size of the Los Angeles Ecosystem over time



London Ecosystem

In order to create the London regional ecosystem model we used the historical number of seed stage investments collected by Crunchbase, as the “Firm Creation” rate (Table 5.13), as well as completed the missing values with our assumptions (marked with a *).

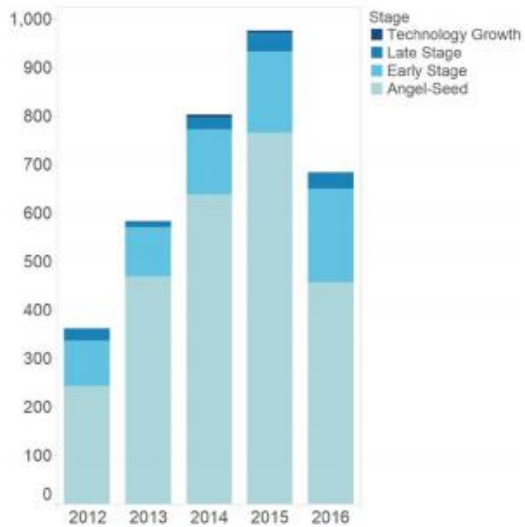
Table 5.13: Historical Number of Seed Stage Investments in London (Source: Crunchbase. 2016)

Year	Number of seed deals in the London ecosystem
2003	10*
2004	25*
2005	25*
2006	50*
2007	75*
2008	100*
2009	125*
2012	225
2013	475
2014	625
2015	775
2016	425
2030	250*

*Assumed

Figure 5.60: Historical Number of Seed Stage Investments in London (Source: Crunchbase. 2016)

london funding rounds



london invested amounts

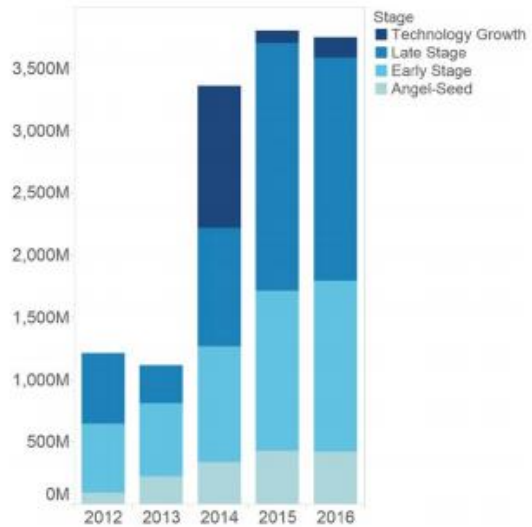
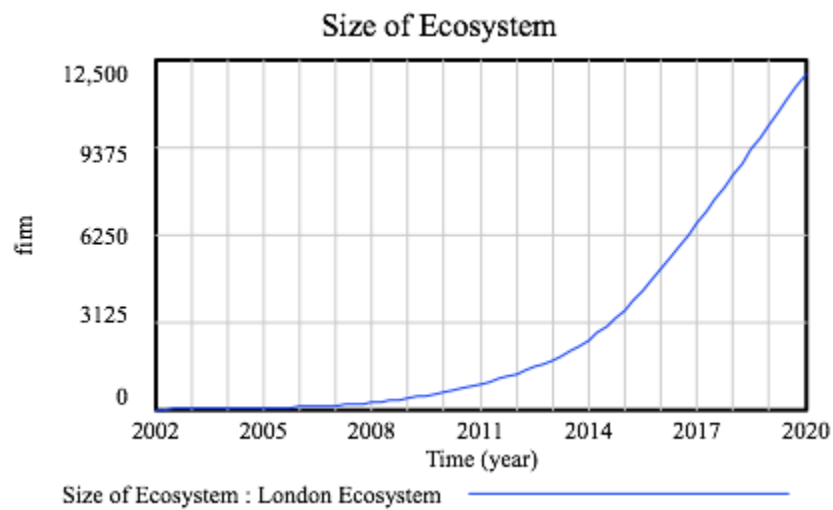


Figure 5.61: Modeled Size of the London Ecosystem over time



Berlin Ecosystem

In order to create the Berlin regional ecosystem model we used the historical number of seed stage investments collected by Crunchbase, as the “Local Population starting companies” factor (Table 5.22), as well as completed the missing values with our assumptions (marked with a *).

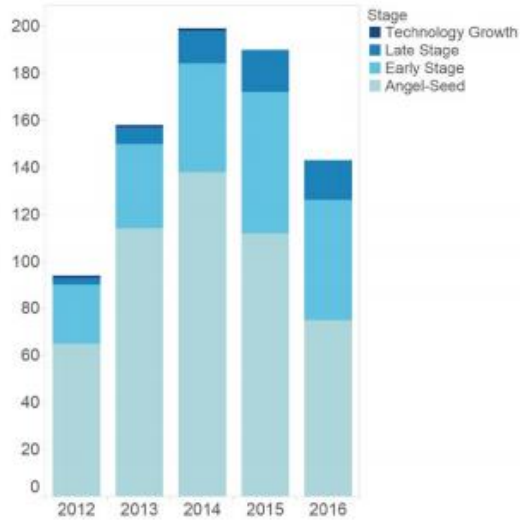
Table 5.14: Historical Number of Seed Stage Investments in Berlin (Source: Crunchbase. 2016)

Year	Number of seed deals in the Berlin ecosystem
2003	10*
2004	25*
2005	25*
2006	50*
2012	60
2013	120
2014	140
2015	120
2016	80
2030	125*

*Assumed

Figure 5.62: Historical Number of Seed Stage Investments in Berlin (Source: Crunchbase.
2016)

berlin funding rounds



berlin invested amounts

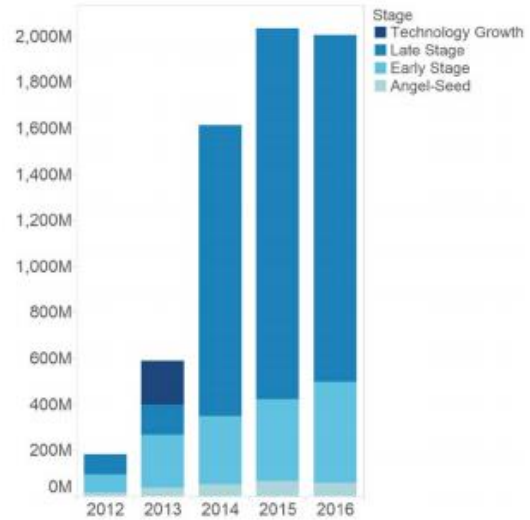
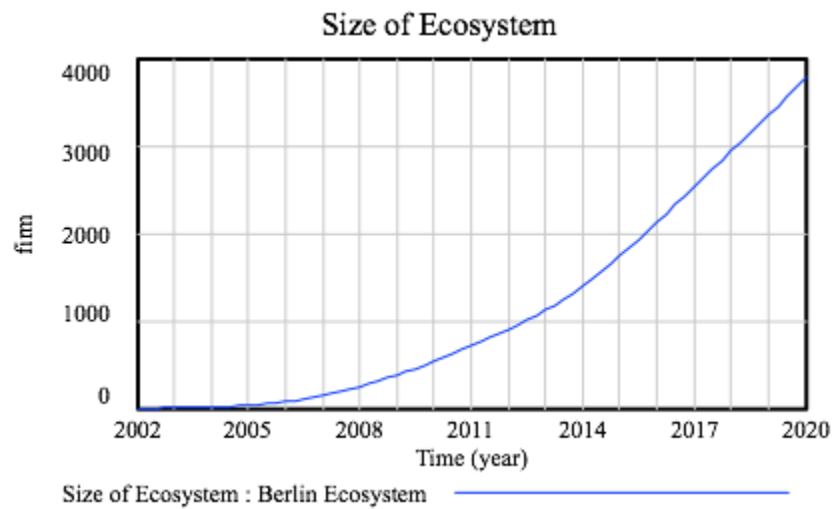


Figure 5.63: Modeled Size of the Berlin Ecosystem over time



Beijing Ecosystem

In order to create the Beijing regional ecosystem model, the historical number of seed stage investments collected by Crunchbase was not reliable in capturing all of the activity happening in the region (Figure 5.61). The coverage of Crunchbase is best in United States and Europe, whereas it was insufficient to explain the Beijing investment activity. As we were unable to find an alternative data source, we completed the missing values with our assumptions, by assuming similar firm creation rates as the Silicon Valley Ecosystem (marked with a *), and used this as the “Firm Creation” rate (Table 5.15).

Table 5.15: Historical Number of Seed Stage Investments in Beijing (Source: Assumed)

Year	Number of seed deals in the Beijing ecosystem
2003	25*
2004	50*
2005	75*
2006	100*
2007	125*
2008	175*
2009	200*
2010	250*
2030	700*

*Assumed

Figure 5.64: Historical Number of Seed Stage Investments in Beijing (Source: Crunchbase. 2016)

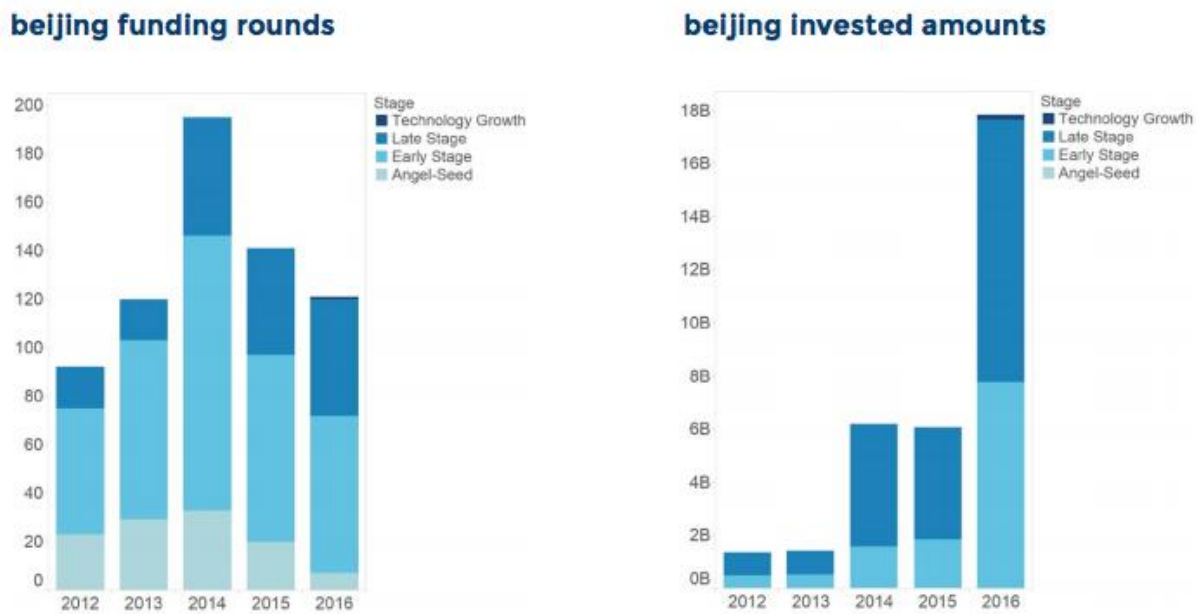
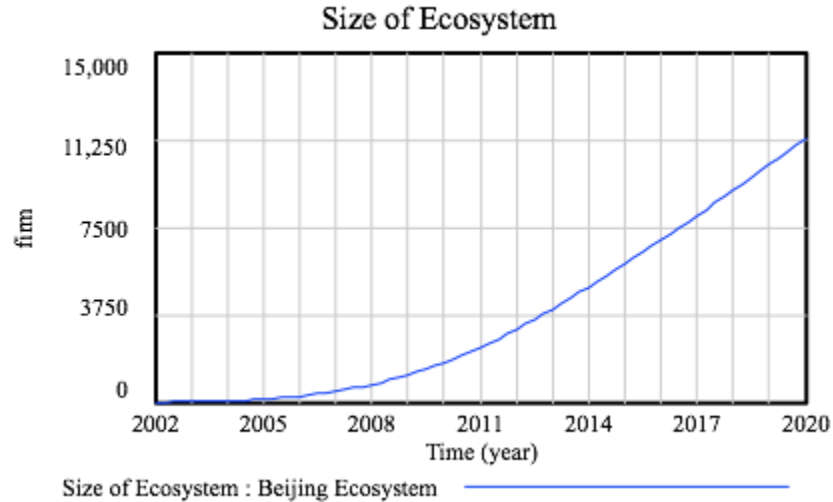


Figure 5.65: Modeled Size of the Beijing Ecosystem over time

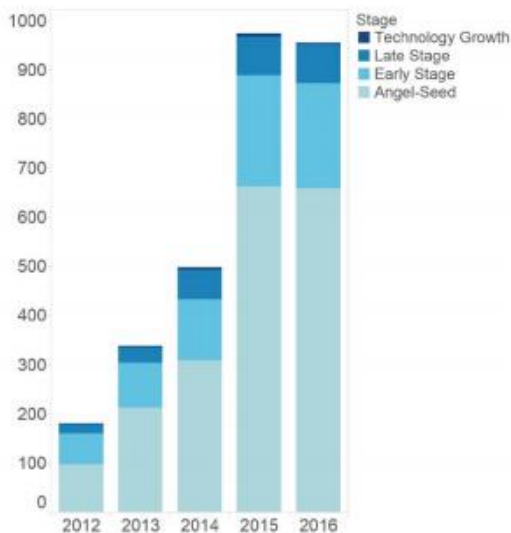


Bangalore Ecosystem

In order to create the Bangalore regional ecosystem model, the historical number of seed stage investments collected by Crunchbase was not reliable as it was capturing the overall investment activity in India as a whole (Figure 5.63), but not broken down per regional ecosystem. As we were unable to find an alternative data source, we completed the missing values with our assumptions (marked with a *) and used this as the “Firm Creation” rate (Table 5.16).

Figure 5.66: Historical Number of Seed Stage Investments in India (Source: Crunchbase.
2016)

India funding rounds



India invested amounts

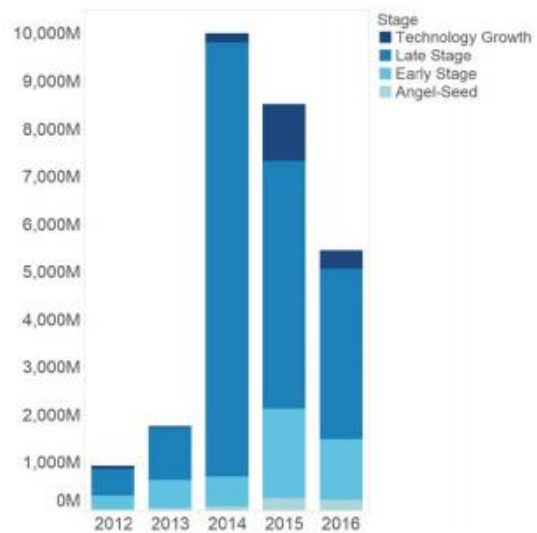
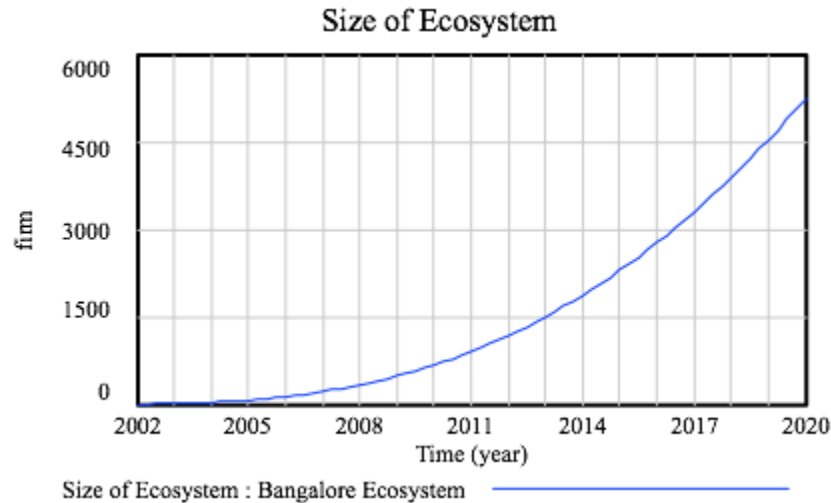


Table 5.16: Historical Number of Seed Stage Investments in Bangalore (Source: Assumed)

Year	Number of seed deals in the Bangalore ecosystem
2003	25*
2005	50*
2007	75*
2030	500*

*Assumed

Figure 5.67: Modeled Size of the Bangalore Ecosystem over time



Estonia Ecosystem

In order to create the Estonian regional ecosystem model we used the historical number of seed stage investments collected by Gruner, M, n.d, as the “Firm Creation” rate (Table 5.17).

As CBInsights did not present dynamic rates (survival, failure and exit) for the Estonian ecosystem, we used the generic rates within the Estonia model.

Table 5.17: Historical Number of Deals and Total Capital Raised (in M\$) in the Estonian Entrepreneurial Ecosystem (Source: Gruner, M, n.d)

Year	No of Deals in the Estonian Ecosystem	Total Capital Raised (in M\$)
2006	5	5.69
2007	4	9.65
2008	10	16.95
2009	8	21.27
2010	11	39.80
2011	19	48.08
2012	28	71.47
2013	45	102.34
2014	45	171.02
2015	38	267.59
2016	43	371.67
2017	40	643.08

Figure 5.68: Historical Aggregate Number of Deals the Estonian Entrepreneurial Ecosystem
(Source: Gruner, M, n.d)

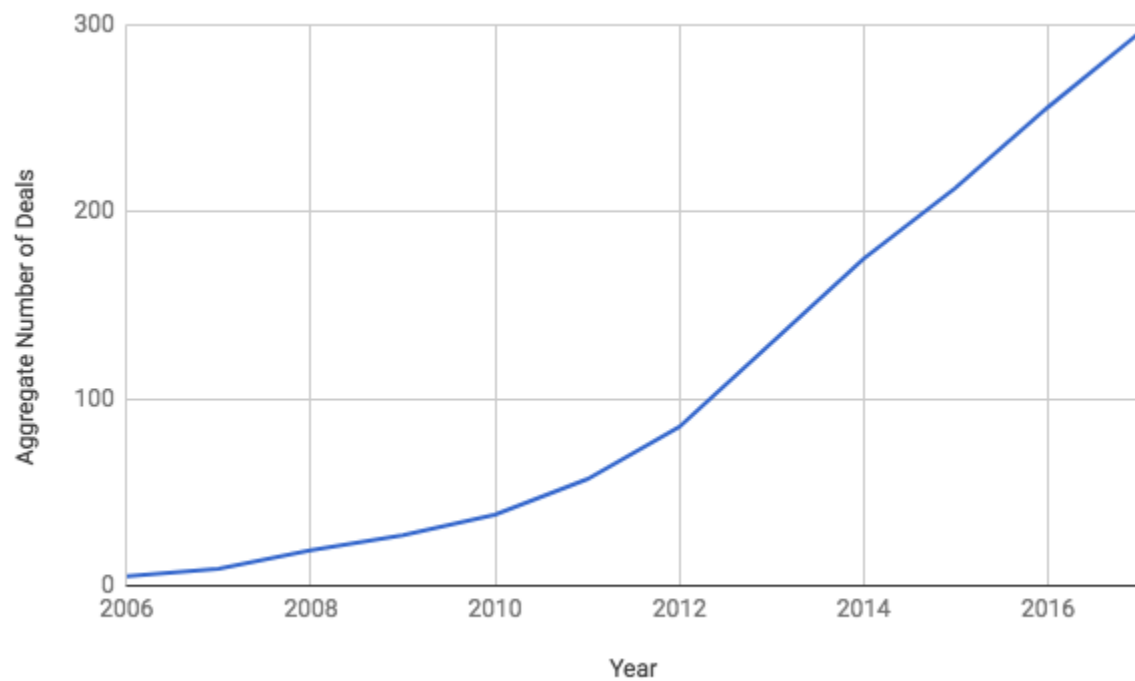
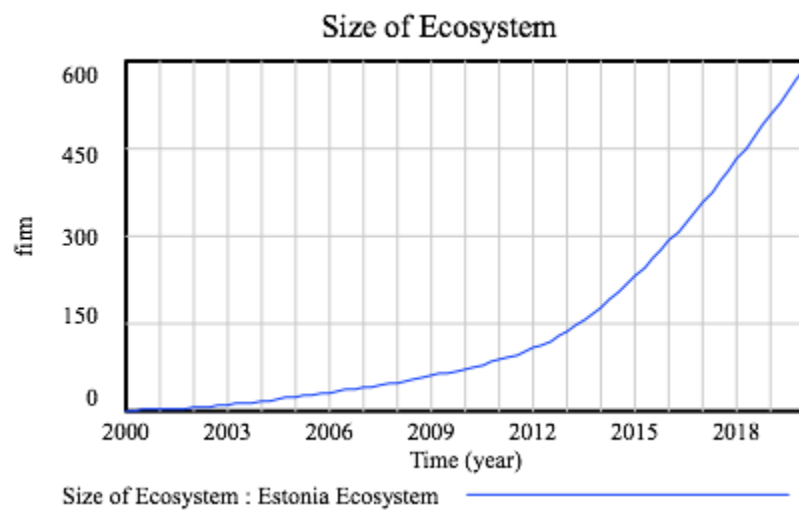


Figure 5.69: Modeled Size of the Estonia Ecosystem over time



Tokyo Ecosystem

In order to create the Tokyo regional ecosystem model we used the historical number of seed stage investments collected by Entrepedia as the “Firm Creation” rate (Table 5.18). However, found the overall seed investments in Japan. Therefore to model the Tokyo Entrepreneurial Ecosystem, we assumed that ~68% of the total amount of investments came from Tokyo. This assumption comes from historical data also found by Entrepedia, in which between 2008-2017 of all venture deals in Japan, 68% came from Tokyo.

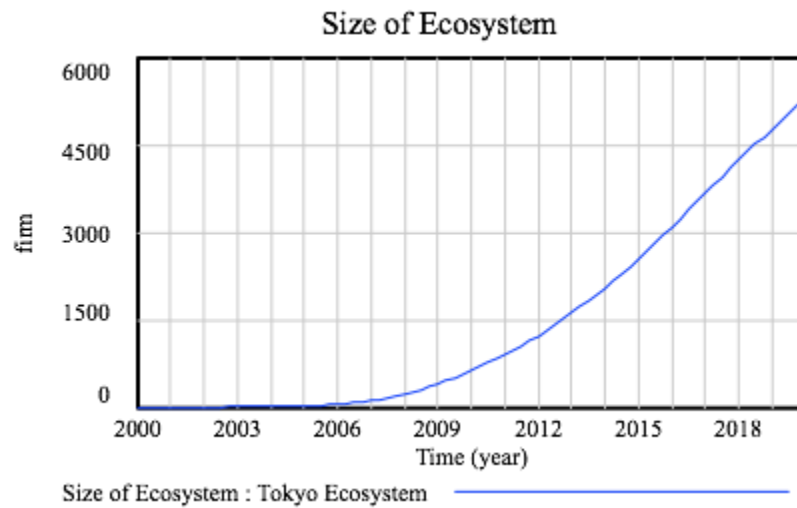
Table 5.18: Historical and Assumed Number of Deals in the Tokyo Entrepreneurial Ecosystem

(Source: Entrepedia)

Year	Number of Seed Investment in Japan	Number of Seed Investment in Tokyo, assuming 68% of total investments
2003	25*	17*
2004	50*	34*
2005	100*	68*
2006	200*	136*
2007	300*	204*
2008	451	307
2009	442	301
2010	467	318
2011	557	379
2012	602	409
2013	632	430
2014	710	483
2015	782	532
2016	678	461
2017	435	296
2030	500*	340*

As CBInsights did not present dynamic rates (survival, failure and exit) for the Japanese ecosystem, we used the generic rates within the Tokyo model.

Figure 5.70: Modeled Size of the Tokyo Ecosystem over time



Comparison of Ecosystems

In Figures 5.71, 5.72 and 5.73 we have captured how the development of the ten Regional Entrepreneurial Ecosystems grouped by geography; United States, Europe and Asia respectively. Depending on the history and specific conditions within the ecosystem, there will be a different rates of development and thus value creation in the region: Value Generation (Figures 5.74-5.76), Employment Generation (Figures 5.77-5.79), Customers Served (Figures 5.80-5.82).

Figure 5.71: Modeled Size of the United States Regional Ecosystems

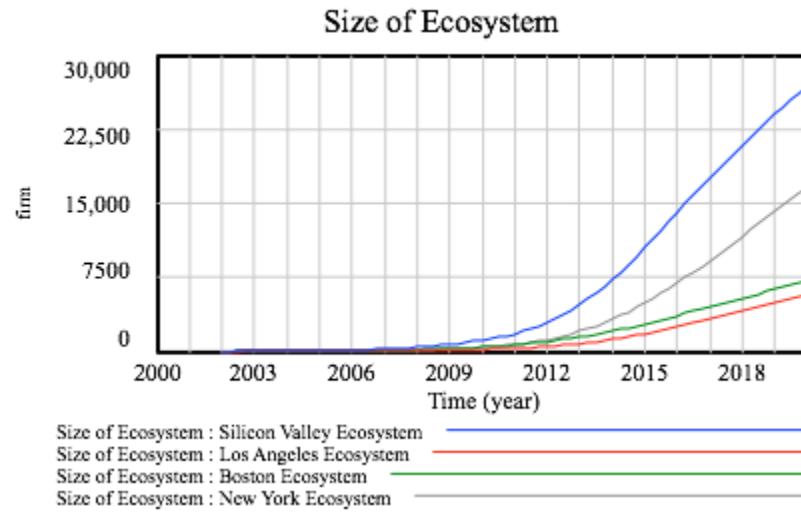


Figure 5.72: Modeled Size of the European Regional Ecosystems

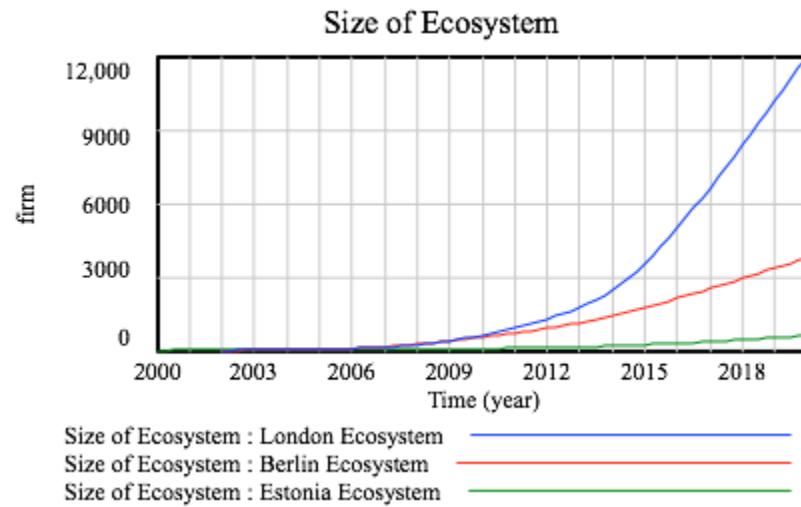


Figure 5.73: Modeled Size of the Asian Regional Ecosystem

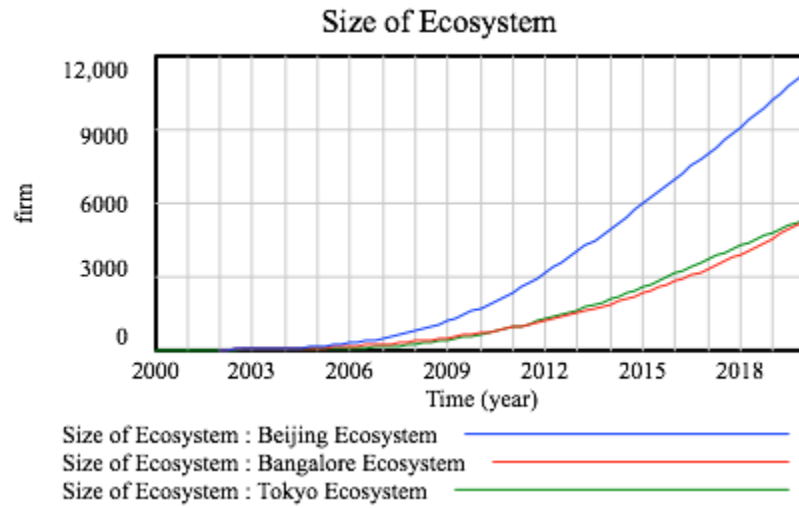


Figure 5.74: Modeled Value generated in the United States Regional Ecosystems

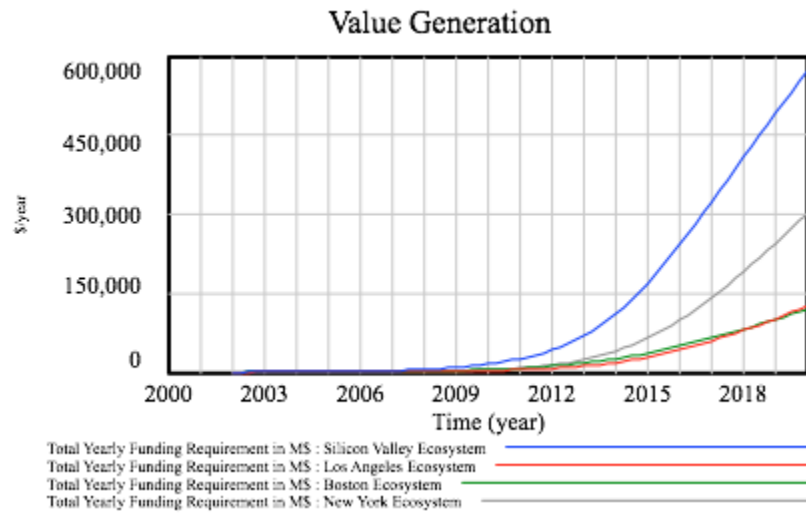


Figure 5.75: Modeled Value generated in the European Regional Ecosystems

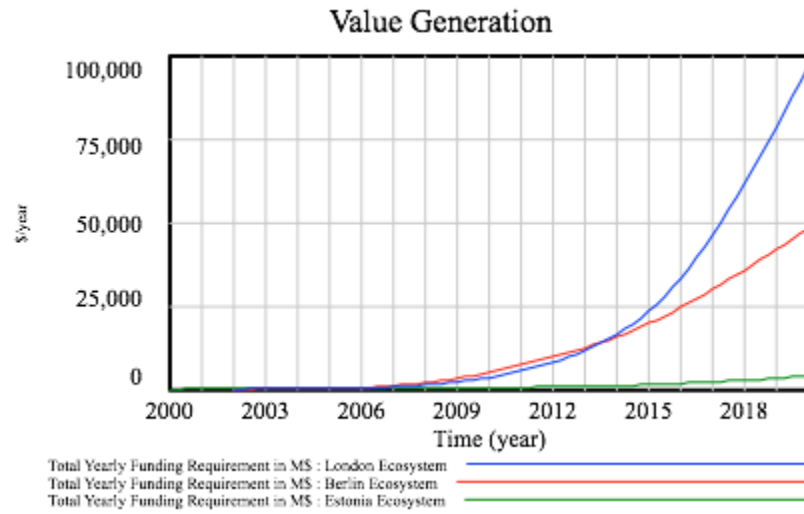


Figure 5.76: Modeled Value generated in the Asian Regional Ecosystems

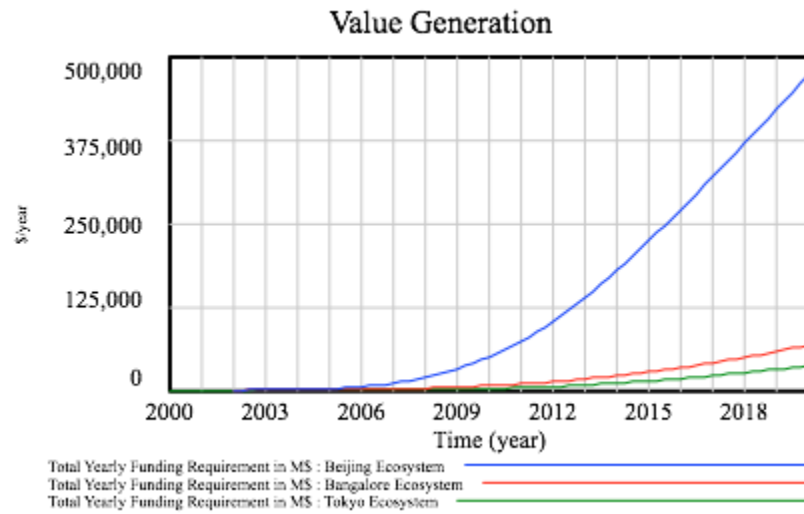


Figure 5.77: Modeled Employment Generated in the United States Regional Ecosystems

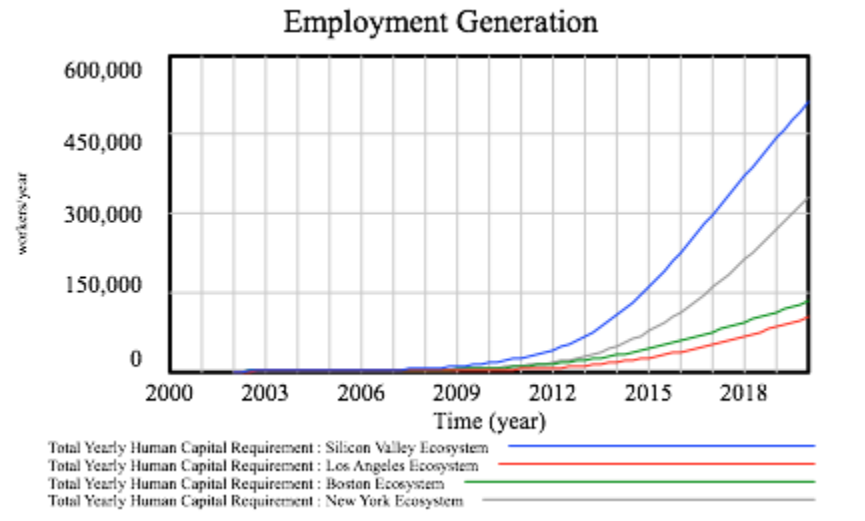


Figure 5.78: Modeled Employment Generated in the European Regional Ecosystems

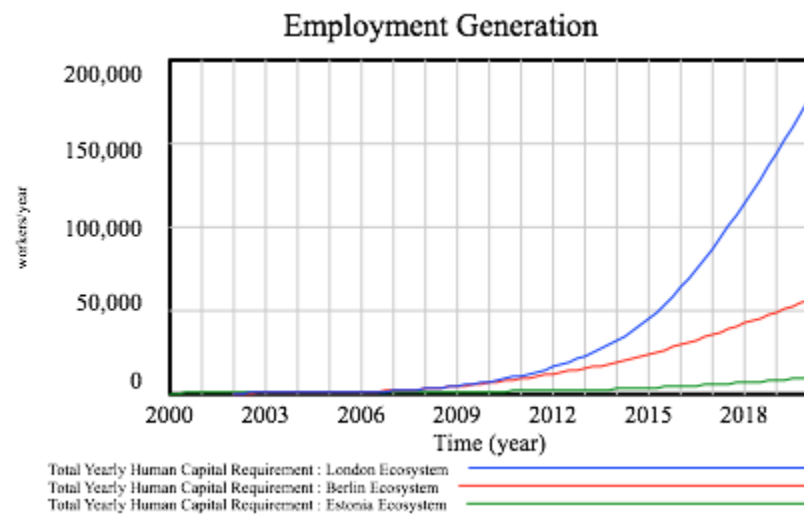


Figure 5.79: Modeled Employment Generated in the Asian Regional Ecosystems

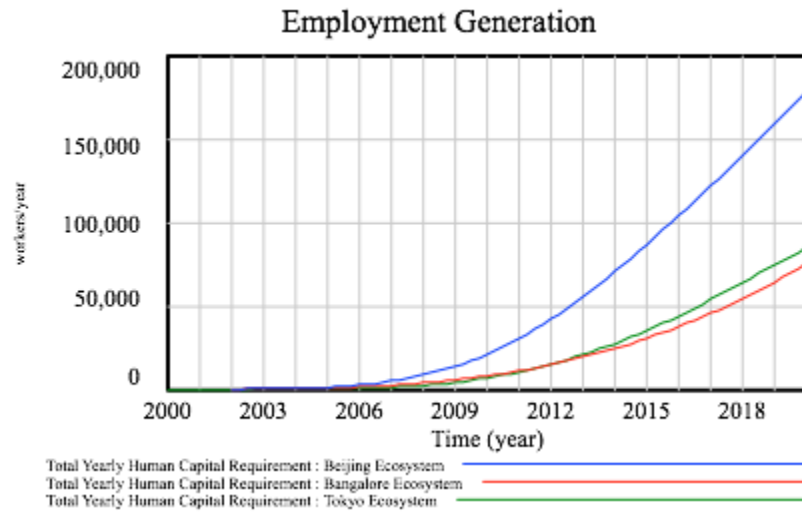


Figure 5.80: Modeled Customers being Served in the United States Ecosystems

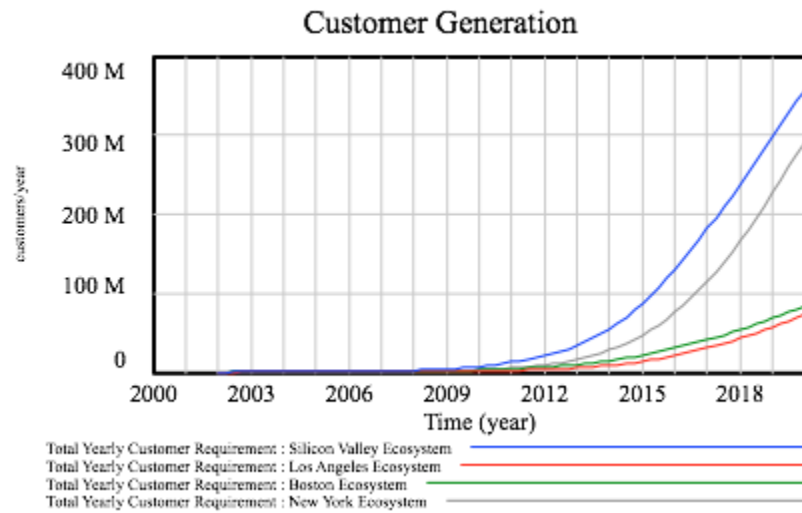


Figure 5.81: Modeled Customers being Served in the European Regional Ecosystems

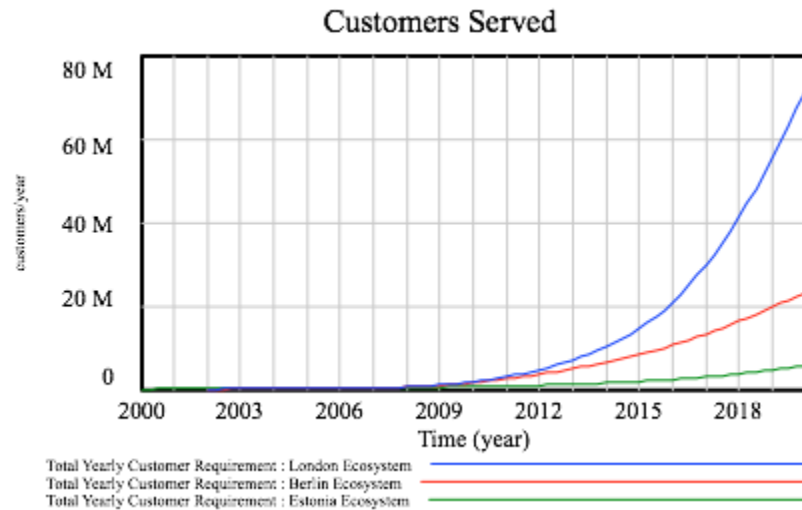
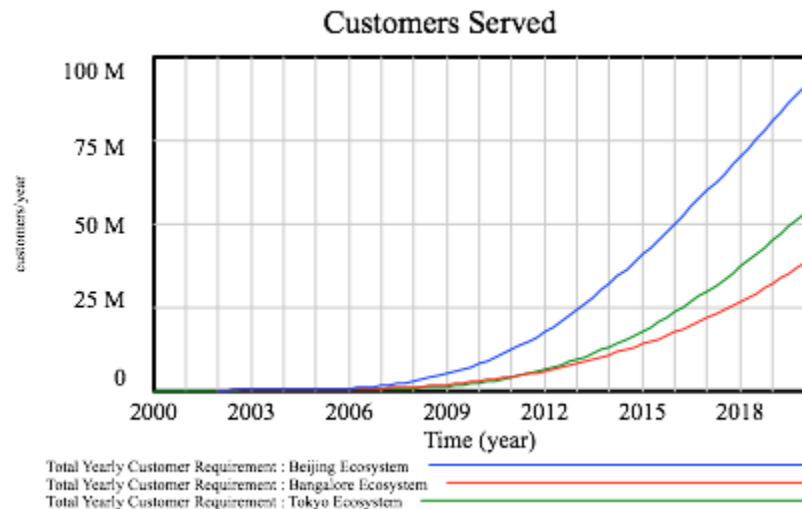


Figure 5.82: Modeled Customers being Served in the Asian Regional Ecosystems



As can be seen from Figures 5.71-5.73, the growth rate and size of the ecosystem is able to achieve is highly dependent on the regional conditions within the area, and thus, the value created within the region (as seen on Figures 5.74-5.82). Therefore policymakers wanting to increase the value creation within their region, should look at ways at supporting the development of their ecosystem.

Table 5.19 is highly significant, as it shows how the historical total number of firms within the ecosystem (in 2016) and the modeled output compare. As can be seen, the historical

and modelled outputs highly resemble each other, except for in the case of Los Angeles Ecosystem.

Table 5.19: Simplifying Assumptions on the Entrepreneurial Ecosystems

Ecosystem	Other Reinforcing Mechanisms (From 1-2)	Other Diminishing Mechanisms (From 0-1)	Year the Ecosystem Began	Historical Startup Output (2016)	Modelled Startup Output (2016)
Silicon Valley Ecosystem	1.25	1	2002	14128	~14000
Boston Ecosystem	1	1	2003	3408	~3400
New York Ecosystem	1.75	1	2003	7030	~7000
Los Angeles Ecosystem	2	1	2003	4170	~2500
London Ecosystem	1	0.65	2003	5136	~5100
Berlin Ecosystem	1	0.75	2003	2098	~2100
Estonia Ecosystem	1	0.45	2006	600	~600
Beijing Ecosystem	1	1	2003	6000	~6000
Bangalore Ecosystem	1	0.65	2003	2040	~2000
Japan Ecosystem	1	0.3	2003	~3000	~3000

In order to adapt to this historical data, our model only required a minimal adjustment (one or zero parameters adjusted), to capture exogenous conditions in the ecosystem that are not captured endogenously by our model. This takes the form of either Other Reinforcing Factors or Other Diminishing Factors. The fact that we were able to recreate the historical development of nine Entrepreneurial Ecosystems, builds great trust and confidence in our model and its findings.

Our hypothesis for the case of the Los Angeles ecosystem is that either the historical number of investments missed to include all existing seed stage investments (maybe considered within a different geographic location), or the number of startups reported in 2016 is an overestimation.

Generalizing from the adjustments we had to make, we can see that the United States Ecosystems present a faster rate of growth than other countries, as we needed to adjust the “Other Reinforcing Factors” parameter. This is in line with prior work that points out at the conduciveness and supportive environment of entrepreneurship in the United States, as well as the long-standing history of entrepreneurship and innovation.

On the other hand, European and Asian Ecosystems, presented a slower rate of growth that that endogenously explained by the model, as we needed to adjust the “Other Diminishing Factors” parameter. Entrepreneurial Ecosystems outside the United States are a more recent phenomenon, this may be one of the reasons why they may be presenting a slower rate of growth.

Chapter 6: Conclusions, Implications and Future Steps

Chapter 6: Conclusions, Implications and Future Steps

This chapter reviews and discusses the answers to the research questions posed in this thesis, as well as point out innovation policy-making implications that it may have. The thesis finally highlights avenues for future Entrepreneurship research.

6.1. Discussion of answers to the Research Questions

As previously mentioned, our motivation within this thesis was threefold: better understanding of the figure of the entrepreneur and the Entrepreneurial Ecosystem and guiding of innovation policy. We will now review the research questions and answers to them.

6.1.1. The Entrepreneur

Firstly, the thesis aims to gain deeper insights into the *figure of the entrepreneur* as the center of startup creation. The thesis explores their profile, motivations, intentions and needs, in an attempt to better understand and thus support them. It does so by finding answers to the research questions:

- Research question 1: “What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?”
 - Hypothesis 1 (**H₁**): Countries with more conducive entrepreneurial culture will have a more positive perception of entrepreneurs.
- Research question 2: “Is there a new and easier way to detect entrepreneurial intention, even before individuals have realized it?”
 - Hypothesis 2 (**H₂**): There will be a positive correlation between a match in entrepreneurial distance and entrepreneurial intention.
 - Hypothesis 3 (**H₃**): There will be a negative correlation between a positive entrepreneurial distance and entrepreneurial intention.
 - Hypothesis 4 (**H₄**): There will be a positive correlation between a negative entrepreneurial distance and entrepreneurial intention.

- Research question 3: “What are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)?”
 - Hypothesis 5 (H₅): Risk aversion will **negatively** affect the entrepreneurial intention of the respondents.
 - Hypothesis 6 (H₆): Entrepreneurial self-efficacy will positively influence entrepreneurial intention
 - Hypothesis 7 (H₇): Entrepreneurial education will positively influence entrepreneurial intention.

Firstly, we were able to understand: “What is the perception that people have of entrepreneurs across countries and are there statistically significant differences between different countries?”. We found that across our sample, there is a very positive general image of entrepreneurs across all countries studied; as them being dynamic, innovative, willing to take risks, having a good entrepreneurial vision and being able to create jobs. However some differences also exist between countries, and these seem to be related, at least in part, to how conducive the culture of the country is, with those being less conducive supporting the least positive image of entrepreneurs. Therefore, our first hypothesis was only partly supported, as the Japanese culture being considered the least conducive towards entrepreneurship (GEM consortium, 2014) and the less agreement with the items relating to the image of entrepreneurs. However, we expected the US respondents to have the most positive view of entrepreneurial characteristics, as the US culture is the most conducive towards entrepreneurship of those studied, but in our study, Spanish respondents appeared to have a more positive image of entrepreneurs than any other country. In the future, it would be important to study the image of entrepreneurs across different countries with varying conducive cultures towards entrepreneurship to find a conclusive relation between both variables.

Secondly, we found “a new and easier way to detect entrepreneurial intention”, by looking at their opinion towards entrepreneurs and their own self-reported abilities, through what we have coined as the “Entrepreneurial Distance”. This new method could be used to detect future entrepreneurial behaviour even before a person had made up their mind about deciding a career choice, and thus target support mechanism to encourage the decision-making and thus rate of entrepreneurship over time. In addition, this “spectator” and “stakeholder” comparative model

could be applicable to other fields by comparing the qualities that are considered important for the profession being considered and the respondent's own abilities and intention to take on that career. In the future, we hope to apply this methodology to other fields in which the stakeholder spectator relationship can be interesting.

Thirdly, we aimed to understand “what are the main factors that affect (support and hinder) the decision of becoming an entrepreneur (entrepreneurial intention)”, in order to understand the decision-making and influencing factors (supporting and hindering) affecting the decision to become an entrepreneur, and thus identifying potential targets to influence entrepreneurial behaviour. Our results indicate that entrepreneurial intentions are positively influenced by entrepreneurship education and entrepreneurial self-efficacy, whilst the fear of failure has a strong negative impact on the decision to become an entrepreneur. Additionally, age, gender and education were found to have no significant impact on entrepreneurial intention or its influencing factors. In the future, we would like to include a larger sample to achieve higher statistical power and to examine if different countries show different entrepreneurial intention patterns according to the differing culture. We hope that our research will help in the allocation of resources to promote entrepreneurship in a more effective manner, towards the factors that have a greater effect on entrepreneurial intentions, and detecting and supporting individuals with entrepreneurial intentions even before they have made this decision (by using the entrepreneurial distance). Particularly, encouraging entrepreneurship education to students from a variety of backgrounds can increase the rate of entrepreneurship. Additionally, we have provided empirical proof of the negative effect risk aversion can have in entrepreneurial intentions. Countries that present higher fear of failure and risk aversion will inherently have lower rates of entrepreneurship and thus competitiveness. Addressing this mindset is a challenging task that must be addressed at a societal level to achieve an increased level of entrepreneurship.

The first part of our thesis explored how entrepreneurs and startups are at the core of value creation. Yet, despite their best efforts, there are events and circumstances outside of their control that affect the success and survival rate of startups. This is why the ecosystem approach is so important because it allows researchers and stakeholders a new way to decipher and understand the complex, intertwined interactions that lead to the development of a strong Entrepreneurial Ecosystem.

6.1.2. Entrepreneurial Ecosystem

Secondly, the thesis explores the system in which entrepreneurs operate, the *entrepreneurial ecosystem*, and what are the environmental requirements and support mechanisms that affect an entrepreneur's ability to create, grow and exit a company. Understanding the dynamic development and value creation of an entrepreneurial ecosystem, is a necessary first step in order to develop targeted support mechanisms to encourage its development. It does so by responding to the questions:

- Research question 4: “Is the Entrepreneurial Ecosystem a good conceptual design to study entrepreneurship?”
 - Hypothesis 8 (H₈): The Entrepreneurial Ecosystem is a good conceptual design to study entrepreneurship
- Research question 5: “If so which are the key factors necessary for startup's success, and thus for the development of the Entrepreneurial Ecosystem?”
 - Hypothesis 9 (H₉): The availability of capital, human capital and customers are they key factors for entrepreneur's success.
- Research question 6: “What are the reinforcing and diminishing mechanisms that affect the development of the ecosystem over time?”
- Research question 7: “Which stage of firms are the main contributors to value creation within a region?”
- Research question 8: “How does this change over time or under varying circumstances (scenarios)?”.

In Chapter 3, we concluded that the Entrepreneurial Ecosystem is a good conceptual design to study entrepreneurship, and out of the numerous factors that compose the ecosystem, the availability of funding, human capital and customers, are the three key resources that entrepreneurs need to start, grow and exit their company.

In Chapter 4 we concluded that there are 6 main feedback mechanisms occurring within the development of an entrepreneurial ecosystem.

- Reinforcing Mechanisms: Experience Reinforcement (R1), Exit Reinforcement (R2), Other Reinforcing Mechanisms (R3), Network Effect on Resource Availability (R4)
- Balancing Mechanisms: Competition for Resources (B1), Other Balancing Mechanisms (B2)

In Chapter 5 we concluded that Growth Stage Firms are cumulatively the main requirers of funding within the Entrepreneurial Ecosystem, whereas Early and Late Stage Firms follow (Figure 5.4). The funding requirement of late stage firms, around year 7 becomes higher than that of seed stage firms (Figure 5.3) despite the much smaller number of firms (Figure 5.1). Nonetheless Seed Stage firms despite being the most numerous, only are responsible for a small part of the funding raised (Figure 5.4).

Additionally, in the first decade of the development of an Entrepreneurial Ecosystem, the Early Stage firms will be the main firm type responsible for employment generation in a new Entrepreneurial Ecosystem (Figure 5.5), whereby from the second decade, Growth Stage become the main employment contributors. Late stage firms only marginally contribute to the number of jobs created, starting from the second decade of development despite each Late Stage firm employing a larger amount of people, their overall low number within an ecosystem make their employment generation only marginal. Seed stage firms on the other hand are the most numerous type of firm, yet are only employing few employees each, therefore also having a marginal contribution to employment generation.

Also, in case of customer requirements, seed and early stage firms have a much smaller scale of impact in this level, with almost imperceptible number of customers being served compared to growth and late stage firms (Figure 5.7-8).

Understanding how value is generated within the region, and how different firm types are responsible for it can help identify prime drivers for value generation (be it employment, innovative products or services or funding), to support them efficiently. As well as providing the firms in the ecosystem with the type of resources that they need, “As individual firms go through their own growth stages—from start-up to survival to growth to exit—the types of support which they utilize also change” (O'Connor & Reed, 2015). For example, the funding required by different stage firms is provided by different institutions; whereas seed stage firms may rely on grants, angel investment, early and growth firms rely on Venture Capital, whereas late stage

firms require of Private Equity. Similarly, the type of Human Capital necessary varies as different skill sets may be more valuable than others according to the stage of firms; whereas at the seed stage level risk-taking and innovative behaviour might be valued, at the early stage Engineering skills to build the product or service, and at the growth and late stage Sales and Customer Development skills may be most valuable to fuel the fast firm growth. Lastly, even the type of customers may have slightly different profiles; whereby at the seed and early stage firms are serving early adopters, growth stage firms serve the majority, and late stage firms may be serving the laggards and customers outside of the ecosystem's own borders.

Once it is understood that an ecosystem as a whole has an overall requirement for resources, that can be estimated from the aggregate needs of firms of different stages and their adapted needs, it is easy to understand that if there is a limited availability of resources (funding, human capital or customers) this will limit the potential for growth of the ecosystem. A scarcity of resources will lead to constraints in the development of the startup ecosystem, as certain firms will be unable to secure the necessary resources and will either fail or leave the ecosystem. This is one of the key avenues for policy makers to efficiently allocate their limited resources to have the maximum impact in the development of the startup ecosystem. In a sense, if a resource is not a limiting factor, improving its availability will have little effect. Acs (Ács et al., 2014), already expressed this idea of “bottleneck factors”, or factors that hold back the system's performance. However, our work is the first to put this concept into practice, within the Entrepreneurial Ecosystem framework, and in doing so, have created a practical tool for policy makers to assess their own regional ecosystem, and understand which aspects require the most attention; by addressing the bottlenecks preventing the ecosystem growth.

6.1.1. Innovation Policy making

Lastly, the thesis aims to apply the better understanding of entrepreneurs and the Entrepreneurial Ecosystem to help *guide the policy-making efforts* of ecosystem stakeholders and thus elicit the positive socio-economic consequences outlined before. The academic literature in which the concept of Entrepreneurial Ecosystems is well proved, and understood.

However how to design and successfully foster entrepreneurship is still an underdeveloped subject matter and pose difficult and significant design challenges.

- Research question 9: Is it possible to expand the carrying capacity of the Entrepreneurial Ecosystem and thus the positive effects?
 - Hypothesis 10 (H₁₀): By identifying the bottlenecks in the Entrepreneurial Ecosystem development, it will be possible to allocate resources to alleviate those bottlenecks, this will help the development of the Entrepreneurial Ecosystem and the positive socio economic spillover effects.

Acs (Ács et al., 2014), already expressed this idea of “bottleneck factors”, or factors that hold back the system’s performance. Throughout our work we revealed how sensitive the development of the ecosystem can be to the environmental conditions and resource availability. The availability of funding, human capital and customers, determine the “carrying capacity” of the ecosystem and thus the size, evolution and value creation being generated within the region.

We hope that the generic System Dynamics model for the development of a Entrepreneurial Ecosystem that we built, can help other regional stakeholders in understanding the dynamics, evolution, and value creation over time. As well as understand how their actions may support (or not) the development of the ecosystem by learning from the different scenarios proposed, which are based out of potential occurrences within an ecosystem.

In addition, our study can serve for regional policy-makers to better understand their regional Entrepreneurial Ecosystem, its current status, and its future prospects. In this way, we hope that we are able to point out towards which would be the main **bottlenecks** or **constraints** for the development of the Entrepreneurial Ecosystem and the support of the entrepreneurs in their region. This can guide **resource allocation to maximize their efficiency** towards the areas that will have **most impact**. In a sense, **allocating budgets** into areas that will **not become pain points or limiting factors** for the support of the ecosystem in the upcoming years, will have **limited value**.

We hope that our ecosystem analysis methodology can help ecosystem stakeholders better understand their **collective responsibility** and **addition** to the ecosystem, as well as support a **more sophisticated approach** towards **innovation policy-making**, rather than the

“create our regional Silicon Valley” approach. Understanding the **current conditions, status and resources available**, and **predicting future needs**, can bring **invaluable insights with regards to resource allocation**.

Other researchers have pointed at the role of policy makers as focusing on the general framework of conditions that are necessary to support entrepreneurs. These have been explored by Acs in the GEDI report (Ács et al., 2014; P. D. Reynolds, Hay, & Camp, 1999). Nonetheless, additionally, we propose that policy makers work closely with other ecosystem stakeholders, to understand the current availability of resources and future requirements, and coordinate and synergize their actions to support the particular requirements or bottlenecks of their region. The role of the regional policy-makers is therefore to work on startup capacity planning and expansion, to reap the economic benefits of a stronger ecosystem.

Policy makers should be aware that there are multiple ways in which improving the availability of resources, both within the **local or national level** as well as tapping into the **global resources and networks**. For example, in order to increase the talent in the region, policy-makers could work together with the region’s higher education institutions to design a program adapted to the needs of the firms in the area (for example the New York Cornell - Technion Open Joint Campus to increase the local engineering talent in the region), as well as could attract foreign talent by immigration policies (for example the French Tech Visa, the United Kingdom's Tech Nation Visa Scheme, or Singapore’s EntrePass). This can be an extremely effective way of **expanding the capacity** of the ecosystem, by **attracting global resources** to the region.

6.2. Main constraints to the development of the entrepreneurial ecosystem

The interviews with ecosystem stakeholders, systems thinking approach as well as the system dynamics model also helped us understand what are some of the key constraining parameters that can affect the development of the ecosystem. Thus we wanted to outline some of them below as a lesson for other regional stakeholder to help them build their own entrepreneurial ecosystem.

First and foremost, one of the key variables that determines the growth and thrive of an ecosystem is the firm creation rate (which is a function of the entrepreneurial intention and local

population). If too few firms are being created, maybe because there is low tolerance of failure, or high risk averseness in the region, it is very difficult for the ecosystem to be “kickstarted”. As an ecosystem requires of internal success stories and exits that can help reinforce the development of the Entrepreneurial Ecosystem.

Second, limiting availability of resources (funding, human capital or customers) limit the growth of the ecosystem, as explained before in the “carrying capacity” context.

Also, high failure rates, due to inexperience within the ecosystem, as well as little tolerance and high stigma for failure, very negatively affect the development of the ecosystem. These cultural factors are difficult to change in the short-term, but positive role models within the ecosystem, improved conditions in case of bankruptcy, can help change this phenomenon.

In addition, lack of exits, or these exits happening too early can also burden the development of the ecosystem, as the reinforcing effect that impacts the future development of the ecosystem happens particularly with larger stage companies. Firms that are exiting too early, would not have a significant “ripple effect”. Small exits are initially important to kickstart the ecosystem, to gain knowledge, for investors to gain confidence in the entrepreneurs in the area, However the ecosystem needs of larger, late stage exits to reach the next level of significance.

Similarly, ecosystems in which a large proportion of companies are being built towards an IPO, rather than an M&A, tend to have resources “trapped” within the firm for a longer period of time, lacking the recycling and reinforcing dynamics that can trigger new and better firm creation. This low level of dynamism in the form of exits, puts a burden on the development of the ecosystem, taking a longer period of time to reach certain scale.

6.3. Value Added

Most studies until now, have focused on the qualitative aspects of entrepreneurship and the Entrepreneurial Ecosystem. The concept of the Entrepreneurial Ecosystem is still quite new, and hasn’t been appropriately addressed, especially from a quantitative perspective. We believe that our approach can have a significant contribution to the field of entrepreneurial studies. The specific knowledge gap that this work has filled, is a first step towards a **deeper understanding** into the **actual conditions** and **resources available** in a regional ecosystem. In this way we can

move from a “one size fits all” or imitating successful support mechanisms, towards a **truly adaptive innovation policy making**.

The **narrowing in scope** exercise that we performed, from all factors important in the Entrepreneurial Ecosystem, into the three key resources required by entrepreneurs, was a necessary step in having a manageable problem to address via System Dynamics. However, when considering a specific regional Entrepreneurial Ecosystem, and wanting to understand the particular dynamics of it, it would be valuable to **re-assess** if these are the key resources that are needed by the entrepreneurs in that region, and **adapt** otherwise.

This thesis has developed a first assessment of **causality** between the factors and resources in the Entrepreneurial Ecosystem, helping better understand cause and effects and development over time. Entrepreneurial Ecosystems take **decades** to develop, in line with the time it takes to create large, innovative, businesses that bring meaningful impact to an area. This long time frame, and delayed mechanisms between support mechanisms and results, can make decision-making and resource allocation very complicated. The System Dynamics model we have developed can be a very useful tool for policy-makers to engage in **scenario planning**, and how different **allocation of resources** could have different outcomes in the development of the Entrepreneurial Ecosystem. In this way, decades of development could be modeled within minutes.

All in all, this allows stakeholders to have a better understanding on the performance of regional economies. We believe that our work can serve as a platform for future research and a starting step to evaluating the regional conditions.

We believe that our work has helped overcome the “**staticity**” of other research in the field of entrepreneurship. The system dynamics approach allows for us to view the ecosystem as an **evolving** and **changing system** rather than a fixed entity or a snapshot taken at a particular point in time. Our approach has added additional complexity layers that other methods have not been able to provide.

6.4. Limitations of our study

Some authors have criticised the rising popularity of the concept of the Entrepreneurial Ecosystem, mentioning that the mere popularity of the term and seductiveness is no guarantee of profundity (Stam & Spigel, 2016). We believe that Chapter 3 addressed this issue, by showing how entrenched the term is with well-studied related concepts. We believe that we have addressed this limitation by better defining and demarcating the term from parallel literature.

Data Sources

One of the biggest limitations of our work, is the scarce availability of high quality data on startups. Startups are privately owned companies, often short-lived because of the high failure rate, fast-growing (and therefore changing), therefore it is hard to accurately keep track of them. In addition, there is little quality data prior to 2003. Accuracy, availability and comparison in different geographies, are therefore all inherent limitations of working on startups. Data aggregators use information from the media, to update their databases. This unfortunately means there is an inherent bias from the news towards large funding rounds, success stories, or large failures. When companies slowly fail and close down quietly, or just not manage to raise an initial funding round, do not make the headlines.

Nonetheless, CB Insights and Crunchbase in terms of startups, and Startup Genome in terms of Entrepreneurial Ecosystems, have done a great effort in gathering, standardizing and offering insights into startup firms. Although an imperfect source of data, the application of their statistics to our work can provide many valuable insights and interesting conclusions.

We expect that the rising importance of startups and understanding of the concept of the ecosystem, the availability and accuracy of startup data will improve in the years to come, especially as more longitudinal studies that require continuous efforts are completed. Currently, the validation of our model is constrained by the data availability. Regional stakeholders with first hand information of their regional location should be involved in the next stage of assessing a regional ecosystem.

Complexity

As we previously saw, the Entrepreneurial Ecosystem is an extremely complex and constantly evolving entity, therefore it is impossible to capture the complete complexity in one model. Simplification is a necessary step in building an insightful model, yet with simplification you necessarily neglect certain factors. In addition as the contribution of each reinforcing and diminishing feedback mechanism is currently unknown we had to assign equal weights to each parameter, which was a necessary simplification. Once current factors are better understood, further studies could build additional layers of complexity.

Macroeconomic

Undoubtedly, macroeconomic conditions affect the development of the Entrepreneurial Ecosystem, for example via the availability of resources such as capital, or the preference of working for a startup rather than a more established institution. We believe that certain macroeconomic factors can be considered by using external information, such as the past availability of capital year over year, or the number of firms historically opened. However it is important to remember that the goal of the model we proposed is not its predictive power, but rather to consider what are the factors that affect the development of the ecosystem and take this knowledge to develop the local ecosystem.

Generalization

Currently, our model looks at the aggregate perspective in the ecosystem, rather than the firm level. In this sense, we are making certain approximations that may not be completely accurate. In the future, it would be interesting to address this gap by combining an agent based model perspective, with startup firms being the agents, combined with the systemic approach that System Dynamic modelling allows to.

6.5. Next Steps

Our work initially developed a conceptual based model, that can be applied and adapted to any regional Entrepreneurial Ecosystem, taking into consideration the specific regional resources and conditions. It is possible that the simplification process we followed may be different with each regional economy, and that some additional factors/ considerations/ resources/ conditions may be important in specific ecosystems. When developing the model with the ecosystem stakeholder, it will be important once again re-evaluate and to narrow down the key resources that are required by entrepreneurs in that particular region

We showed how a practical application to explore the development of nine different Entrepreneurial Ecosystems around the world, and pointing out a bottleneck and its alleviation. We were able to do so thanks to the well-documented and availability of data. The rising importance of Entrepreneurial Ecosystems worldwide have meant that there has been also been an increase in the collection of time series data, and successful and unsuccessful initiatives to support entrepreneurs. As Entrepreneurial Ecosystems take several cases to develop, it is necessary that we use the collective learnings from initiatives worldwide, so we can learn and apply these learnings to support the development of other region.

As we mentioned in the previous chapter, the system dynamics model we presented should **not** be considered “final”. As many others have pointed out before, the act of modeling is a **never-ending** process and is never complete. New information, and new analysis, bring new learning opportunities, to develop our understanding and to evaluate new scenarios. The continuous building, refining and validating of Entrepreneurial Ecosystem models should become a **collective effort**, to increase the learning opportunities worldwide. Entrepreneurial Ecosystems are an ever changing entity, and so are the models that define them. Therefore we encourage other to build upon our model.

Our work, was the first to explore the dynamic development of the ecosystem, but there is much future work to explore. Each of the stakeholders that compose the Entrepreneurial Ecosystem have knowledgeable insights into what is happening in the Entrepreneurial Ecosystem. Therefore they should be involved and their input should be considered in adding more intricacies on how the ecosystem is connected. There are many fruitful avenues for further

research: such as exploring the causality of the different factors that lead to the development of the ecosystem, or shed more light into the recycling of resources.

The Entrepreneurial Ecosystem perspective is still a young discipline, yet it is promising as the future of innovation policy making. This work has proven that it is possible to explore a new avenue when trying to support a regional entrepreneurial ecosystem, by understanding the conditions and requirements of the firms in their areas. This can prove extremely valuable for policy-makers to assign their limited resources to the initiatives that will have the biggest impact within their regional context. We hope that this work can inspire and guide future research and implementation by academics, practitioners and policy-makers alike.

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Appendix

Model Documentation

(001) Average Early Residency=
3.5

Units: year

On average, it will take 3.41 years (41 months) for a startup to move from early to growth stage. Regional Ecosystem Rates: Average Early Residency (years) Boston 3.58 New York 3.50 Silicon Valley 3.42 Los Angeles 3.33 Germany 5.17 United Kingdom 5.00 China 2.67 India 3.50

(002) Average Growth Residency=
2.08

Units: year

On average, it will take 3.08 (37 months) years to for a growth stage firm to become a late stage firm. Regional Ecosystem Rates: Average Growth Residency (Years) Boston 3.00 New York 3.08 Silicon Valley 2.92 Los Angeles 2.25 Germany 3.08 United Kingdom 3.17 China 2.08 India 2.08

(003) Average Late Residency=
1.58

Units: year

On average, it will take 1.08 (13 months) years to become a continued growth stage firm Regional Ecosystem Rates: Average Late Residency (years) Boston 1.08 New York 1.25 Silicon Valley 0.92 Los Angeles 0.92 Germany 0.92 United Kingdom 1.17 China NA - 1 or there is an error India 1.58

(004) Average Seed Residency=
1

Units: year

On average, seed stage firms will take about 1 year to become early stage firms

(005) Customer multiplier tab(

$[(-1000,0)- (1000,1)], (-1000,1e-06), (-99,0.01), (-9,0.1), (-3,0.25), (-1,0.5)$
 $, (0,1), (0.5,1), (1,1), (3,1), (3,1), (20,1), (1000,1))$
Units: Dmnl

(006) Customers Effect=

Customer multiplier tab(Customers Ratio)

Units: Dmnl

Used to test for the effect of availability of a resource on the success rate of firms. Currently set so that if more customers are available than that required by the firms in the ecosystem, there is no effect on the success rate. Nonetheless, if less customers are available than required, the effect will be negative, until customers become available once again.

(007) Customers in the Ecosystem=

6e+07

Units: **undefined**

Base: 60M, 6e+07 Limited Scenario = 10M, 1e+07 Very Limited = 5M, 5e+06

(008) Customers Ratio=

(Yearly Customers Available-Total Yearly Customer Requirement)/Yearly

Customers Available

Units: Dmnl

(009) Diminishing Effect=

Effect of Availability of Resources*Other Diminishing Factors

Units: Dmnl

Average

(010) Early Exit Valuation Factor=

15.47

Units: year/firm

The bigger the exit, the more ripple effect. According to the total amount of funding raised as a proxy for impact generated. Early Stage Exit: 15.47 Growth Stage Exit: 101.15 Late Stage Exit: 275.75

(011) Early Stage Exit Effect=

Early Stage Exit Rate*Early Exit Valuation Factor

Units: Dmnl

(012) Early Stage Exit Rate=

$(\text{Early Stage Firms} * \text{Exit Percentage Early}) / \text{Average Early Residency}$

Units: firm/year

(013) Early Stage Failure Rate=

$(\text{Early Stage Firms} * \text{Failure Percentage Early}) / \text{Average Early Residency}$

Units: firm/year

(014) Early Stage Firms= INTEG (

Early Stage Maturation Rate-Early Stage Exit Rate-Growth Stage Maturation

Rate

-Early Stage Failure Rate,

Initial number of early stage firms)

Units: firm [0,?]

Number of firms in the ecosystem that are early stage

(015) Early Stage Maturation Rate=

$(\text{Seed Stage Firms} * \text{Survival Percentage Seed}) / \text{Average Seed Residency}$

Units: firm/year

Maturation Rate considers a “perfectly mixed” scenario in

which firms have an average residency time captured by the
parameter “Average Seed Residency”.

(016) Early Stage Rate of Customer Requirement=

1000

Units: customers/(year*firm)

Assume Early Stage Firms serve 1000 Customers per firm per year

(017) Early Stage Rate of Funding Requirement in M\$=

17

Units: \$/(year*firm)

Assume Early Stage Firms Require 4,33M\$ per firm per year

Regional Ecosystem Rates: Early Boston 11.8 New York 13.8

Silicon Valley 17 Los Angeles 15.9 Germany 14.8 United Kingdom 9

China 39 India 17

(018) Early Stage Rate of Human Capital Requirement=

15

Units: workers/(year*firm)

Assume Early Stage Firms employ 15 people per firm per year

(019) Early Stage Requirement of Customers=

Early Stage Firms*Early Stage Rate of Customer Requirement

Units: customers/year

Early Stage Requirement of Customers will be the average

Customer Requirement rate for Early stage firms * number of
Early stage firms

(020) Early Stage Requirement of Funding=

Early Stage Firms*Early Stage Rate of Funding Requirement in M\$

Units: \$/year

Early Stage Funding Requirement will be the average Funding

Requirement rate for early stage firms * number of early stage
firms

(021) Early Stage Requirement of Human Capital=

Early Stage Firms*Early Stage Rate of Human Capital Requirement

Units: workers/year

Early Stage Funding employment will be the average Human Capital

Requirement rate for early stage firms * number of early stage
firms

(022) Effect of Availability of Resources=

(Customers Effect*Funding Effect*Human Capital Effect)

Units: Dmnl

Switch on: (Customers Effect*Funding Effect*Human Capital

Effect) To switch off: $1+(0*(Customers\ Effect*Funding\ Effect*Human\ Capital\ Effect))$: switched of in the Regional
Ecosystems as no historical information on the availability of
resources

(023) Entrepreneurial Intention Effect=

Entrepreneurial Intention Reinforcing Effect*Entrepreneurial Intention

Percentage Diminishing Effect

Units: Dmnl

(024) Entrepreneurial Intention Percentage Diminishing Effect=

Entrepreneurial Intention Percentage Diminishing Effect Mult Tab(Diminishing

Effect

)

Units: Dmnl

(025) Entrepreneurial Intention Percentage Diminishing Effect Mult Tab(

[(0,0)-(10,10)],(0,0),(1,1),(2,2))

Units: Dmnl

(026) Entrepreneurial Intention Reinforcing Effect=

Reinforcing Intention Mult Tab(Reinforcing Effect)

Units: Dmnl

(027) Exit Effect=

Exit Effect Mult Tab(Early Stage Exit Effect+Growth Stage Exit Effect+Late
Stage Exit Effect

)

Units: Dmnl

The experience is a function of the valuation (the bigger the

exit, the more ripple effect). Experience = f(valuation) =

alpha*early stage exit + beta*Growth stage exit + gamma*late

stage exit Early Stage Exit: 11.242 Growth Stage Exit: 40.242

Late Stage Exit: 100

(028) Exit Effect Mult Tab(

[(-1000,-1000)-(20000,1000)],(-1000,0),(0,0),(500,0.1),(1000,0.2),(10000,
1),(20000,1))

Units: Dmnl

Experience is a factor that influences factors in the ecosystem

by making them certain % better. 0.1 = 10% better 0.5 = 50%

better 1 = 100% better 2 = 100% better

(029) Exit Percentage Early=

0.173

Units: Dmnl

Around 35% of firms exit at the early stage (0.35). Regional

Ecosystem Early Stage Exit Rate (%) General 0.35 Silicon Valley

0.303 Boston 0.26 New York 0.33 Los Angeles 0.23 United Kingdom

0.3 Germany 0.38 China 0.09 India 0.173

(030) Exit Percentage Growth=

0.18

Units: Dmnl

Around 22% of firms exit at the growth stage (0.22). Regional

Ecosystem Growth Stage Exit Rate (%) General 0.22 Silicon Valley
0.205 Boston 0.216 New York 0.21 Los Angeles 0.156 United
Kingdom 0.2 Germany 0.22 China 0.09 India 0.18

(031) Exit Percentage Late=

0

Units: Dmnl

Around 11% of firms exit at the late stage (0.11). Regional

Ecosystem Late Stage Exit Rate (%) General 0.11 Silicon Valley
0.06 Boston 0 New York 0.09 Los Angeles 0.33 United Kingdom 0
Germany 0 China 0 India 0

(032) Failure Percentage Early=

1-Survival Percentage Early-Exit Percentage Early

Units: Dmnl

Firms can either exit, fail or survive at the early stage.

(033) Failure Percentage Growth=

1-Survival Percentage Growth-Exit Percentage Growth

Units: Dmnl

Firms can either exit, fail or survive at the growth stage.

(034) Failure Percentage Late=

1-Survival Percentage Late-Exit Percentage Late

Units: Dmnl

Firms can either exit, fail or survive at the late stage.

(035) Failure Percentage Seed=

1-Survival Percentage Seed

Units: Dmnl

Firms can either fail or survive at the seed stage (assume no
exits at such an early stage).

(036) FINAL TIME = 2020

Units: year

The final time for the simulation.

(037) Firm Creation(

[(2000,0)-(2030,200)],(2000,0),(2003,25),(2005,50),(2007,75),(2030,500))

Units: firm/year

Base: [(0,0)-(25,500)],(0,0),(15,250),(25,250) Low:

[(0,0)-(25,500)],(0,0),(15,150),(25,150) High:

[(0,0)-(25,500)],(0,0),(15,350),(25,350) Drought:

[(0,0)-(25,500)],(0,0),(15,250),(16,100),(17,100),(18,100),(19,250),(25,250) Spike:

[(0,0)-(25,500)],(0,0),(15,250),(16,400),(17,400),(18,400),(19,250),(25,250) Silicon Valley Ecosystem

[(2000,0)-(2017,800)],(2002,7),(2003,10),(2004,23),(2005,23),(2006,43),(2007,79),(2008,93),(2009,133),(2010,232),(2011,409),(2012,567),(2013,657),(2014,741),(2015,762),(2016,607),(2017,435)

Boston Ecosystem

[(2000,0)-(2030,3000)],(2002,3),(2003,8),(2004,7),(2005,7),(2006,28),(2007,27),(2008,30),(2009,50),(2010,92),(2011,117),(2012,148),(2013,151),(2014,167),(2015,131),(2016,135),(2017,99),(2030,150)

New York Ecosystem

[(2000,0)-(2030,3000)],(2002,1),(2003,2),(2004,2),(2005,8),(2006,14),(2007,31),(2008,38),(2009,39),(2010,94),(2011,183),(2012,258),(2013,276),(2014,330),(2015,300),(2016,270),(2017,222),(2030,250)

Los Angeles Ecosystem

[(2000,0)-(2030,3000)],(2002,0),(2003,1),(2004,3),(2005,3),(2006,10),(2007,11),(2008,11),(2009,24),(2010,34),(2011,66),(2012,111),(2013,111),(2014,120),(2015,123),(2016,107),(2017,114),(2030,125)

London Ecosystem

[(2000,0)-(2030,3000)],(2002,7),(2003,10),(2004,25),(2005,25),(2006,50),(2007,75),(2008,100),(2009,125),(2012,225),(2013,475),(2014,625),(2015,775),(2016,425),(2030,425) Berlin Ecosystem

[(2000,0)-(2030,3000)],(2002,0),(2003,10),(2004,25),(2005,25),(2006,50),(2012,60),(2013,120),(2014,140),(2015,120),(2016,80),(2030,125) Estonia Ecosystem

[(2000,0)-(2020,3000)],(2006,5),(2007,4),(2008,10),(2009,8),(2010,11),(2011,19),(2012,28),(2013,45),(2014,45),(2015,38),(2016,43)

Beijing Ecosystem

[(2000,0)-(2030,3000)],(2000,0),(2003,25),(2004,50),(2005,75),(2006,100),(2007,125),(2008,175),(2009,200),(2030,700) Bangalore Ecosystem

[(2000,0)-(2030,200)],(2000,0),(2003,25),(2005,50),(2007,75),(2030,500) Japan Ecosystem

[(2000,0)-(2030,3000)],(2000,0),(2002,0),(2003,25),(2004,50),(2005,100),(2006,200),(2007,300),(2008,451),(2009,442),(2010,467),(2011,557),(2012,602),(2013,632),(2014,710),(2015,782),(2016,678),(2017,435),(2030,500)

(038) Funding Effect=

Funding multiplier tab(Funding Ratio)

Units: Dmnl

Used to test for the effect of availability of a resource on the success rate of firms. Currently set so that if more funding is available than that required by the firms in the ecosystem, there is no effect on the success rate. Nonetheless, if less funding is available than required, the effect will be negative, until funding becomes availability once again.

(039) Funding in the Ecosystem in M\$=

20000

Units: \$/year

Base Scenario In M\$: 20000 Limited: 5000 Very Limited: 2500

[(0,0)-(10,5e+08)],(1,0),(5,0),(6,5e+08),(8,0),(9,0)

(040) Funding multiplier tab(

[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25),(-1,0.5), (0,1),(0.5,1),(1,1),(3,1),(3,1),(20,1),(1000,1))

Units: Dmnl

Excess doesn't matter:

[(0,0)-(10,1)],(0,0),(0.5,0.5),(1,1),(2,1),(3,1),(3,1),(20,1)

Excess leads to 90% SR

[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25), (-1,0.5),(0,1),(0.5,0.9),(1,0.9),(3,0.9),(3,0.9),(20,0.9),(1000,0

.9) Option 2: Excess doesn't matter:

[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25), (-1,0.5),(0,1),(0.5,1),(1,1),(3,1),(3,1),(20,1),(1000,1)

[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25), (-1,0.5),(0,1),(0.5,1),(1,1),(3,1),(3,1),(20,1),(1000,1)

(041) Funding Ratio=

(Yearly Funding Available-Total Yearly Funding Requirement in M\$)/Yearly

Funding Available

Units: Dmnl

(042) Growth Exit Valuation Factor=
101.15

Units: year/firm

The bigger the exit, the more ripple effect. According to the
total amount of funding raised as a proxy for impact generated.
Early Stage Exit: 15.47 Growth Stage Exit: 101.15 Late Stage
Exit: 275.75

(043) Growth Stage Exit Effect=
Growth Stage Exit Rate*Growth Exit Valuation Factor
Units: Dmnl

(044) Growth Stage Exit Rate=
(Growth Stage Firms*Exit Percentage Growth)/Average Growth Residency
Units: firm/year

(045) Growth Stage Failure Rate=
(Growth Stage Firms*Failure Percentage Growth)/Average Growth Residency
Units: firm/year

(046) Growth Stage Firms= INTEG (
Growth Stage Maturation Rate-Growth Stage Failure Rate-Growth Stage Exit
Rate
-Late Stage Maturation Rate,
Initial number of growth stage firms)
Units: firm [0,?]
Number of firms that are in the Growth Stage

(047) Growth Stage Maturation Rate=
(Early Stage Firms*Survival Percentage Early)/Average Early Residency
Units: firm/year
Maturation Rate considers a “perfectly mixed” scenario in
which firms have an average residency time captured by the
parameter “Average Early Residency”.

(048) Growth Stage Rate of Customer Requirement=
50000
Units: customers/(year*firm)
Assume Growth Stage Firms serve 50000 customers per firm per year

(049) Growth Stage Rate of Funding Requirement in M\$=
47.2

Units: \$/(year*firm)

Assume Growth Stage Firms Require 27.82M\$ per firm per year

Regional Ecosystem Rates: Growth Boston 54.5 New York 55 Silicon
Valley 65 Los Angeles 77.5 Germany 44.7 United Kingdom 30 China
177.8 India 47.2

(050) Growth Stage Rate of Human Capital Requirement=
50

Units: workers/(year*firm)

Assume Growth Stage Firms employ 50 people per firm per year

(051) Growth Stage Requirement of Customers=

Growth Stage Firms*Growth Stage Rate of Customer Requirement

Units: customers/year

Growth Stage Requirement of Customers will be the average

Customer Requirement rate for Growth stage firms * number of
Growth stage firms

(052) Growth Stage Requirement of Funding=

Growth Stage Firms*Growth Stage Rate of Funding Requirement in M\$

Units: \$/year

Growth Stage Funding Requirement will be the average Funding

Requirement rate for Growth stage firms * number of Growth stage
firms

(053) Growth Stage Requirement of Human Capital=

Growth Stage Firms*Growth Stage Rate of Human Capital Requirement

Units: workers/year

Growth Stage Requirement of human capital will be the average

human capital Requirement rate for growth stage firms * number
of growth stage firms

(054) Human Capital Effect=

Human Capital multiplier tab(Human Capital Ratio)

Units: Dmnl

Used to test for the effect of availability of a resource on the

success rate of firms. Currently set so that if more human

capital is available than that required by the firms in the ecosystem, there is no effect on the success rate. Nonetheless, if less human capital is available than required, the effect will be negative, until human capital becomes availability once again.

(055) Human Capital in the Ecosystem=
50000

Units: **undefined**

Base = 50,000 Limited Scenario = 10000 Very Limited = 5000

(056) Human Capital multiplier tab(
[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25),(-1,0.5)
,(0,1),(0.5,1),(1,1),(3,1),(3,1),(20,1),(1000,1)
)

Units: Dmnl

Option 1: Excess leads to 10% more

[(-1000,0)-(1000,1,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25
,(-1,0.5),(0,1),(0.5,1.1),(1,1.1),(3,1.1),(20,1.1),(1000,1.1)

Option 2: Excess doesn't matter:

[(-1000,0)-(1000,1)],(-1000,1e-06),(-99,0.01),(-9,0.1),(-3,0.25),
(-1,0.5),(0,1),(0.5,1),(1,1),(3,1),(3,1),(20,1),(1000,1)

(057) Human Capital Ratio=
(Yearly Human Capital Available-Total Yearly Human Capital
Requirement)/Yearly Human Capital Available
Units: Dmnl

(058) Initial number of early stage firms=
0

Units: firm [0,1000]

Assume that an Ecosystem starts with 0 early stage firms

(059) Initial number of growth stage firms=
0

Units: firm [0,1000]

Assume that an ecosystem starts with 0 growth stage firms

(060) Initial number of seed stage firms=
0

Units: firm [0,1000]

Assume that the ecosystem starts with 0 seed stage firms

(061) INITIAL TIME = 2002

Units: year

The initial time for the simulation.

(062) Late Exit Valuation Factor=

275.75

Units: year/firm

The bigger the exit, the more ripple effect. According to the
total amount of funding raised as a proxy for impact generated.
Early Stage Exit: 15.47 Growth Stage Exit: 101.15 Late Stage
Exit: 275.75

(063) Late Stage Exit Effect=

Late Stage Exit Rate*Late Exit Valuation Factor

Units: Dmnl

(064) Late Stage Exit Rate=

(Late Stage Firms*Exit Percentage Late)/Average Late Residency

Units: firm/year

(065) Late Stage Failure Rate=

(Late Stage Firms*Failure Percentage Late)/Average Late Residency

Units: firm/year

(066) Late Stage Firms= INTEG (

Late Stage Maturation Rate-Maturation Rate-Late Stage Exit Rate-Late Stage
Failure Rate

,

0)

Units: firm

(067) Late Stage Maturation Rate=

(Growth Stage Firms*Survival Percentage Growth)/Average Growth Residency

Units: firm/year

Maturation Rate considers a “perfectly mixed” scenario in
which firms have an average residency time captured by the
parameter “Average Growth Residency”.

(068) Late Stage Rate of Customer Requirement=
500000

Units: customers/(firm*year)

Assume Late Stage Firms serve 500,000 customers per firm per year

(069) Late Stage Rate of Funding Requirement in M\$=
57

Units: \$/(firm*year)

Assume Growth Stage Firms Require 161.67M\$ per firm per year

Regional Ecosystem Rates: Late Boston 153 New York 52.5 Silicon
Valley 70 Los Angeles 200 Germany 32.6 United Kingdom 76.1 China
NA India 57

(070) Late Stage Rate of Human Capital Requirement=
100

Units: workers/(firm*year)

Assume Late Stage Firms employ 100 people per firm per year

(071) Late Stage Requirement of Customers=
Late Stage Firms*Late Stage Rate of Customer Requirement

Units: customers/year

Late Stage Requirement of Customers will be the average Customer
Requirement rate for Late stage firms * number of Late stage
firms

(072) Late Stage Requirement of Funding=
Late Stage Firms*Late Stage Rate of Funding Requirement in M\$

Units: \$/year

Late Stage Funding Requirement will be the average Funding
Requirement rate for late stage firms * number of late stage
firms

(073) Late Stage Requirement of Human Capital=
Late Stage Firms*Late Stage Rate of Human Capital Requirement

Units: workers/year

Late Stage Requirement of human capital will be the average
human capital Requirement rate for Late stage firms * number of
Late stage firms

- (074) Maturation Rate=

$$\frac{(\text{Survival Percentage Late} * \text{Late Stage Firms})}{\text{Average Late Residency}}$$
Units: firm/year
- (075) Number of Exits=

$$\text{Early Stage Exit Rate} + \text{Growth Stage Exit Rate} + \text{Late Stage Exit Rate}$$
Units: firm/year
- (076) Other Diminishing Factors=
0.65
Units: Dmnl
From 0 - 1: according to the availability 0.5: Diminished
Scenario 1: Base case and other scenarios Regional Ecosystem
Rates: Ecosystem Other Diminishing Mechanisms Silicon Valley
0.92 Boston 1 New York 1 Los Angeles 1 London 0.75 Berlin 0.83
Beijing 1 Bangalore 0.75 Estonia 1
- (077) Other Reinforcing Mechanisms=
1
Units: Dmnl
From 0 - 1: according to the availability Base: 1 Regional
Ecosystem Rates: Silicon Valley 1 Boston 1 New York 1 Los
Angeles 1 London 0.5 Berlin 1 Beijing 1 Bangalore 1 Estonia 1
- (078) Reinforcing Effect=

$$1 + ((\text{Exit Effect} + \text{Other Reinforcing Mechanisms} + \text{Size of Ecosystem Experience Effect}) / 3)$$
Units: Dmnl
1+ Average: $1 + ((\text{Exit Effect} + \text{Other Reinforcing Mechanisms} + \text{Size of Ecosystem Experience Effect}) / 3)$ Base case (and limited scenario): disregard the Reinforcing effect by multiplying by 0.
 $1 + (((\text{Exit Effect} + \text{Other Reinforcing Mechanisms} + \text{Size of Ecosystem Experience Effect}) / 3) * 0)$
- (079) Reinforcing Intention Mult Tab(

$$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3))$$
Units: Dmnl
- (080) Reinforcing Survival Mult Tab(

$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3))$

Units: Dmnl

(081) Resource Reinforcing Effect=

Resource Reinforcing Effect Mult Tab(Reinforcing Effect)

Units: Dmnl

(082) Resource Reinforcing Effect Mult Tab(

$[(-1,0)-(100,100)],(-1,0),(1,1),(3,3))$

Units: Dmnl

(083) SAVEPER =

TIME STEP

Units: year [0,?]

The frequency with which output is stored.

(084) Seed Failure Rate=

$(\text{Seed Stage Firms} * \text{Failure Percentage Seed}) / \text{Average Seed Residency}$

Units: firm/year

(085) Seed Rate of Customer Requirement=

100

Units: customers/(year*firm)

Assume Seed stage startups serve 100 customers per firm per year

(086) Seed Rate of Human Capital Requirement=

5

Units: workers/(year*firm)

Assume seed stage firms employ 5 people per firm per year

(087) Seed Stage Firms= INTEG (

$(\text{Startup Creation Rate}) - (\text{Seed Failure Rate}) - (\text{Early Stage Maturation Rate})$

,

Initial number of seed stage firms)

Units: firm [0,?]

Number of firms in the ecosystem which are very early stage
(seed level)

(088) Seed Stage Rate of Funding Requirement in M\$=

0.5

Units: \$/year/firm

Assume Seed Stage firms require 690,000\$ (0.69M) per firm per
year Regional Ecosystem Rates: Seed Boston 0.7 New York 0.8
Silicon Valley 0.7 Los Angeles 0.8 Germany 0.8 United Kingdom
0.8 China 1.3 India 0.5

(089) Seed Stage Requirement of Customers=

Seed Stage Firms*Seed Rate of Customer Requirement

Units: customers/year

Seed Stage Requirement of Customers will be the average Customer
Requirement rate for Seed startups * number of Seed startups

(090) Seed Stage Requirement of Funding=

Seed Stage Firms*Seed Stage Rate of Funding Requirement in M\$

Units: \$/year

Seed Stage Funding Requirement will be the average Funding
Requirement rate for startups * number of startups

(091) Seed Stage Requirement of Human Capital=

Seed Stage Firms*Seed Rate of Human Capital Requirement

Units: workers/year

Seed Stage Funding employment will be the average Human Capital
Requirement rate for startups * number of startups

(092) Size of Ecosystem=

Seed Stage Firms+Early Stage Firms+Growth Stage Firms+Late Stage Firms

Units: firm

(093) Size of Ecosystem Experience Effect=

Size of Ecosystem Experience Mult Tab(Size of Ecosystem)

Units: Dmnl

(094) Size of Ecosystem Experience Mult Tab(

[(0,0)-(20000,10)],(0,0),(500,0.1),(1000,0.25),(2000,0.5),(3000,0.75),(5000
,1),(15000,1))

Units: Dmnl

(095) Startup Creation Rate=

Firm Creation(Time)*Entrepreneurial Intention Effect

Units: firm/year

How many new firms will be established in the ecosystem per year

(096) Survival Effect=

Survival Effect Mult Tab(Survival Percentage Reinforcing Effect*Survival Percentage Diminishing Effect
)

Units: Dmnl

Should be between 0.75 to 1.25: 25% above or below the standard rate, affecting the survival rate.

(097) Survival Effect Mult Tab(

[(0,0)-(10,10)],(0,0.75),(2,1.25))

Units: Dmnl

(098) Survival Percentage Diminishing Effect=

Survival Percentage Diminishing Effect Mult Tab(Diminishing Effect)

Units: Dmnl

(099) Survival Percentage Diminishing Effect Mult Tab(

[(0,0)-(10,10)],(0,0),(1,1),(2,2))

Units: Dmnl

(100) Survival Percentage Early=

max(0, 0.423*Survival Effect)

Units: Dmnl

Assume 47% of early stage firms survive/mature * the “Effect to Survival Rate”. Around 47% of the firms survive at the early stage, but this survival rate is affected positively by reinforcing factors and negatively by diminishing factors. Construct preventing it from being negative. Regional Ecosystem Rates: Survival Rate Growth (%) General 0.47 Silicon Valley 0.513 Boston 0.48 New York 0.48 Los Angeles 0.46 United Kingdom 0.39 Germany 0.28 China 0.42 India 0.423

(101) Survival Percentage Growth=

max(0, 0.09*Survival Effect)

Units: Dmnl

Assume 20% of growth stage firms survive/mature * the “Effect to Survival Rate”. Around 20% of the firms survive at the growth stage, but this survival rate is affected positively by

reinforcing factors and negatively by diminishing factors.
Construct preventing it from being negative. Regional Ecosystem
Rates: Survival Rate Late (%) General 0.2 Silicon Valley 0.18
Boston 0.108 New York 0.28 Los Angeles 0.188 United Kingdom 0.12
Germany 0.22 China 0.04 India 0.09

- (102) Survival Percentage Late=
 $\max(0, 0.5 * \text{Survival Effect})$

Units: Dmnl

Assume 33% of late stage firms survive/mature * the “Effect to
Survival Rate”. Around 33% of the firms survive at the late
stage, but this survival rate is affected positively by
reinforcing factors and negatively by diminishing factors.
Construct preventing it from being negative. Regional Ecosystem
Rates: Late Stage Survival Rate (%) General 0.33 Silicon Valley
0.43 Boston 0.25 New York 0.27 Los Angeles 0.17 United Kingdom
0.67 Germany 0.75 China 0 India 0.5

- (103) Survival Percentage Reinforcing Effect=
Reinforcing Survival Mult Tab(Reinforcing Effect)

Units: Dmnl

- (104) Survival Percentage Seed=
 $\max(0, 0.52 * \text{Survival Effect})$

Units: Dmnl

Assume 60% of seed firms survive/mature * the “Effect to
Survival Rate”. Around 60% of the firms survive at the seed
stage, but this survival rate is affected positively by
reinforcing factors and negatively by diminishing factors.
Construct preventing it from being negative. Base: 0.6 Regional
Ecosystem Rates: Survival Rate Early (%) General 0.6 Silicon
Valley 0.76 Boston 0.77 New York 0.81 Los Angeles 0.7 United
Kingdom 0.64 Germany 0.65 China 0.55 India 0.52

- (105) TIME STEP = 0.25

Units: year [0,?]

The time step for the simulation.

- (106) Total Yearly Customer Requirement=
Growth Stage Requirement of Customers+Early Stage Requirement of Customers

+Seed Stage Requirement of Customers+Late Stage Requirement of Customers

Units: customers/year

Addition of Customer Requirements across all firms in the ecosystem, measured in customers/year, it is the number of customers being served by startups in the ecosystem per year.

(107) Total Yearly Funding Requirement in M\$=

Growth Stage Requirement of Funding+Early Stage Requirement of Funding+Seed Stage Requirement of Funding
+Late Stage Requirement of Funding

Units: \$/year

Addition of Funding Requirements across all firms in the ecosystem, measured in dollars/year

(108) Total Yearly Human Capital Requirement=

Growth Stage Requirement of Human Capital+Early Stage Requirement of Human Capital
+Seed Stage Requirement of Human Capital+Late Stage Requirement of Human Capital

Units: workers/year

Addition of Human Capital Requirements across all firms in the ecosystem, measured in workers/year, it is the number of jobs being created in the ecosystem per year.

(109) Yearly Customers Available=

Customers in the Ecosystem*Resource Reinforcing Effect

Units: customers/year

(110) Yearly Funding Available=

Funding in the Ecosystem in M\$*Resource Reinforcing Effect

Units: \$/year

(111) Yearly Human Capital Available=

Human Capital in the Ecosystem*Resource Reinforcing Effect

Units: workers/year

Guideline for the Qualitative semi- structured interviews and conversations

- Part A: Understanding their **role and perspective** on their local ecosystem.
 - What is the **role** of your organization within the startup ecosystem?
 - When did your startup ecosystem **start** to develop?
 - What is the **biggest success** story (biggest exit within your startup ecosystem)? Is there a **unicorn**?
 - Is there any famous **Serial Entrepreneurs** within the region?
 - What is the **main expertise/field/type** of startups within the region? (B2C, B2B, deep tech...)
 - What are the main **resource requirements** that entrepreneurs need in order to found and scale their companies?
 - What are the **average resource requirements** (funding, HC, customers), according to your experience, per stage of firm
 - What, if any, are the **main limiting factors** in your startup ecosystem?
 - What, if any, are the **main reinforcing factors** in your startup ecosystem?
 - Was there a **trigger** to the development of your startup ecosystem?
 - What is the main **source of entrepreneurs** within the region?
 - Who are the main entrepreneurship **supporters**? Accelerators/Incubators, Venture Capitalists, Government, Universities, Mentors
 - What type of involvement does the **Government/Policy Makers** have within the ecosystem?
 - What is the role of the **Universities** within the startup ecosystem?
 - What is the role of the **Corporates** within the startup ecosystem? Investors/CVC, Acquirers/M&A, Customers/buying startup products
 - Are all **forms of funding** accessible to entrepreneurs within the region? Seed: Angel, FFF, grants, Early: Venture Capital, Growth/Late: PE, local and global VC
- Part B: Discussing about the entrepreneurial ecosystem Causal Loop Diagram and SD model and their **perspective on reinforcing/diminishing factors** over time and their effect on the development of entrepreneurial ecosystems.

Questionnaire

English Measurement Model

Entrepreneurship around the world

This questionnaire is part of the Master Thesis of Alba Zurriaga at The University of Tokyo. Our purpose is the understanding of how entrepreneurship is viewed around the world and what are some of the challenges that are faced in different countries in relation to this issue. The responses are completely anonymous and should take 10 minutes to complete. Thank you very much for your cooperation, your effort is greatly appreciated.

Please evaluate which attributes you believe characterize entrepreneurs.

	Completely disagree	Disagree	Neither disagree nor agree	Agree	Completely agree
Entrepreneurs earn a high income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs create jobs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs are dynamic people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs have good organizational skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs are able and willing to take risks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs help the economic development of the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs have good financial and management skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs can accomplish every task successfully	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs are professionally well prepared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs are very innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs can manage a company successfully	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entrepreneurs have a good entrepreneurial vision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Evaluation of your own abilities

Please give a self evaluation about what attributes you believe to possess.

	Completely disagree	Disagree	Neither disagree nor agree	Agree	Completely agree
I can accomplish every task successfully	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can create jobs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can manage a company successfully	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can help the economic development of the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would rather found a new company than be a manager of an existing one	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the knowledge, skill and abilities required to start a new business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am very innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have good organizational skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have good financial and management skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would rather be my own boss than have a secure job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to earn a high income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a good entrepreneurial vision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am professionally well prepared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a dynamic person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able and willing to take risks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Entrepreneurial perceptions

Please let us know if you agree or disagree with the following statements

	Completely disagree	Disagree	Neither disagree nor agree	Agree	Completely agree
Currently, the economic conditions are unfavourable for starting your own business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to be risk averse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't like facing uncertainty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My university encourages me to develop creative ideas for being an entrepreneur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My country's economy provides many opportunities for entrepreneurs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My studies have prepared me well for my selected career choice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am optimistic about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are overly complex procedures for the creation and management of a business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My university provides the necessary knowledge about entrepreneurship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a lack of support and help, when starting your own business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a lack of profitable opportunities for starting your own business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fear of failure would prevent me from starting my own business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My university develops my entrepreneurial skills and abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I decided to be an entrepreneur, my friends would support me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I decided to be an entrepreneur, my family members would support me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starting my own business is an attractive idea to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Country aspects

Do you agree with the following statements? "In my country..."

	Completely disagree	Disagree	Neither disagree nor agree	Agree	Completely agree
...taking loans from banks is quite difficult for entrepreneurs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...failure is accepted or tolerated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...becoming an entrepreneur would delay your career progression	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...most people consider starting a new business a desirable career choice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...most people would prefer that everyone had a similar standard of living	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...state laws (rules and regulations) are adverse to running a business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...most people would prefer for everyone to have their own identity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...getting a job is relatively easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...failure is seen as a chance to learn from your mistakes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...entrepreneurs are encouraged by a structural system (including private, public, and non-governmental organizations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...entrepreneurs have a positive image	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...changing jobs frequently may damage your career	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...you will often see stories in the public media about successful new businesses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...those successful at starting a new business have a high level of status and respect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...most people would prefer that everyone would conform with the norms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I plan to establish my own business or be self-employed in the foreseeable future?

Are you currently a student?

Personal career

Please rank your desirability to work for the following companies.

Where would you like to work?

	Very undesirable	Undesirable	Neither undesirable or desirable	Desirable	Very desirable
Large firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SME (small and medium enterprise)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public Sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NPO (non-profit organization)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starting my own firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How easy would it be to get a job in these companies?

	Very unfeasible	Unfeasible	Neither unfeasible or feasible	Feasible	Very feasible
Large firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SME (small and medium enterprise)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public Sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NPO (non-profit organization)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starting my own firm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Are you planning to start working immediately after graduation?

Have you started job hunting?

If so, how long before graduation did you start job-hunting?

Have you already secured a job?

If so, how long before graduation did you secure a job?

Which University do you currently attend?

Demographics

Almost there! Only some background questions left.

What is your age?

What is your gender?

What is your home country?

☐ Japan

☐ US

☐ Spain

☐ India

☐ Canada

☐ Other:

Were both your parents born in the same country as you were?

Have you lived outside your home country for over a year?

What is the highest level of education you are enrolled in or have completed?

What is the topic of your degree?

What is the occupation of your father?

What is the occupation of your mother?

What category best describes your annual household income?

Do you have any work experience?

Choose all that apply

☐ No

☐ Yes, internship/work placement

☐ Yes, part-time

☐ Yes, full-time

Do you know someone personally who started a business in the past 5 years?

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世界各国の起業家精神について

このアンケートは東京大学の学生であるAlba Zurriagaの修士論文のための調査目的で実施されています。世界各国において起業家精神というものがどのように認識されているのか、またこれに関連してどのような課題が各国において存在するのかを理解することが本研究の目的です。ここでの回答は匿名でお答えいただきます。回答の所要時間は10分程度になります。ご協力いただきますこと、心より感謝申し上げます。

あなたが考える起業家像に関して、以下の各項目を評価をしてください。

	まったく同意 しない	あまり同意 しない	どちらでもな い	まあまあ同意 する	とても同意す る
起業家はとても活 動的である	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は組織をま とめる技能に優れ ている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は財務やマ ネジメントに関し て優れた技能を持 つ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家はとても革 新的なことをする	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家には専門性 がとても蓄えられ ている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は進んでリ スクを取りにいく ことができる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は優れた未 来像を持っている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は仕事を作 り出すことができ る	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は国の経済 成長を助ける	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家はたくさん お金を稼ぐ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家は首尾よく 会社をマネジメン トできる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
起業家はどんな仕 事でもうまくこな していくことがで きる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

あなた自身が持つ能力について、以下の項目に沿って自己評価をしてください。

	まったく同意 しない	あまり同意し ない	どちらでもな い	まあまあ同意 する	とても同意す る
私はとても活動的 である	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は組織をまとめ る技能に優れている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は財務やマネジ メントに関して優 れた技能がある	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私はとても革新的 な仕事ができる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は進んでリスク を取りに行くこと ができる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は優れた未来像 を持っている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は仕事を作り出 すことができる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は国の経済発展 に貢献することが できる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私はたくさんお金 を稼ぎたいと思っ ている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は首尾よく会社 をマネジメントで きる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私はどんな仕事で もうまくこなして いくことができる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は既存の企業の マネージャーにな るよりも新しい会 社を起こしたい	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私には専門性が蓄 積されている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は新しいビジネ スを始めるのに必 要な知識や才能、 経験を持っている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私は安定した仕事 につくよりも独力 で仕事ができるよ うになりたい	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

起業の認識に関して

以下の項目について、あなたはどの程度同意できるか教えて下さい。

	まったく同意 できない	あまり同意で きない	どちらでもな い	まあまあ同意 できる	とても同意で きる
自らビジネスを起 こすというのは自 分にとって魅力的 な考え方である	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ビジネスを生み出 したり、マネジメ ントすることには、非常に複雑な 手続きが伴う	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
自らのビジネスを 起こすには支援や 援助が不十分であ る	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
今のところ、自分 で事業を起こすに は経済状況が好ま しくない	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
自ら事業を起こす には、利益を得る 機会が欠けている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
大学の教育を受け ることで、起業家 になるために必要 である独創的な考 えを伸ばすことが できる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私の大学は起業に 必要な知識を提供 してくれる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
大学では起業のた めの技能、能力を 向上させることが できる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
もし私が起業する と決めたら、家族 は私を助けてくれ るだろう	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
もし私が起業する と決めたら、友達 は私を助けてくれ るだろう	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
私の国の経済環境 は多くの起業の機 会を提供してくれ ている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

国からの側面に関して

以下の項目について、あなたはどの程度同意できるか教えてください。「日本では…」

	まったく同意 できない	あまり同意で きない	どちらでもな い	まあまあ同意 できる	とても同意で きる
…新しい事業を立 ち上げることに成 功した人々は高い ステータスを得 て、また尊敬の対 象となる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…起業家に対して 好意的なイメージ が持たれている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…新しいビジネス に成功したという 話をメディア上で よく見る機会があ る	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…頻繁に仕事を交 えることはキャリ アを傷つけること につながる	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…失敗はそこから 学びを得るチャン スであるというよ うに捉えられている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…失敗を寛容し、 受け入れてもらい やすい環境がある	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…起業家になるこ とでキャリアの向 上が遅くなってし まう	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…仕事をすることは比較 的簡単である	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…起業することは 社会システム（任 意団体、公共組 織、NGOなどを含 む）によって奨励 されている	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
…起業家が銀行か らお金を借りてく ることは大変むず かしい	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

...法律（規則や規制）がビジネスを行うのに不向きなものとなっている

☐☐☐☐☐

あなたは近い将来、自分でビジネスを立ち上げたり、自営業を行うような計画がありますか。

あなたは現在学生ですか。

将来のキャリア選択について

以下のそれぞれの会社・組織形態について、あなたがどの程度そこで働きたいと思うかを評価してください。

	まったく望まない	あまり望まない	どちらでもない	まあまあ望む	とても望む
大企業	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
中小企業	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
官庁・行政	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NPO	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
自ら起業する	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

以下のそれぞれの会社・組織形態について、そこで仕事を得ることはどの程度容易だと思うかを評価してください。

	まったく容易ではない	あまり容易ではない	どちらでもない	まあまあ容易である	かなり容易である
大企業	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
中小企業	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
官庁・行政	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NPO	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
自ら起業する	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

あなたは卒業後、すぐに働きたいと思いますか。

あなたはすでに就職活動を始めていますか。

就職活動は卒業よりもどれだけ前から始めましたか。

まだ始めていない方は「卒業後から始める」を選択してください

あなたはすでに内定をもらっていますか。

内定は卒業よりもどれだけ前にもらいましたか。

まだもらっていない方は「卒業後にもらう」を選択してください

現在、あなたはどこの大学に所属していますか。

人口統計項目

最後のページです。あなたの生い立ちについてお聞きます。

あなたの年齢を教えてください。

あなたの性別を教えてください。

あなたの国籍を教えてください。

- ☐ 日本
☐ アメリカ
☐ スペイン
☐ インド
☐ カナダ

☐ Other:

あなたのご両親はあなたが生まれた国と同じ国籍の方ですか。

あなたは1年以上、母国から離れた国で暮らしていたことがありますか。

あなたの最終学歴を教えてください。現在どこかに所属中であり、まだ修了していない場合は、現所属をお答えください。

あなたの現在、もしくはかつての学位における研究テーマは何ですか。

あなたのお父さんの勤め先は以下のどれにあたりますか。

あなたのお母さんの勤め先は以下のどれにあたりますか。

あなたの家庭内における年間収入は以下のどの範囲にあたりますか。

1ドル=120円換算

あなたはこれまで仕事を経験したことがありますか。

- ☐ ない
- ☐ ある/短期インターンシップ
- ☐ ある/長期インターンシップ
- ☐ ある/アルバイト
- ☐ ある/正社員

あなたにはここ5年以内に自ら起業した知り合いがいますか。

« Back

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Espíritu emprendedor alrededor del mundo.

Este cuestionario forma parte del proyecto final de Máster de Alba Zurriaga, ex-alumna de la UPV en Valencia y alumna de The University of Tokyo en Japón. El propósito del mismo es profundizar en la comprensión de cómo el espíritu emprendedor es visto alrededor del mundo y cuáles son algunos de los desafíos de esta disciplina. El cuestionario se puede completar en menos de 10 minutos y es completamente anónimo. Muchas gracias por tu colaboración.

Por favor, evalúa que cualidades, en tu opinión, caracterizan a los emprendedores.

"Los emprendedores..."

	Completamente en desacuerdo	En desacuerdo	Indiferente	De acuerdo	Completamente de acuerdo
... ganan mucho dinero	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... pueden gestionar una empresa con éxito	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... están profesionalmente bien preparados	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... crean empleo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... son capaces y están dispuestos a asumir riesgos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... pueden realizar cualquier tarea con éxito	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... tienen buenas habilidades de gestión y finanzas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... tienen una buena visión para emprender	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... son personas dinámicas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... son muy innovadores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... ayudan al desarrollo económico del país	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... tienen buena capacidad de organización	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Auto-evaluación de tus cualidades

Indica tu grado de acuerdo con las siguientes afirmaciones

	Completamente en desacuerdo	En desacuerdo	Indiferente	De acuerdo	Completamente de acuerdo
Puedo gestionar una empresa con éxito	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soy una persona dinámica	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Puedo realizar cualquier tarea con éxito	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Puedo ayudar al desarrollo económico del país	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Puedo crear puestos de trabajo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soy muy innovador	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preferiría crear una nueva empresa antes que dirigir una ya existente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tengo buenas habilidades de gestión y finanzas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soy capaz y estoy dispuesto a asumir riesgos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quiero ganar mucho dinero	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tengo una buena visión emprendedora	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tengo buenas habilidades de organización	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tengo el conocimiento y la habilidad necesaria para iniciar un nuevo negocio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prefiero ser mi propio jefe que tener un trabajo estable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Estoy bien preparado profesionalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Indica tu grado de acuerdo con las siguientes afirmaciones

	Completamente en desacuerdo	En desacuerdo	Indiferente	De acuerdo	Completamente de acuerdo
oportunidades rentables para crear tu propio negocio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No me gusta afrontar la incertidumbre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Si me hiciese emprendedor, mi familia me apoyaría	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hay una falta de apoyo y ayuda, al crear tu propio negocio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
La educación de mi universidad me anima a desarrollar ideas creativas para ser un emprendedor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Cuestiones específicas del país

¿Cómo de acuerdo estas con las siguientes declaraciones?

"En España..."

	Completamente en desacuerdo	En desacuerdo	Indiferente	De acuerdo	Completamente de acuerdo
... la mayoría de la gente preferiría que todo el mundo tuviese su propia identidad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... la mayoría de la gente preferiría que todo el mundo sea único	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... el fracaso es visto como una oportunidad de aprender de tus errores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... la mayoría de la gente considera que iniciar un nuevo negocio es una buena elección	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... los emprendedores tienen una imagen positiva	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... la mayoría de la gente preferiría que todo el mundo tuviese un nivel de vida similar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... conseguir trabajo es relativamente fácil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... el fracaso es aceptado o tolerado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... a menudo se ven historias en los medios de comunicación pública sobre el éxito de nuevos negocios	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Cómo de acuerdo estas con las siguientes declaraciones?

"En España..."

	Completamente de acuerdo	En desacuerdo	Indiferente	De acuerdo	Completamente de acuerdo
... convertirse en emprendedor sería retrasar tu progresión profesional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... cambiar de trabajo frecuentemente puede dañar tu carrera	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... aquellos que inician un nuevo negocio con éxito tienen un alto nivel de estatus y respeto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Tienes la intención de establecer tu propio negocio o trabajar por cuenta propia en el futuro?

¿Estás estudiando actualmente?

Si es que sí, ¿cuánto tiempo antes de graduarte empezaste a buscar trabajo?

¿Has encontrado ya trabajo?

Si es que sí, ¿cuánto tiempo antes de graduarte encontraste trabajo?

¿Cuál es tu Universidad?

Futuro profesional

¿En cuáles de las siguientes empresas te gustaría trabajar?

	Muy indeseable	Indeseable	Indiferente	Deseable	Muy deseable
Gran empresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PYME (pequeña y mediana empresa)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sector Público	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ONG (organización no gubernamental)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crear mi propia empresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Cómo de fácil sería encontrar trabajo en estas empresas?

	Muy inviable	Inviable	Indiferente	Viable	Muy viable
Gran empresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PYME (pequeña y mediana empresa)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sector Público	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ONG (organización no gubernamental)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crear mi propia empresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Quieres empezar a trabajar inmediatamente después de graduarte?

☐

¿Has empezado a buscar trabajo?

☐

Cuestiones demográficas

Ya casi está! Sólo unas preguntas más

¿Cuál es tu edad?

¿Cuál es tu género?

¿Cuál es tu país de origen?

☐ España

☐ Japón

☐ EEUU

☐ India

☐ Canadá

☐ Other:

¿Tu padre y tu madre nacieron en el mismo país que tu?

☐

¿Has vivido fuera de tu país durante más de un año?

☐

¿Cuales son tus estudios más avanzados que has finalizado o estas cursando?

¿Cuál es el tema de tus estudios, tanto actuales como anteriormente?

Múltiples respuestas son posibles

- ☐ Programas especiales
- ☐ Educación y magisterio
- ☐ Humanidades, lenguas y artes
- ☐ Ciencias sociales, negocios y derecho
- ☐ Ciencias, matemáticas e informática
- ☐ Ingenierías y arquitectura
- ☐ Agricultura y veterinaria
- ☐ Salud y bienestar
- ☐ Servicios
- ☐ Other:

¿Cuál es la ocupación de tu padre?

¿Cuál es la ocupación de tu madre?

¿Qué categoría describe mejor el ingreso familiar anual?

¿Tienes experiencia laboral?

¿Conoces a alguien personalmente que haya empezado un negocio en los últimos 5 años?

Por favor, evalúa tus propios conocimientos del inglés

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100%: You made it.