

A Model of Collaboration Between Developed and Developing Clusters of High-Tech Innovation: Benefits and Applications

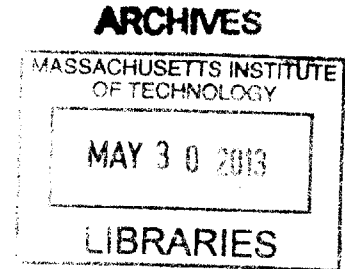
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ABSTRACT

Innovation is not produced in an isolated fashion but rather it is a highly interactive process where firms establish a wide variety of networks. This concept is valid for any cluster at any stage of development. Innovation is not even a local process; it should be a global system where firms can interact and exchange ideas. Collaboration between developed and developing clusters of innovation is proposed here as a way to obtain enormous benefits for both types of clusters. Developing an innovation cluster may take a long time and requires the participation of many actors: Universities, government, entrepreneurs, and the private sector. Every one of them has a role in the development of an innovation cluster in a developing economy. Collaboration between a developed innovation cluster and a developing cluster is analyzed in this paper as a catalyzer of the development of such clusters, with clear benefits for both. In order to be able to work with developed clusters, a developing cluster has to leverage its current strengths to build up a more technological, innovation-driven ecosystem, receiving collaboration from developed clusters. It means that the process to select a cluster to compete is neither random nor based on the desires of policymakers. Rather, this is a process that should arise from the strengths and skills obtained by other less developed clusters in the emerging economy. This is an evolution from a first-generation cluster to a third-generation cluster. The city of Medellin is positioning as a high-tech innovation hub in Colombia; however, it is still lagged in terms of the quality of its research centers, high-level institutions, and participation of the private sector. Surrounding these reasons is a lack of qualified people able to think locally but at the same time able to build up networks to insert the developing cluster into the global markets. On that sense I propose here a triad of clusters: Cambridge in Massachusetts, Amsterdam in Holland and Medellin in Colombia. Collaboration among these three cities would bring enormous benefits to all of them, building on the strengths that each one can bring to the table.

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TABLE OF CONTENTS

Acknowledgements.....	5
Table of Exhibits	9
1. Thesis Statement.....	11
2. Overview of Innovation in Latin America	14
3. Concept of Collaboration	21
3.1 Expected Innovations From the Proposed Model of Collaboration.....	27
3.2 Benefits of Collaboration for Developed and Developing Clusters.....	29
4. The Role of Government in Fostering Collaboration Between Innovation Clusters	38
5. The Role of the Big Private Sector in Fostering Collaboration Between Innovation Clusters.....	40
6. A Model of Collaboration.....	44
6.1 Possible Origins of Linkages That May Derive Into Collaboration.....	44
7. The Innovation Funnel.....	50
7.1 Ideas Generation.....	52
7.2 Accelerators and Incubators.....	53
7.3 Universities as Accelerators/Incubators.....	55

7.4	Global Network of Mentoring Programs.....	58
7.5	International Venture Capital (VC) Funds.....	61
8.	Collaboration Among Firms Generated in an Innovation Ecosystem: The Three-Step Model of Collaboration	68
8.1	The Three-Step Model of Collaboration	69
8.2	<i>Upgrading</i> of New Ventures in Developing Clusters	73
8.3	Framework for Collaboration Between Firms	76
8.4	Characteristics of Processes/Products That Lead to Partnership Among Firms in Different Clusters	77
9.	Case Studies.....	79
9.1	City of Medellin.....	80
9.2	Greater Boston Area.....	88
9.3	Amsterdam, Holland.....	91
9.4	Collaboration Among The Three Clusters.....	94
10.	Conclusions.....	97

TABLE OF EXHIBITS

Exhibit 1:	Global Innovation Index 2012	15
Exhibit 2:	Innovation Index of Top-10 Performing Medium-Income Countries.....	17
Exhibit 3:	R&D Expenditure as a Share of GDP	19
Exhibit 4:	Environment of Entrepreneurship in Latin America	20
Exhibit 5:	Process of Collaboration Between Developed and Developing Clusters	24
Exhibit 6:	Evolution of Clusters	47
Exhibit 7:	Steps in the Development of a New High-Tech Venture	51
Exhibit 8:	First Step in the Role of Locals in Developing Clusters in Creating Networks in Developed Clusters	65
Exhibit 9:	Second Step in the Role of Locals in Developing Clusters in Creating Networks in Developed Clusters	66
Exhibit 10:	Third Step in the Role of Locals in Developing Clusters in Creating Networks in Developed Clusters	67
Exhibit 11:	Step One in the Process of Collaboration Throughout the Innovation Funnel	69
Exhibit 12:	Step Two in the Process of Collaboration Throughout the Innovation Funnel	71
Exhibit 13:	Step Three in the Process of Collaboration Throughout the Innovation Funnel	72

Exhibit 14:	Map of the Innovation Ecosystem in the City of Medellin	81
Exhibit 15:	Most Developed Clusters in Chile	86
Exhibit 16:	A Comparison of Clusters in Medellin and Amsterdam	95

1. Thesis Statement

Collaboration and its positive effects on innovation are widely recognized in the literature. For instance, Engel et al. (2009)¹ recognize collaboration among firms as the catalyzer for the creation of Clusters of Innovation (COI) and even networks of clusters of innovation. In a general context collaboration refers more to linkages among local companies or international cooperation between very similar companies from a technological standpoint. In this analysis, however, I will address a topic that has not been completely considered: the role of collaboration between developed and developing clusters in fostering innovation in both. In general terms this is cross-border collaboration.

Latin America is devoting a lot of efforts to promote innovation as a way to generate employment and economic growth. Even though some clusters in the region have reached a good level of competency, innovation in high technology domains has not fostered the systematic creation of world-class companies. In order to shorten this gap, all the institutions that are somehow involved in the development of innovation clusters have to do their part: local and national government, Universities, private sector, regulators and investors for alike. Although the participation and decision of all these actors is critical to succeed, there is another way to shorten that gap which has to do with **collaboration** between developed clusters and developing clusters.

Collaboration refers to an active cross-participation of one cluster in the other's processes and/or markets. Some of the reasons for a developing cluster to collaborate with a developed cluster are commonsense yet the underpinnings of these benefits may not be fully understood. On the other hand there are numerous, although less evident, benefits for a developed cluster to collaborate with a developing cluster, which are treated in detail in this paper. As was pointed out in the

¹ Engel, Jerome S., and Itxaso del-Palacio. Global Networks of Clusters of Innovation: Accelerating the Innovation Process. *Business Horizons*. Vol. 52, Issue 5. Sept-Oct 2009. pp. 493-503.

Global Innovation Index 2012 report, “Innovation is about much more than just technological breakthroughs. Increasingly it is about breakthroughs in collaboration – forming linkages among **different types** of companies, industries, and public institutions to address challenges and opportunities that reach far beyond the scope or capability of any individual organization”. In that regard Collaboration of developed clusters with developing clusters should not be seen as a social contribution of the formers; rather it has to be seen as a strategy that can contribute to expand markets, discover new technologies and create new networks. In other words, developed clusters might see collaboration with developing clusters as a way to make their companies more sustainable in the long run.

Chile is the Latin American country that more progress has achieved in innovation, and part of its success has been based on collaboration with much more developed clusters. This collaboration, in turn, has represented numerous benefits for the developed clusters. In several passages of this work I will refer to the collaboration projects that Chile has pursued and how other countries in the region should follow this example.

For this particular work I want to focus on innovation clusters in Latin America, especially in Colombia, and how to connect them with developed innovation clusters. In general, innovation clusters in Latin America have a low degree of development making it hard for them to integrate with some production processes in developed clusters. However, at the same time there are several benefits that developed clusters can obtain from working with clusters in regions like Latin America. This situation, which at a first glance may sound as a dichotomy, actually means that there are incentives for both sides to work together in a common innovation process.

The last part of the paper deals with what I consider is a feasible relationship between a very well developed innovation cluster in Cambridge, Massachusetts; a moderately-

developed cluster in Amsterdam, Holland; and a lower developed cluster in the city of Medellin, Colombia. This triad is analyzed under the framework developed along this paper, citing the possible steps to be followed in order to reach a high level of collaboration among these three clusters.

The question that arises at this point is: why are entrepreneurship and innovation important for a country? Why should the emerging world bother about developing innovation-based entrepreneurship? There are many answers to this question, but perhaps Steve Case, Chairman of Startup America Partnership and Chairman and CEO of Revolution LLC gives one of the most compelling in his foreword to Brad Feld's book *Building an Entrepreneurial Ecosystem in Your City*. Case states: "During the past three decades, startups in the United States have created nearly 40 million American jobs, all the net job creation in the country over that period". In other words, entrepreneurship and innovation is all about job creation and that is maybe the best way to combat one of the worst evils of mankind today.

Along this paper the reader will find references to developed and developing clusters. Developed clusters refer to a group of companies working in a developed economy that has reached world-class leadership in innovation and spring of new ideas. Developing clusters refer to a group of companies in a developing economy that in most cases are trying to create new ideas and processes but at a considerable lower degree of development than its peers in the developed clusters.

Finally, it is important to narrow down the concept of innovation, which is widely used in many different contexts. One good definition of innovation was presented in the Oslo Manual and developed by the European Communities and the OECD: "An innovation is the implementation of a new or significantly improved product (good or service), a new process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations". However, for

the purposes of this paper I'll use the much simpler definition described in Gupta, Tesluk, and Taylor (2007)² that innovation is the production or emergence of a new idea. Given that my interest is technological innovation, the complete definition of innovation that I'll use throughout this paper is the following: *innovation is the production or emergence of a new technological idea.*

2. Overview of Innovation in Latin America

Latin America is lagging behind in its efforts to innovate compared with the developed world, measured either by the expenditure in research and development (R&D), number of scientific publications or number of patents. This is concluded from the 2011-2012 Global Innovation Index Ranking done jointly by the U.N. World Intellectual Property Organization (WIPO) and the France-based INSEAD business school. In this study Chile, the first ranked Latin American country, stands in position 39th, whereas countries like Colombia and Peru hold the mediocre positions 65th and 75th, respectively.

There are several reasons that explain this result, including: (i) lack of robust institutions (in quality of institutions³, Colombia ranks 73rd in the world and Peru 70th), (ii) very low quality of education, including a very low number of PhD-level professionals working in R&D, (iii) even many of the most important companies in these countries do not invest important amounts of money in R&D, and (iv) there is low tolerance to failure and failure is part of the innovation process.

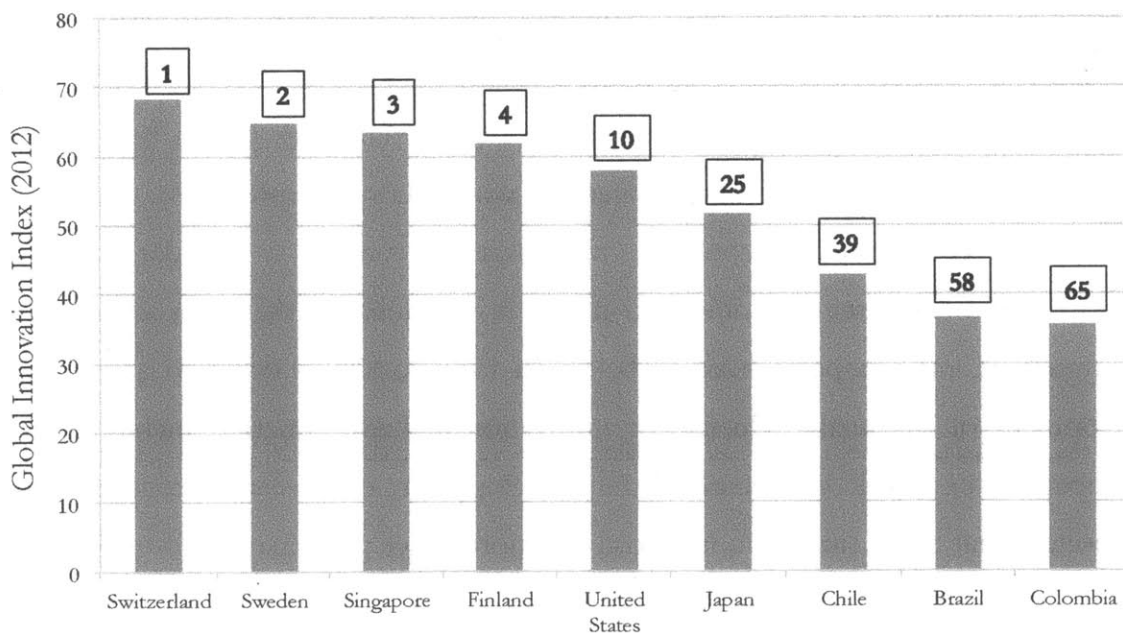
All these reasons are very well documented in the literature as the main causes for the lack of world-class entrepreneurs able to launch an innovation revolution in Latin America and most of the emerging economies. In many cases overcoming these

² Gupta, Tesluk, and Taylor. Innovation At and Across Multiple Levels of Analysis. *Organization Science* 18(6) pp. 885-897. Informs 2007.

³ Institutions include Political Environment, Regulatory Environment, and Business Environment.

issues may take a lot of time and requires the active participation and leadership of policymakers. For example, central and local governments play an important role in improving the quality of education. Even having a better regulation is something that depends upon the determination of politicians. One of the central points that I want to develop throughout this thesis is that even though it is desired that governments participate in the development of innovation clusters and for that purpose, adopt the necessary steps they can contribute with, there are many other alternative ways that entrepreneurs/innovators, established companies, and Universities can adopt to develop world-class innovation clusters. The argument that innovation can propagate in emerging economies despite the quality of institutions is also commented in Scheela and Chua (2003)⁴. These authors state that venture capital investments have been flowing to emerging markets in spite of the lack of fully developed institutions.

Exhibit 1. Global Innovation Index 2012



□ Indicates the position of the country in the global ranking

Source: The Global Innovation Index 2012 -

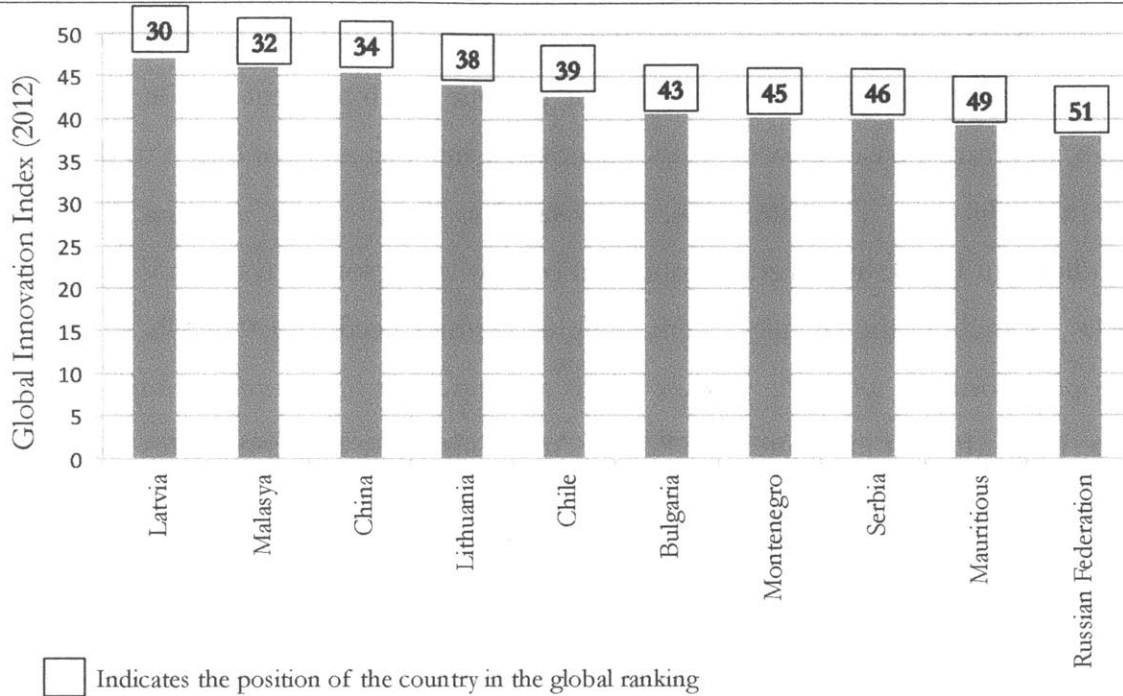
⁴ Scheela, William and Chua, Ronald. Venture Capital in a Developing Country: the Case of the Philippines (2003). Paper presented at the 7th International Conference on Global Business and Economic Development, January 8-11, Bangkok, Thailand.

Like an infectious process, the development of high-tech clusters in Latin America requires a focal point where the innovation ecosystem can be generated from and where a world-class community of entrepreneurs can flourish and spread out through the rest of the country. In other words, it is not necessary to create a very broad base of innovative companies. Just a few of them or even one with the proper characteristics, can be enough to launch the creation of innovation clusters. The characteristics required for a company in a developing cluster to become a world-class competitor through collaboration with a developed cluster are analyzed in this paper.

According to Porter (2001)⁵, “new clusters may also arise out of the formation of one or two innovative companies that stimulate the formation and growth of others”. Porter’s argument represents one of the main reasons for the necessity to explore alternatives of collaboration between clusters in the U.S. and clusters in Latin America, especially in a country like Colombia. The sole interaction with world-class innovators in clusters like San Francisco, Boston, New York or Boulder, just to mention some, would stimulate the creation of new companies in the region and would plant the seeds for the development of world-class entrepreneurs. Later on, this seed of entrepreneurs would be in charge of forming a broader base of innovators and entrepreneurs, able to compete in the global markets. In addition to this argument, other aspects have to be worked out locally in order to assure the development of sustainable clusters of innovation in Latin America, including the participation of local Universities, the development of research centers – a component that today simply do not exist –, a more active participation of the private sector and of course, a proper regulation that makes easier the creation of new companies.

⁵ Porter, Michael. Clusters of Innovation: regional Foundations of U.S. Competitiveness. Clusters of Innovation Initiative. 2001.

Exhibit 2. Innovation Index of Top-10 Performing Medium-Income Countries



Source: The Global Innovation Index 2012 -

There is not any Latin American city in the first 100 cities in the world in terms of innovation according to the Innovation Cities™ Index 2012 published by 2thinknow, an independent consulting group devoted to the analysis and promotion of innovation in urban centers. This is one more example of how lagged Latin America is in terms of innovation and this is the main reason why it is imperative to find ways to shorten this gap in a reasonable time. Collaboration between developing innovation clusters in Latin America and developed clusters is possible and is a *fast track* to reach the objective of catching up with the most innovative cities in the world. It is not obvious why a developed cluster may be interested to collaborate with developing clusters. However, this thesis focuses on the different incentives for collaboration on both sides (developed and developing cluster) and on the types of collaboration that could be reached in the different stages of the innovation ecosystem.

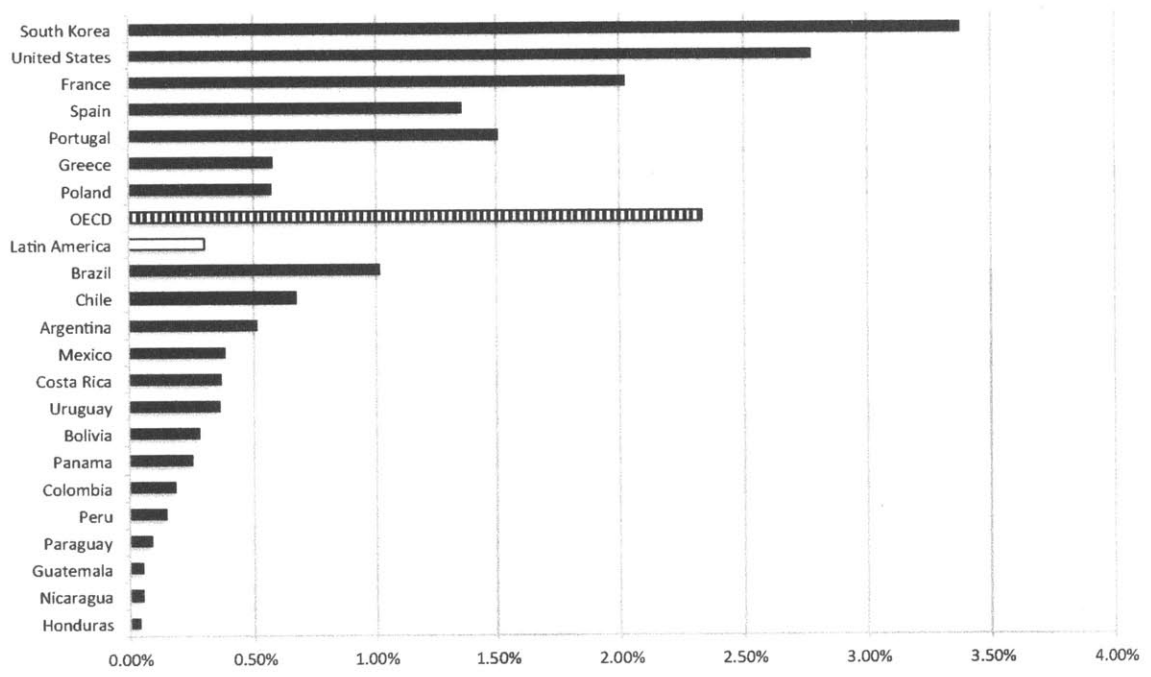
There are several paths Latin American countries can adopt to shorten the gap with the developed world in terms of innovation and entrepreneurship. One is to pursue a better education system, which takes a lot of time to implement but is required, though, to create a base of world-class scientists, a sine qua non condition to develop innovation clusters. The other one, also related to the previous, is to increase the expenditure in R&D; however, the question of in what sectors to focus is not easy to answer. Somehow the clusters in emerging economies need to get signals from the developed world on what the market trends are and what has more potential to pay off the most after an investment in R&D. An example like this constitutes the body of evidence for the necessity to implement some sorts of collaboration between developed and developing clusters in order for the latter to prosper. Exhibit 3 shows the lag of Latin American countries with respect to their expenditures in R&D.

The real problem with innovation in Latin America has to do with its weak capabilities to articulate policy orientations and coordinate priorities across various national stakeholders, which result in innovation systems characterized by a focus on technology adoption rather than innovation.⁶ In Latin America there is a lack of innovation in many R&D-intensive fields. Even when ideas may surge, in many occasions those ideas do not receive the opportunity to emerge and thereby to become real companies. Therefore, allowing entrepreneurs to expose their new ideas and technical skills to more mature entrepreneurs in developed innovation ecosystems is a big step into developing innovation clusters in Latin America. In other areas where today the Latin American country is not producing new ideas, the efforts have to be focused on the formation of a new generation of scientists and as in the previous case, allowing them to communicate their ideas to the right people that have potential to help them to transform such ideas into real companies. Any model of collaboration between entrepreneurs in developed and developing countries like the ones that are proposed here has the potential to become a detour to shorten

⁶ Innovalatino: Fostering Innovation in Latin America (2011). Published by Ariel and Fundación Telefonica, in collaboration with Editorial Planeta.

the gap in terms of knowledge, so that creating incentives not only for developing clusters but also for developed ones. Some others paths adopted with the intention to shorten the innovation gap in the developing world can be achieved in a shorter period of time with a great impact on innovation and new ventures creation. In this paper I propose some of the alternatives that could be adopted by Latin American countries to boost the entrepreneurial capabilities of their citizens, including models of collaboration between entrepreneurs in developed and developing economies that can render benefits to both sides.

Exhibit 3. R&D Expenditure as a Share of GDP.



Source: Main Science and Technology Indicators, OECD Statistics, World Bank, World Development Indicators.⁷

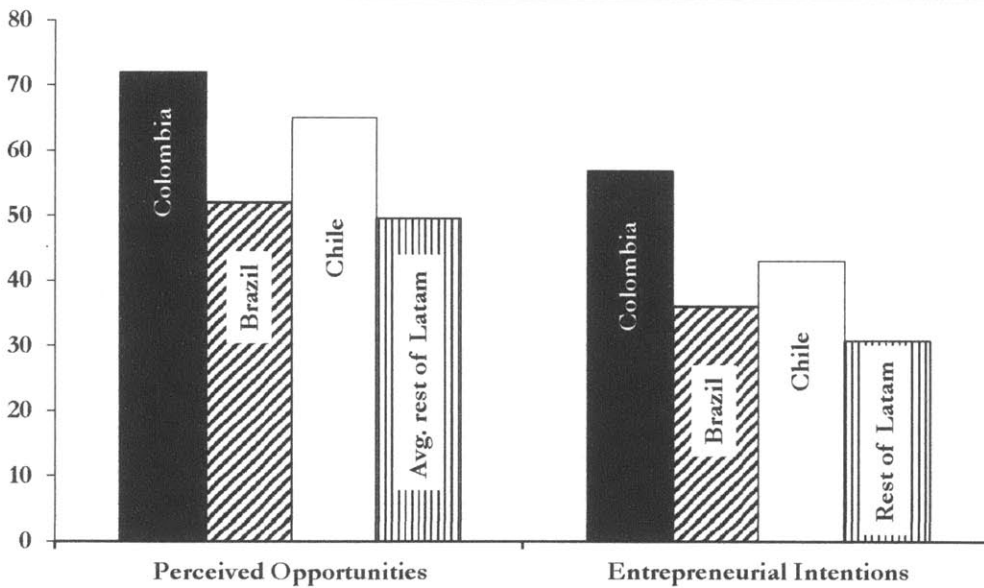
The Global Entrepreneurship Monitor (GEM) 2012 Global Report, done jointly by Babson University (Boston, MA), Universidad del Desarrollo (Santiago, Chile), and Universiti Tun Abdul Razak (Kuala Lumpur, Malaysia), provides a good stock of information that lets participants in a developed cluster to know what to find in Latin America and this in turn will help them to know how to deal with those aspects in

⁷ Taken from *InnovaLatino: Fostering Innovation in Latin America* (2011)

order to expand the frontiers of their markets. And for clusters in Latin America this information is critical to understand where to focus the efforts in order to reach a high level of competency.

There are five areas in the GEM Report where all the Latin American countries show a negative balance whereas in two aspects the situation is promising. In terms of financing, which refers to the availability of financial capital for entrepreneurs, regulation, primary and secondary school, and R&D transfer, the results are quite disappointing. This is somehow an expected result, especially the one that is related to primary and secondary education as well as R&D. In terms of post-school education (college), and physical infrastructure, the results are very favorable.

Exhibit 4. Environment of Entrepreneurship in Latin America



Source: Global Entrepreneurship Monitor 2012 Global Report

Particularly for Colombia, there are very interesting results that make the country attractive for a developed cluster looking for opportunities to establish partnerships in the region. For instance, the entrepreneurial intentions are higher in Colombia than in any other Latin American country. This indicator measures the intentions of the population to start a business. In other words, there exists a strong

entrepreneurial culture in the Colombian population, but for reasons related in many cases with funding and in others with not having the right connections, these intentions are not transformed into real companies. In Perceived Opportunities, which refers to how people perceive favorable business opportunities in their area, again Colombia ranks first in Latin America. This is maybe the most important achievement of the last 10 years in the country. Now its inhabitants are confident in the country and many issues related to favorable business opportunities like security, macroeconomic stability, or a better business and tax regulations, contribute to the sentiment among Colombians that it is feasible to start up a business in their country.

3. Concept of Collaboration

Collaboration between developed and developing clusters is a long-run positive-sum game. For companies and agents in a developed cluster, collaboration is a rewarding strategy to create not only new products, but also new markets. This concept remains valid when we are dealing with collaboration with a developing cluster. That will ultimately add to their sustainability as well as to the creation of new and high-quality jobs. According to the World Bank the GDP per capita in Latin America has grown at an average rate of 5% during the last three years. For many analysts this trend should continue during the next five years. This rapid growth in income will ultimately derive in higher consumption. This fact is appealing to companies in both the U.S. and in the rest of the developed world (including of course, high-tech companies, which will be eager to capitalize on a more sophisticated clientele eager to catch up in technology with the more developed world). However, in order to succeed in the Latin American markets, with all their specificities, many adaptations to the products and technologies originated in developed clusters may be required. These adaptations may be better known by locals who in turn may be in a better position to implement them, should they have the technological knowledge or funding to do so. This is exactly what explains the advent of big players like General

Electric to the Indian and Chinese markets, a phenomenon also known by Immelt (2009) as “Reverse Innovation”⁸. In Latin America, ideas like this motivated companies like Hewlett Packard to set up an R&D center in the city of Medellin, Colombia⁹.

For developing clusters, collaboration is also a long-term positive-sum game, especially because companies over there can gain access to a broader technological knowledge. In the same sense, collaboration is important for developing clusters because it is a way to have access to the same global markets where companies in the developed cluster are competing. With the advent of technologies that made the world flatter (e.g. the Internet) and the globalization itself that eased the mobility of human resources from one region in the world to the other, location is becoming less and less important for competition. Developing clusters can create strong linkages with developed clusters in spite of their geographical separation, so that competing in the global markets even being at a large physical distance from the large markets. At a first glance, this view of how clusters might collaborate seems contrarian to Porter’s (2000)¹⁰ analysis of the comparative advantage that proximity creates, increasing the exchange of information between participants of a cluster. However, it reconciles with Porter’s view in the sense that isolated companies are not likely to be successful competing in the global markets. It is required the creation of clusters of innovation in developing economies, in order to guarantee that the companies that have sprung out from the country have the DNA that allows them to be competitive in the global markets. Proximity within the developing cluster is important during the first stages of development of the cluster, but as the cluster evolves and reaches a higher degree of development, proximity turns less and less important, in the same guise as proximity is not important between a developed and a developing cluster. In this

⁸ Immelt, Jeffrey R., Vijay Govindarajan and Chris Trimble, “How GE is Disrupting Itself?” Harvard Business Review. October 2009.

⁹ Nearshore Americas (www.nearshoreamericas.com) “HP Expansion in Medellin Boosts Colombia as Services Hub”. Feb 2011.

¹⁰ Porter, Michael E. Location, Competition, and Economic Development: Local Clusters in a Global Economy. SAGE Publications. Feb 2000.

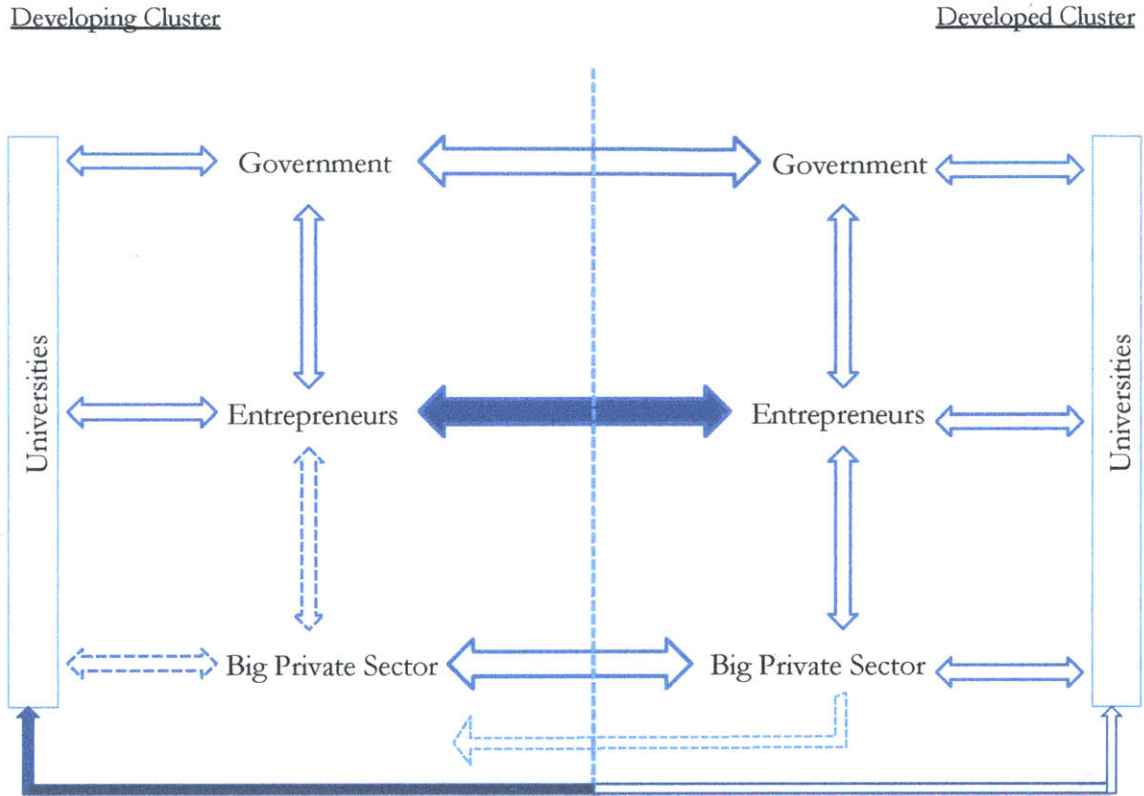
case the success of the collaborative efforts depends greatly on the strength of the linkages that connect components in the developed cluster with components in the developing cluster.

In general, collaboration between developed and developing clusters is performed initially in an international scenario, that is, we have a cluster of innovation in a developed economy, be it in the U.S., Western Europe or Asia, and a nascent cluster of innovation in a developing economy for example in Latin America. The participation in an international platform of collaboration is a fundamental feature to guarantee the success of this model. Authors like Tracey et al (2003)¹¹ also highlight the importance of international networks: "...international networks may constitute a crucial source of innovation and new ideas". This environment establishes relations among persons that lives or works in clusters under very different conditions, but that are clearly defined on a national context. However, these relations should evolve with time to the point where collaboration between these two types of clusters is established in a transnational setup, that is, participants from both clusters end up sharing a good portion of their knowledge and differences between them turn blurrier.

There are basically four types of players in each cluster: Universities, government, entrepreneurs, and big private companies. In this case the group of entrepreneurs encompasses all the players of the innovation funnel (ideas generation, accelerators, incubators, mentors networks, Venture Capital Funds, angel investors, and finally, the operating new companies that are created), which is presented later in chapter 7. This type of collaboration can be represented by a Matrix, as is depicted in the exhibit below.

¹¹ Tracey, Paul and Gordon L. Clark. *Alliances, Networks and Competitive Strategy: Rethinking Clusters of Innovation*. *Growth and Change*, Vol. 34 No. 1, Winter 2003, pp. 1-16.

Exhibit 5. Process of Collaboration Between Developed and Developing Clusters



Source: the author

This is a matrix system where each agent collaborates on a cross border basis with its peers in the other country. Nevertheless, on a local basis collaboration is given among the different players (government, entrepreneurs, big private sector, and Universities). In other words, it is not expected that the government in a developed cluster collaborate directly with entrepreneurs or with the big private sector in the developing cluster on a cross border basis. However, it is feasible and expected to see inter-cluster collaboration between governments, or between big companies in the private sector, or between entrepreneurs. Collaboration between Universities is also expected although it flows from developed clusters towards developing clusters (dark line on the bottom of the graph). On the same sake, the government in a developing cluster is expected to collaborate with entrepreneurs in the same cluster in the same manner as big companies in the private sector are expected to collaborate with entrepreneurs in the same cluster. As is depicted in the graph, Universities play

a fundamental role in the development of clusters in emerging economies because they are the common interest of the other players: government, entrepreneurs, and big private sector companies, so that can serve as coordinators of the activities aimed at creating innovation clusters. Universities also closely interact with the other players of the cluster, either executing govern-sponsored programs or hosting accelerators/incubators or working on specific research projects sponsored by big private companies. Universities are, if you will, the main players in a developing cluster in this model of collaboration. They are in a position to establish strong linkages with all the players in the nascent cluster of innovation and they could also serve as the initial point of contact with the components of the developed cluster thorough their relationships with Universities in those clusters. Once the seed of collaboration is planted, other players in the clusters have to take the lead to strength the linkages and coordinate efforts.

It is important to notice that I have made the arrow that relates entrepreneurs in both clusters darker, meaning that it has to be the most lasting and strongest relationship between the components of the clusters, in order to increase the chances to succeed in the efforts of collaboration. This relationship can be improved and nurtured through a cross ownership model between companies that are being created in the developed cluster and companies that are collaborating with them in developing clusters. It is also noticeable that the arrows are always pointing to both ends, representing the fact that collaboration is expected to come from and to benefit both clusters. The dotted arrows connecting entrepreneurs with the big private sector and this with Universities in a developing cluster denotes where the weakest linkages are in these types of clusters and certainly where to focus the efforts.

This basic matrix model of collaboration demands certain defined skills from the people involved in it. In each of the four gross components: universities, government, entrepreneurs, and big private companies, people have to be local so as to understand and be able to extend the networks between these four components,

but also do need a global component, able to build up networks with peers around the globe, especially where developed clusters have established. It is worth acknowledging that in order to increase the chances to succeed in the efforts to create and develop innovation clusters in developing countries, it is important to have onboard as many people as possible with the profile described above, even though they may be a scarce resource. No doubt this is one more aspect where the local government in developing economies has to work to promote innovation: facilitating the education of its nationals in institutions with a global environment where the knowledge can be replicated internally, but also where they can nurture and expand the networks around the globe. People with the proper skillset to help in the development of an innovation cluster in a developing economy have to be preferably placed either in Universities or working as entrepreneurs. Once the innovation wave starts to rise, government and the big private sector will surf it hiring people with similar skills, which will help to build up the linkages depicted in the graph above. But it is worth to insist in the role of government and the private sector as well, in promoting the education of individuals that can work in Universities or as entrepreneurs.

Finally, for the big private companies, collaboration can take two forms. One is direct collaboration between the private sector in developed and developing clusters. However, collaboration of this type is restrained to a basic exchange of information although there are not really clear incentives, especially for big private companies in the developed clusters to involve in a model of collaboration like this. The other, more feasible approach is to open operations in a developing country near a developing cluster and use that branch as a center of activities for collaboration with the local ecosystem of innovation. The main benefit from having a branch in a developing cluster is the possibility to set up a research center that works for the development of products for the local market, leveraging in technologies originated in developed clusters but with modification to tackle local requirements in the developing cluster. Eventually, and that is the ultimate objective, from that subsidiary

or research center in a developing cluster may arise new products that are intended not only for the local market but also for customers in developed economies. This is for instance the case of General Electric (GE) that opened up a research center in India to develop products suited for a populous but low-income market. It is also the case of Hewlett-Packard that established a research center in Medellin, using the newly built facility of Ruta-n¹².

3.1. Expected Innovations From the Proposed Model of Collaboration

At this point let us refer to the three kinds of innovation proposed by Clayton Christensen (1997)¹³: empowering innovations, which transform complex and costly products into simpler and more affordable products; sustaining innovation, in which old products are transformed into new models; and efficiency innovations, which reduce the cost of making and distributing existing products and services. According to Christensen, one of the main problems of the U.S. economy is that it is stuck on efficiency innovations, which generates a lot of capital but not more markets and consequently no more wealth. New markets creation; that appears as one of the most important catalyzers to incentivize collaboration between developed and developing clusters, especially for the former. And collaboration between these two types of clusters goes right to the heart of the problem described by Christensen. He criticizes the way many managers in developed economies (especially the U.S.) are addressing the problem, because they only focus on shaving costs in order to compete for the markets they have been on for many years. The result of this is a pale economic growth. Amidst this disappointing outlook, new markets can be the key to untie the knot. But then the question of how can new markets be created arises. Well, certainly some opportunities will pop up in the countries where these companies in a developed cluster are used to competing at. But a myriad of new opportunities are to be exploited in Latin America, especially now that the per-capita

¹² Hewlett Packard in Ruta-n Goes for the Talent of 1,100 Medellinians. El Tiempo. Sep 2012.

¹³ Christensen, Clayton. "The Innovators Dilemma". HarperBusiness Ed. 1997.

income is soaring. However, local companies in Latin America are not well prepared to exploit these opportunities in a stand-alone basis. For them it would be much more efficient to find leverage on the knowledge and experience of companies that have competed in global markets for years.

The ideas shown here serve to confirm that collaboration is a long-term effort. As Christensen suggests, the idea is to move away from short-term profits and toward long-term bets on new innovations. Latin America, and a country like Colombia, is well positioned to partner with companies and other agents in developed clusters with the aim of discovering new markets.

Another innovation that is expected from this model of collaboration is when Universities take a more active role coordinating the efforts of all the other players, fostering innovation that not necessarily is directly linked to high-tech innovation but that ultimately can end up in an innovation-related entrepreneurship. This is the case of the *World Class Cities Partnership* (WCCP) created by Northeastern University, one of the world-class academic institutions in the Greater Boston Area. Its motto is creating globally competitive cities, something truly in concordance with the proposal developed throughout this paper. WCCP intends to be the catalyst for connecting an international cadre of municipal officials, University faculty and students, business leaders and policy innovators. All of these are components of the clusters of innovation that have been addressed here. WCCP includes cities as diverse as Barcelona (Spain), Boston (U.S.A), Dublin (Ireland), Guadalajara (Mexico), Haifa (Israel), Hamburg (Germany), Lisbon (Portugal), Lyon (France) and Vancouver (Canada). Even though WCCP has been designed to work more on urban innovation (transportation, waterfront development, sustainability), the linkages sprung out from this model of collaboration may also help to foster high-tech innovation and entrepreneurship. WCCP acts like a coordinator of the different actors in the mentioned cities. This is an interesting application of the model of collaboration between developed and developing clusters proposed in chapter 3. Notice that in

WCCP, the Northeastern University is the coordinating device among players in the different clusters. The University is not directly attempting to collaborate with governments, entrepreneurs or private sector, but is instead trying to foster government-government, entrepreneur-entrepreneur or private sector-private sector collaboration. This endorses the model of collaboration that is developed throughout this thesis in the sense that Universities are in the best position among participants of a cluster of innovation to facilitate and coordinate collaboration. With the successful example of Northeastern University it has to be pointed out that now is the turn of local Universities in developing clusters to take a similar role, in order to promote collaboration among developing clusters of innovation, with the participation also of their peers in some developed clusters. Later on I will refer to the cluster of innovation that is developing in the city of Medellin, Colombia. Even though this cluster is still in a very early stage of development and no high-tech world-class companies have sprung out from it, the city has made important efforts in other areas related to urban innovation that has put it onstage as the “Innovative City of the Year” in 2013. This acknowledgement is important because the city has been in headlines of important newspapers around the globe that will catch the attention of investors and other governments for alike. This has to be exploited to imprint trust among participants in developed clusters of innovation so that they can discover the benefits of working in this developing cluster.

The following chapter of this paper explores in detail the benefits of collaboration for both, developing and developed clusters.

3.2 Benefits of Collaboration for Developed and Developing Clusters

There are two considerations here: one is the importance for clusters to collaborate with other clusters and the other one is the benefits for developed clusters that can be obtained in the long run from working with clusters in developing economies. The

benefits of collaboration between clusters have been widely documented. For instance, Sturgeon, Van Biesebroeck, and Gereffi (2008)¹⁴, argue, “Linkages between clusters are worth the effort because they provide access to novel information and resources not available within the cluster”. Later on they argue that cluster dynamics have been studied in detail but the linkages between clusters have only begun to be examined and discussed in any detail.

In analyzing the benefits for developed clusters to collaborate with developing clusters, it is worth to review the case of the United States. In general terms the U.S. economy has been open to host new researchers and innovators coming from the rest of the world, a fact that can be considered as an acknowledgement of the benefits of collaboration. However, the pace of innovation in the U.S. has slowed down since the early 2000’s after the Internet bubble burst and later on with the financial crisis that unleashed in 2008. Elaborating on Christensen’s ideas, it has been argued that accelerating the pace of innovation requires a fresh approach to research and development. President Barak Obama pointed out in his 2012 State of the Union speech the necessity to “stop expelling responsible young people who want to staff our labs or start new businesses.” In that sense it can be argued that the inwards open-doors policy that the country has sustained for years should be complemented with an outwards open-doors policy to cooperate with clusters in other countries, especially its partners in the Americas with whom the U.S. have strong trading ties after the signature of free trade agreements, among them with Colombia, Peru, and Chile. In other words, high-tech clusters in developed economies like the United States can obtain big benefits collaborating with clusters in developing countries, and that is precisely one of the points that are explored in this paper.

¹⁴ Sturgeon, Timothy; Van Biesebroeck, Johannes; and Gereffi, Gary. Value Chains, Networks, and Clusters: Reframing the Global Automotive Industry. Massachusetts Institute of Technology, Working Paper Series. February 2008.

The concept of collaboration used here goes far beyond the simple notion of interconnected clusters where each one specializes in a product or service and then creates the way to share either products or information. This basic concept is seen in initiatives of cluster collaboration like ProInno Europe, whose aim is “to become the focal point for innovation policy analysis and policy cooperation in Europe”. This initiative has developed the European Cluster Collaboration Platform to foster collaboration among different clusters in the European Union. Rather, the concept of cluster collaboration here proposed includes the creation and development of clusters in regions like Latin America that can become part of the supply chain of innovation clusters in developed economies, where even the more advanced counterparty (developed cluster) has incentives to help in the development of the less advanced counterparty (developing cluster).

The general idea behind this work is that the seed for innovation can be transplanted from innovation clusters in developed economies to clusters in the developing world through collaboration. For example, through the insertion in one or some stages of the value chain of an innovation process or product of a *developed* cluster, *developing* countries can create clusters that evolve into innovation clusters. However, this is not a unidirectional beneficial relationship as was mentioned above.

Clusters of innovation in developed economies could benefit from the development of other related clusters in the developing world. Well-established innovation clusters in the United States like Boston, Boulder, New York, and San Francisco, among others, should turn to look at how to collaborate with developing clusters in different regions like Latin America. In the aftermath of this collaboration, many benefits may arise for the developed clusters. One of them is the fact that when collaboration is given between companies or clusters of the same technological skills, there is not too much to share and collaboration rapidly fades. This point was commented in

Schilling (2007)¹⁵. Collaborating with developing clusters and helping to construct an ecosystem of innovation would create a more diversified, more lasting and more sustainable network for developed clusters, which at the end would cement the sustainability of their technological edge. There are several other incentives for clusters of innovation in developed economies to collaborate and help to develop clusters in developing economies, including:

- The possibility to avoid the problem of overspecialization.
- Avoid the increase in real estate prices.
- Diversification.

Overspecialization can lead established firms to fail to innovate given their recent success in what they are doing. In the rapidly changing environment that characterizes the globalization, it is easy to get caught in the disastrous situation of spending a huge amount of resources in the development and commercialization of a specific product or service, remaining blind to the changes or new trends that may be forging in the marketplace. The problem of overspecialization is also known as the problem of “putting all the eggs in the same basket”. This overspecialization certainly creates a paradox in the sense that focusing on just one process or product creates a knowhow and a skillset that may turn companies in that cluster into world leaders, but on the other hand, overspecialization may also be dangerous for a developed cluster that has spent many resources in that specific product/service if the market conditions are leading towards a different technology. However, while for a developing cluster overspecialization can also create many perils, they are greatly offset by the benefits obtained from the exposure to new technological knowledge and the creation of valuable networks in the Global markets. Gaining scale is another incentive for a company in a developing cluster to participate in a collaboration effort

¹⁵ Schilling, Melissa A., and Corey C. Phelps. Interfirm Collaboration Networks: The Impact of Large-Scale Network Structure on Firm Innovation. *Management Science*. Vol. 53, No. 7, July 2007, pp. 1113-1126.

with companies in a developed cluster, which also may help to reduce the problems of overspecialization.

For companies in a developed cluster, collaboration with developing innovation clusters means expanding into new markets, which also helps to address the problem of overspecialization. Expanding a developed cluster's network into new markets, for instance through its collaboration with developing clusters, can help the former to detect early signals of market trends that would allow to quickly turn the steering wheel to catch up with those new trends. Or perhaps more importantly, new markets in Latin America would help a developed cluster to find new applications of a certain technology that simply were not considered before. That is the case of General Electric (GE) with its introduction of new models of Electrocardiogram (ECG) solutions to the Indian and Chinese markets (MAC 400 and MAC 800, respectively)¹⁶. These devices turned into a great success in these emerging economies thanks to the participation of local engineers that made use of old technologies to adapt the devices especially for the Indian market, so that obtaining an affordable product for the vast majority of the low-income Indian population, and perfectly adapted to the requirements of that specific market.

Increase in real estate prices happens when engineers or software developers migrate to be part of a cluster in a developed economy, increasing the demand for space in those areas and pushing the prices of real estate up. For example, according to Inc., in San Francisco's SOMA district, commercial real estate prices are up 16% during the first eight months of 2012. Similarly, in Silicon Alley (New York City, near Union Square), prices have soared 8%. In the River North's neighborhood, Chicago, where Google will open a new office, rents grew 4% in a year. In Silicon Beach, comprising Santa Monica and Venice Beach, rents went up more than 6%. San Francisco is the most extreme case where real estate prices have ballooned nearly 43% in the last five years. All this translates into a major disadvantage for these

¹⁶ Singh, Jasjit. GE Healthcare (A): Innovating for Emerging Markets. INSEAD Business School. 2011.

developed clusters because creating new companies turns to be an expensive endeavor.

Diversification is perhaps one of the most important incentives for a developed cluster to collaborate with a developing one. Once the cluster in the developing economy reaches a certain degree of development, the cluster in the developed economy can benefit from new processes or products created over there. Collaboration between firms of similar technical capabilities has been broadly addressed by both academics and experts and is identified as one of the main reasons to foster innovation in the companies that participate of the process. However, as was explained before, Schilling (2007)¹⁷ shows how precisely these similarities in technical skills lead to a rapid decrease in the incentives for collaboration. The incentives for developed clusters to collaborate with companies in developing clusters that have gone through all the steps of the innovation ecosystem that receives collaboration from a developed cluster are commented with more detail in chapter 8. Meanwhile it is important to acknowledge the importance of collaboration in the diversification of the source of potential partners in the future or new ideas that could be incorporated into companies in a developed cluster.

Other benefits for developed clusters obtained from collaboration with developing clusters are:

- Cost reduction: the possibility for developed clusters to get raw materials and other inputs, including human capital, at a lower cost.
- Geographic diversification of the Supply Chain: Lowering the dependence on local suppliers is an argument to increase the bargaining power of a cluster.
- Adoption of alternative practices observed in emerging clusters. This part refers to some alternative uses given to an existing technology whose applications could also be brought in to the markets of the developed cluster. Or eventually the

¹⁷ Ibid footnote 15.

adoption of certain regulations developed in emerging clusters. One example of this is the regulation in work for the Colombian financial sector that passed the stress test of the financial crisis of 2008-2009. Some of the best practices there could be applied in a more developed cluster like the United States. Or the pension system reforms adopted in some Latin American countries like Colombia and Chile that are leading towards a healthier pension system compared to what is seen in Europe and the U.S.

And for a developing cluster, the possibility to collaborate with a developed cluster generates many benefits:

- Development of knowledge in high technological areas.
- More access to capital.
- Information about the new technologies with better chances to be commercialized.
- Access to new and more sophisticated markets.

The possibility to develop knowledge in high technological areas would serve as the seed to start an innovation revolution in the country. This must be accompanied by some minimum measures adopted by both the local and national governments, aimed at creating adequate conditions that allow the innovation seed to prosper. This is a step in the collaboration chain that relies heavily on the Universities and the government. The government to generate adequate conditions for international players to look for opportunities in the developing cluster and Universities to establish links with top Universities in the world to foster research in the developing cluster and the exchange of students and faculty that could help to learn from the more developed clusters.

Additionally, for clusters in low-cost countries, a collaborative model with a developed cluster would provide **access to capital** during the different stages of the new venture development, from Acceleration/Incubation to early stage and to

growth, these last two from Venture Capitalists (VC). The latter would create the first wave of VC investment in the developing cluster, event that should be followed by a wave of investments in new ventures from more VCs and Angel investors, especially from local investors. The case of Spanish Telefonica's Amerigo funds goes right to this point: this is the first international VC fund established in a country like Colombia, where only one fund of that kind existed¹⁸. Chapter 7.5 explains in detail the impact that Amerigo may have in the local innovation ecosystem.

Information about the kind of technologies with better possibilities to be commercialized is critical because that allows entrepreneurs in developing clusters to avoid the large investments required in the exploration phases of a new technology, and focuses more on participating in the development of that application (technology).

Finally, **access to new and more sophisticated markets** is related to the fact that developing clusters able to connect with more developed clusters and collaborating in the production of a high-tech product, would be having participation in a much larger market and with a higher degree of sophistication, which would demand a more rigorous production process and management practices in the developing clusters. However, as is touched further in this paper, it is unlikely for companies in developing clusters that have never had experience dealing with sophisticated markets in the high-tech space, to suddenly be part of a network of collaborating clusters. It is necessary to follow a process of change that includes working with peers in developed clusters and in that direction, hiring people able to contribute in the origination of such kind of linkages with developed clusters.

In general, the benefit of adding to the knowledge stock that arises from collaboration applies to both types of clusters (developed and developing). Bell and

¹⁸ This fund's name is Progesa Capital and is administered by the local funds manager Promotora, a company established in Medellin, the second largest city in Colombia.

Albu (1999)¹⁹ describe three ways “by which firms may add to their knowledge stock”:

- Internal technological activities
- From external sources
- Human capital formation at the firm level either via formal or informal training activities or hiring people with the knowledge being sought.

Internal technological activities include research and development pursued by the firm, demanding considerable amount of time and effort.

Collaboration between clusters or more particularly between entrepreneurs constitutes a form of adding knowledge to the existing cluster from an external source, which is critical for the long-term sustainability of clusters. The same authors even argue that “possibly more important (for clusters) is their openness to knowledge flows from outside”. That opens up room for the question of the real scope of the word “outside”. Clearly it refers to knowledge flows that do not come from internal resources. But even it is hard to imagine a knowledge flow of high technology going from one developing cluster to the other, simply because such kinds of clusters do not possess a high flow of relevant knowledge. Certainly developing clusters within a region (Latin America for instance) should look for ways to collaborate among them, even though the “efficiency” of this type of collaboration is quite lower than the efficiency of collaboration between developed and developing clusters of high-tech innovation. Following this reasoning, Bell and Albu’s ideas should be applied to the flow of knowledge from companies within clusters in a developed economy to companies within a cluster in less developed regions like Latin America. The benefits of this for innovation clusters in developing countries relies in that they will learn by doing some of the processes involved in the production of a

¹⁹ Bell, Martin and Michael Albu. Knowledge Systems and Technological Dynamism in Industrial Clusters in Developing Countries. *World Development Journal*. Vol. 27, No. 4 (Sep. 1999) pp. 1715-1734

certain technology. As was mentioned before, this should be taken just as the first step in the process of developing high-tech innovation clusters in developing economies. In the long run, clusters in developed economies should benefit from this model of international openness because a higher degree of development of clusters in developing countries should provide new knowledge, procedures or organizational structure that can be applied in companies in developed clusters, and the first receptors of these benefits would be those companies of entrepreneurs in developed clusters that took the initiative to collaborate with a developing cluster.

4. The Role of Government in Fostering Collaboration Between Innovation Clusters

Governments in Latin America have a prominent role in promoting collaboration with clusters in more developed economies. In chapter 2 it was mentioned why governments in developing economies should promote the formation not only of scientists, but also of people able to understand the business models that can lead to innovation clusters and how to replicate them in the local country as well as individuals able to create a broad network around the globe to help entrepreneurs and innovators to find partnerships. I also have argued that even if the government does not recognize the importance of innovation, local entrepreneurs in Latin America have different ways to accelerate it, and collaboration with developed clusters is aimed at that. However, it does not mean that governments should not take an active role in these matters. The best case to illustrate this is Chile where the government has a clear strategy to bring in the conditions required by developed clusters to work with Chilean companies. Two examples of this are the Fraunhofer-Chile center and the Massachusetts-Chile collaboration agreement, both of which arose from the Chilean Economic Development Agency (CORFO) whose mission is to promote entrepreneurship and innovation. One of CORFO's main projects is aimed to attract International Centers of Excellence (ICE) in Chile. The ICE in turn, seeks to

generate new products, services, patents, and technology to increase productivity within Chilean companies.

Fraunhofer-Chile is a center that was set up to promote collaboration between Chile and Germany in biotechnology. This model of collaboration includes many of the dimensions that I have commented previously in this work:

- a) The establishment and execution of research centers
- b) Promoting the development of an industry out of the results obtained from their research
- c) Transfer of knowledge to local industries
- d) Promote training and development of human capital through the exchange of scientists between the two countries

The parent organization is Fraunhofer-Gesellschaft, the largest European application-oriented research center. Fraunhofer-Gesellschaft maintains 66 institutes and research units and the majority of its more than 22,000 staff are qualified scientists and engineers. Through the partnership Fraunhofer-Chile, the South American country can have access to all these scientific resources, improving the quality of its research and creating new knowledge in areas related to health, security, communication, energy and the environment.

Chile-Massachusetts is important because it is another example that it is possible to create collaboration between developed and developing clusters. This particular agreement will be focused on education, energy, and biotechnology. This particular collaboration is government-based and is expect to bring in to Chile some of the benefits that have been mentioned when a government is committed to promote innovation and entrepreneurship in high-tech areas. Chile-Massachusetts will help to call the attention of the hundreds of players in the Massachusetts cluster towards Chile, especially in areas related to biotechnology and software development.

The **Massachusetts-Colombia** Innovation Partnership Mission 2013²⁰, which followed after the Massachusetts-Chile agreement, is another example of collaboration between governmental institutions in a developed and in a developing cluster. This mission has the objective to explore opportunities, create links and cooperation between both regions. As was explained prior in this paper, collaboration between developed and developing clusters is expected between similar players (government-government in this case) and this particular agreement involves only the governments of Colombia and the State of Massachusetts. However, the real beneficiaries of the collaboration between governments are the players that are in the business of creating high-tech companies. In the case of the visit of the Governor of Massachusetts to Colombia, a large delegation, including high-tech private sector accompanied him with the aim to explore opportunities in the Latin American country. The National Government of Colombia will help to nurture these relationships, but here is where it is necessary the generation of entrepreneurs and managers able to establish long-term relations with their peers in Massachusetts, which will ultimately derive in a more distributed collaboration, including entrepreneurs and the big private sector. In addition to that, the government-government relationship has to be brought to a lower level, in this case the governors and majors in Colombia. This is perhaps the only way to assure the interest of the developed cluster in the different regions.

5. The Role of the Big Private Sector in Fostering Collaboration Between Innovation Clusters

Latin America and some other emerging economies are characterized by business groups (group of companies that work under the same strategic goals and that share an important proportion of their shareholders), which exert dual effects on

²⁰ Massachusetts to “get in on the ground floor” with an emerging Colombian economy. Today Colombia (www.todaycolombia.com). Published on Feb. 14th, 2013.

innovation, facilitating it by providing institutional infrastructure, but also discouraging innovation by creating entry barriers for nongroup firms and thereby inhibit the proliferation of new ideas²¹.

If business groups are popular in Latin American countries, then what role can they play in the development of innovation? Well, certainly business groups must be salient participants in these efforts to develop high-level innovation companies in Latin America. According to Mahmood and Mitchell (2004)²², business groups can facilitate innovation by providing internal capital markets in weak external capital markets, business reputation and government ties that attract foreign technology providers, and concentrated ownership that provides long-term perspectives on R&D investments.

However, business groups can also hinder innovation because they do not want to promote new ideas that can threaten their market position. Mahmood and Mitchell (2004) also explicitly explain why sometimes business groups end up frustrating innovation efforts in emerging markets. According to these authors business groups may hinder innovation by creating barriers to new entrants and thereby limiting opportunities to experiment with new technology.

The authors state that innovation in an industry first increases with the market share that business groups hold in that industry, and then declines after group share crosses a threshold. In other words, the innovation in an industry (in emerging markets), exhibits an inverted-U shape. The authors also argue that even if several groups operate in a sector, high group share will limit the generation of new ideas.

²¹ Mahmood, Ishtiaq P., and Mitchell, Will. Two Faces: Effects of Business Groups on Innovation in Emerging Economies. *Management Science*. Vol. 50. No. 10, (Oct. 2004), pp. 1348-1365.

²² Ibid footnote 21.

When business groups dominate a sector, the diversity in the source of ideas in that sector is reduced and therefore the access to new ideas decline. This is the case of some sectors in Colombia like food, cement and financial services, where there is presence of at least one large business group. In the case of financial services (banking), large business groups dominate the sector and there is little or no innovation in it. Large economic groups also dominate the food industry in Colombia and here also we see a very low flow of innovation. In the same way, the cement industry is dominated by just a few big players, being it the sector with perhaps the lowest level of innovation among the ones here mentioned. These examples confirm the hypothesis presented by Mahmood and Mitchell. All this may suggest that the presence of large business groups in a country like Colombia tends to hinder innovation, just because these business groups do not have too many incentives to alter the economic equilibrium that lets them be leaders in their sectors.

One sector where there is no presence of large business groups is textiles, fashion and design. This sector is being promoted by the Mayoralty of Medellin, the Medellin Chamber of Commerce and the Institute for the Exports and Fashion, *Inexmoda*. Once more confirming the hypothesis of the aforementioned authors, this is by far the most innovative sector in the city and maybe in the entire country. In fact this could be the most developed cluster in Colombia and even though is not based on high-tech, its origins may help to determine the steps that should be followed by entrepreneurs willing to compete in high-tech areas in this developing country²³.

The findings of Mahmood and Mitchell are easily confirmed in the Colombian market. However, one of my arguments in favor of the role of large business groups is that once a big structural change appears, the dynamics of the economy is also susceptible to big changes, including in this case a new role for the large economic groups in the development of high technological clusters. In the case of Colombia

²³ See chapter 6.1 for an explanation of the evolution of high-tech clusters from less developed ones.

and Peru, these two countries recently implemented a free trade agreement with the United States, a fact that will change the rules of the game and will force all the companies from startups to big private corporations, to think globally, something they are not familiarized with. In the aftermath of these changes the large economic groups will be interested in following closely the new trends in the economy, including the migration towards a more technical economy, based on high-tech companies producing new services and knowledge. And these large economic groups have to capitalize on their network of international contacts to help local emerging companies to access global markets. In fact, international contacts of large business groups also contribute to the internationalization of local startups in Latin America as is mentioned in chapter 9. These groups either are receiving flows from international investors or they are allocating capital internationally. The case of the so-called GEA²⁴ in Medellin exemplifies this idea. This group has made several investments in Central America and even in the U.S.²⁵ This expansion into the North American market is critical to help to develop new links over there, links that up to some extent could be used as a platform to help local small entrepreneurs in Colombia to develop their ideas in the U.S. market. Nutresa and Argos have been also engaged in the promotion of entrepreneurship in the city of Medellin, both directly and indirectly through their participation in Proantioquia, but there are no signs that they are using their presence in the U.S. market to help leverage SMEs in Colombia into the North American economy. Certainly a strong contribution to the development of the Colombian clusters of innovation would be to help to connect their network in the U.S. with entrepreneurs in Colombia, following the model here proposed.

²⁴ GEA stands for Group of Enterprises from Antioquia, one of the most important economic groups in Colombia, whose companies are mostly headquartered in the city of Medellin, Antioquia's capital city.

²⁵ Nutresa is the most important food producer in Colombia and belongs to the GEA. Fehr Foods, Nutresa's subsidiary in the U.S. is based in Texas and was acquired by the Colombian producer in 2010. Argos is the most important cement producer in Colombia, and also belongs to the GEA. Argos entered into the U.S. market in 2005 and in the seven years to 2012 had invested \$1,600 million there.

6. A Model of Collaboration

Collaboration between developed and developing clusters is certainly not spontaneous. There must be incentives for a company or an entrepreneur in a developed cluster to turn her sight towards a developing cluster to collaborate or work with it. Similarly, it requires the existence of entrepreneurs in developing clusters with the vision and capabilities able to work with their peers in developed clusters. Players in a developed cluster have to perceive a clear benefit, achievable in the medium term. Otherwise there will not be interest and collaboration will fade.

6.1. Possible Origins of Linkages That May Derive Into Collaboration

Here I propose a model under which the starting point is the existence of some kind of cluster or intent to form a cluster in a developing economy, even if it is not a world-class cluster yet. After all, as was stated in Porter (2000)²⁶, clusters arise out of existing clusters. This existing cluster can gravitate around the most important natural resources of a country, of which certainly Latin America was well endowed, but that does not necessarily has to be so, as is the case seen in the textiles and fashion cluster in Colombia. This cluster is in many respects characterized for being low-tech and capital intensive, but is certainly not a cluster based on natural resources. Examples of clusters based on natural resources are commonplace in Latin America, including: copper in Chile, coal and oil in Colombia, fishing in Peru. Let us call these clusters *first-generation clusters*.

In a second stage, other clusters (*second-generation clusters*) that somehow are related to the more basic clusters, either because the latter are part of their value chain or because they are their customers, have higher chances to start to develop²⁷. For

²⁶ Ibid footnote 10.

²⁷ According to John Price, managing director of Americas Market Intelligence, Innovation in South America is making headway in two areas of natural competitiveness. Access to cheap commodities and energy gives Latin America a global advantage in the transformation and fabrication of

instance, in Colombia some companies that provide equipment for the rapidly growing oil and coal sectors may start to develop supplying iron components to a set of companies in different sectors that perhaps require more specialized components. Initially the newly developed companies may arise in the heavy-industry sector, and evolve into more technological ones but to achieve that, collaboration with developed clusters is critical. The second-generation cluster is certainly a big leap towards the creation of more technological clusters. However, as the reader can figure out, the first-generation cluster is important because can generate enough financial resources and some skills that would be necessary to migrate to more technologically advanced industries that will help to develop the second-generation clusters and others with a more technological component.

Among those more technological clusters that may be striving to arise, especially in Latin America, it is important to choose the one with the highest odds to become a player in the global markets and it is important to highlight that being good is not enough. What really matters here is the development of clusters in emerging economies that can compete in the global markets, so that helping to spread out a world-class culture of entrepreneurship within the country of origin. After all, the goal for developing clusters is to develop companies able to compete at a global scale where the skills and knowledge acquired can be spread out in the younger generations of entrepreneurs. In other words, a cluster where the country or city might have a clear comparative advantage and preferably that already had shown signals of becoming a cluster sustainable in the long term. It is relevant to highlight that this is not only important that the target cluster be competitive in the local market; it has to show the potential to compete in a global environment as well and overall, it has to be clear that this cluster is able to create linkages (collaborate) with other clusters in developed economies. This cluster is certainly more technological than the first and

secondary goods such as refined oil, glass and metals, as well as extraction machinery. In these fields, Latin inventors produce their most commercially viable patents.

second generation of clusters that initially emerged, but is not still considered a high-tech cluster.

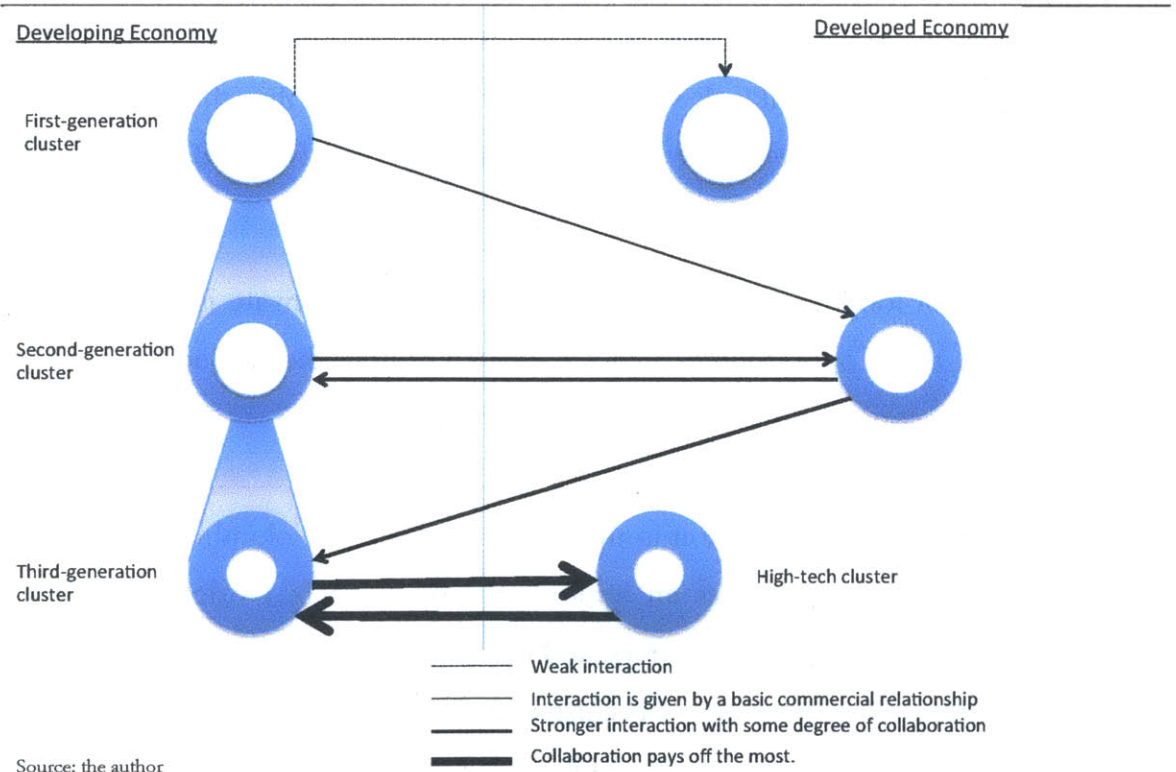
It is important to notice that in order to reach collaboration between a developed and a developing cluster, collaboration can start even in second-generation clusters. Once a developed economy creates linkages with a developing economy, even in a cluster that may not necessarily be competing in a high-technological space, it could be easier to expect collaboration in more technological domains. Based on the observation that clusters emerge out of existing clusters, it has to be argued that clusters of innovation may arise in countries like Colombia, working closely with other existing, less technological clusters. To give an example, regions like the city of Medellin in Colombia will not have a world-class high-tech cluster just because policymakers decide that. Not even the high-techiest clusters in the world like Silicon Valley or Boston emerged from scratch. The case of Silicon Valley is closely related to the development of the military industry whereas the Biotech cluster in Boston has its origins in the world-class hospitals and health care industry in the area. Industries like software development that may be considered as the gateway entrance to the high-tech world, are more likely to develop from software companies developing products for other clusters. For instance, software companies in developing clusters working with a less technological but world-class cluster in developing economies will increase their chances to create strong linkages with global players, using the networks already created by the latter. Such is the case of the textiles and fashion industry in Medellin where a software cluster may arise leveraging in the global connections created by the former.

A country or city can devote resources to the development of several clusters at the same time, but the result will be a not-well-developed group of clusters, and certainly none of them will be world-class clusters. If on the contrary the intentions are to develop a leader cluster, able to compete and thrive in the global markets, the efforts should be focused in the one with the characteristics mentioned above, especially the

one with the highest potential to establish strong linkages (collaborate) with a developed cluster.

Exhibit 6 shows the different connections and lines of collaboration between clusters and how they can evolve. In a developing economy, a first-generation cluster gives origin to a second-generation cluster and this, in turn, to a third-generation cluster. The dotted line simply denotes a basic interaction between two basic clusters, but collaboration is absent. The continuous thin lines connecting the first-generation cluster in a developing economy with clusters in a developed economy simply denote any possible commercial relationship characterized by a company or cluster in a developing economy, dispatching some commodity to be used as input in a production process in the developed economy. In this relationship collaboration is also absent.

Exhibit 6. Evolution of Clusters



Then, the second-generation cluster in a developing economy may also have linkages with clusters in a developed economy based only on a commercial relation, but also

can start to collaborate with more technological clusters in a developed economy. Finally, the third-generation cluster emerging in a developing economy may receive the influence of collaboration from other clusters in a developed economy, even when the latter exerts influence in a less technological domain. The interaction between this cluster in a developed economy and a more technologically driven cluster in that economy, may give rise to collaboration between the third-generation cluster and the more advanced cluster in that developed economy.

In its path to become a high-tech cluster, the targeted group of companies has to work on a set of products or services that may be linked to this cluster but that have a high-tech component. At this point it is important to ask the following questions:

- Who are the main suppliers of this cluster
- Who are the main buyers of this cluster
- Who are the other key components of the value chain
- For each of the main suppliers and each of the main buyers, and each of the main players in general, ask what are the main features that they require to become a global player. For instance, what kind of software developments would be required to allow them to be more competitive?

Then the efforts of local as well as national governments and private investors alike should focus on those opportunities that are devised around the second-generation cluster to start developing a new generation of clusters.

A cluster like the textiles and fashion in the city of Medellin in Colombia, which was already mentioned, is emerging as an important cluster, where fabrics producers, designers, models, garment manufacturers, and components suppliers of thread, wool and other products, take part of it. This cluster has been able to call the attention of many players in the global supply chain and is a good candidate to explore as a world-class cluster from a Latin American economy. Around this second-generation cluster, more advanced clusters may arise (third, fourth generation clusters), leveraging for

instance in the software products that are necessary in the design process of a garment or to manage this supply chain more efficiently.

A good example of technological clusters that arise around other existing and more basic clusters in Latin America is the Astronomy cluster in Chile. The Chilean government understood that the country had a natural competitive advantage over the rest of nations in the world: the quality of its skies for astronomical observation. Promoting the country around the world as the best spot to place the newest generation of telescopes called the attention of many scientists who now spend a good part of the year in Chile observing the skies. This first group of scientists interested in Chile was crucial to start developing other technological fields because once a base of scientists and researchers established in Chile, they started to create stronger bones with local Universities that ultimately attracted scientists in other areas once they noticed the interest of some of their colleagues in this Latin American country.

The simple questions shown above conforms a test that every cluster with the intentions to internationalize has to answer in order to capture the attention of developed clusters and broaden the chances to achieve collaboration. Lessard, Leonard et al (2013)²⁸ developed a methodology called RAT to assess whether a company is ready to expand into international markets. In general terms the same set of questions applies to assess whether a cluster in a developing cluster is ready to work with a developed cluster to create linkages of collaboration. With some adaptations, the questions that are raised in RAT would be the following for the case of collaboration between developing and developed clusters:

²⁸ Lessard, Leonard; Lucea, Rafael, and Vives, Luis. Building Your Company's Capabilities Through Global Expansion. MIT Sloan Management Review, Winter 2013.

1. Are the capabilities developed in the home market (second and third-generation clusters) relevant to counterparties in developed clusters? In other words, do these capabilities create value for the company in the developed cluster?
2. Are the new capabilities acquired through collaboration appropriable? In other words, once the company in the developing cluster is collaborating with a company in a developed cluster, is able to learn new knowledge and use it to develop even more of its internal capabilities? If the answer is no, it does not make much sense to collaborate with a developed cluster if the intention is to develop high-tech clusters in the developing economy.
3. Are the capabilities transferable? Working with a certain developed cluster, can the companies in the developing cluster deploy their capabilities effectively and capture value creation?

7. The Innovation Funnel

So far I have described collaboration between innovation clusters at a macro level, considering the role of government, universities, and big companies. Now I am going to address collaboration at the entrepreneur's level, which includes the four phases of the innovation funnel, from ideas generation to the creation of global operating companies.

Four main players comprise the typical ecosystem for innovation at the entrepreneur level: (i) **ideas generators**. Ideas may come generally from initiatives like hackathons²⁹ or time-intensive gathering of entrepreneurs with mentors and VCs (e.g. Three Day Startup, known as 3DS³⁰, MIT \$100K³¹ or MassChallenge³²), (ii) **Product**

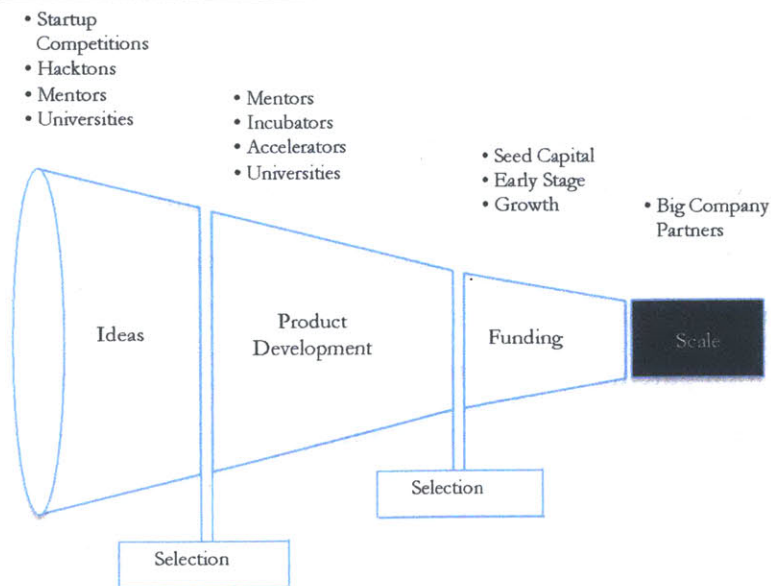
²⁹ A hackathon (also known as a hack day, hackfest or codefest) is an event in which computer programmers and others in the field of software development, as well as graphic designers, interface designers and project managers collaborate intensively on software projects. Taken from Wikipedia.

³⁰ "3 Day Startup is an entrepreneurship education program designed for university students with an emphasis on learning by doing. The idea is simple: start tech companies over the course of three days". Taken from www.3daystartup.org

Development, which includes mentors, accelerators, incubators, and Universities. Accelerators consist of a three-to-four-month program where entrepreneurs get support, mentoring, and sometimes funding. In this stage the accelerators set the times. Incubators also provide support and mentoring, but unlike accelerators, they help entrepreneurs hit the ground running at its own pace; (iii) **Funding**, which includes VC funds, which are the last step for a new venture “before graduation”. This stage also comprises Angel investors and the known Family Offices. (iv) **Company scaling and developing**. In this stage we have operating companies, with a market and an organizational structure, able to compete in the global markets.

Every one of the four steps is necessary to develop a cluster of innovation and in every one of them it is feasible to find models of collaboration from developed clusters. Exhibit 7 shows the different steps involved in the creation of innovation-driven companies.

Exhibit 7. Steps in the Development of a New High-Tech Venture



³¹ The MIT \$100K is an entrepreneurship competition that includes the participation in a series of three contests: the Pitch Contest, the Accelerate Contest, and the Launch Contest. The winner of the Launch Contest wins \$100K.

³² The MassChallenge is a contest to help early-stage entrepreneurs win, connecting them with the resources they need to launch and succeed immediately.

Any effort of collaboration between developed and developing clusters has to work on each of the four stages of the innovation funnel. The next part of this thesis focuses on the components of the innovation funnel, defining and seeing them from the standpoint of collaboration. In other words, it is not about giving examples of the humongous number of participants in each step of the funnel, but rather it is about giving examples of those that are designed to collaborate in an international environment, especially those with the potential to collaborate with clusters of innovation in Latin America.

7.1. Ideas Generation

Latin America as a region has to accelerate its pace of talent creation. Between 2008 and 2013 the region showed almost no progress in talent development, according to the talent index developed by the firm Heidrick & Struggles³³, which is certainly a demonstration of the enormous efforts that have to be deployed in order to shorten this gap in talent formation. A new generation of talented Latin Americans would be better prepared to generate new transformative ideas, but it is not guarantee that those ideas will create new companies. There are two issues that have to be addressed in Latin America to become more innovative hubs and to transform those ideas into products or startups. Firstly is the lack of generation of breakthrough ideas and secondly, the gap between ideas and creation of products/startups. If we measure the number of registered patents as a proxy for ideas generation, the numbers are disappointing: Latin America represents 6.5% of global GDP, but only publishes 0.2% of the world's total patents (around 400 patents per year). Moreover, a high proportion of homegrown patents is published by universities and has little or no commercial value.

This is the most critical phase in the collaboration model here proposed. Ideas may spring everywhere but ideas with the potential to become companies able to compete

³³ Mapping Talent in Latin America. Heidrick & Struggles, developed in cooperation with the Economist Intelligence Unit. 2013.

in the global markets are rare. The DNA of global competition has to be implanted in the entrepreneurs since the inception of the idea. This is the main breakthrough from the traditional processes of ideas generation, especially in Latin America. It is easily seen how the efforts are mostly focused on the other phases of the innovation ecosystem. However, it is important to insist that one of the main arguments in this paper is that the seed of competition in the global markets has to be implanted since this early stage. Maybe the best case to exemplify this idea is the 3 Day Startup.

Just to mention one case, 3-Day Startup (3DS) was born as a student organization at the University of Texas at Austin, but now has widespread to other schools in North America, Europe, South America, the Middle East and Asia. The idea of 3DS is to teach entrepreneurial skills in a hands-on environment, which enable students to start tech companies over the course of three days. 3DS rent workspace for the three days, recruit a number of student participants (as of 2013 the number of students recruited was 45) from very diverse backgrounds, including computer science, business, engineering, law, design, communications and others. 3DS cater food and drinks, and bring in experienced entrepreneurs and investors. During the Friday session all the participants brainstorm their ideas for a startup, the students work on them and on Sunday night deliver a prototype and investor pitches. 3DS is a good sample of collaboration between participants in developed and developing clusters. For instance, a 3DS event in Latin America includes the participation of some local entrepreneurs and investors but also from countries in developed countries. This allows the spilling over of ideas from developed clusters to their developing peers.

7.2. Accelerators and Incubators.

According to the National Business Incubation Association, “Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources

and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. When these incubators graduates have the potential to create jobs, revitalize neighborhoods, commercialize new technologies, and strengthen local and national economies”.

One example of incubation given at the corporate level is seen in Microsoft, which established an incubator in its state-of-the-art facility in the heart of Bangalore, India. The incubator, like its sibling, is focused on bringing in startups that are focused on working with cloud computing, and linking them up with office space, meeting rooms, communications, video conferencing, mentorship, and \$60,000 in credits to use Microsoft's Azure platform. Azure, of course, is the company's cloud computing play. With this idea Microsoft intends to help them build businesses in Cloud, Internet, and Mobile that can take the advantage of the Cloud such as e-commerce, mobile, media, social applications, gaming, education & healthcare, or even enterprise products. This is a four-month acceleration program, at the end of which Microsoft will organize an Investor Day Demo where Microsoft executives as well as angel investors and venture capitalists will check out the technology and listen to the pitch. Microsoft will also organize informal dinners each week and invite key industry leaders, influencers, and thought leaders to speak on relevant topics.

But this is not the only example of high-tech companies incubating innovative ideas. Spanish Telefonica has established an incubation program called Wayra operating in Brazil, Mexico, Colombia, Argentina, Peru, Chile, and Venezuela in Latin America and in other countries including the UK, Deutschland, Spain, Czech Republic, and Ireland. For being an international network of incubators, Wayra is a good example of cooperation between one of the components of innovation clusters (incubators/accelerators). While the generation of ideas is a local process where

entrepreneurs may try to tackle a particular problem or take advantage of a foreseen opportunity, the collaboration that surges among these clusters creates more opportunities for these companies to compete in the global markets. In other words, through these closely interconnected accelerators, an idea intended to address a local problem in one of the countries, may be extended to solve the same problem in another country or as a component of an idea that is developing abroad. For instance, Wayra is interconnecting the clusters in all the countries it has operations, so that stimulating productivity. The Wayra management team is also part of the project, which provides advisory to entrepreneurs in areas like best management practices, patents, how to compete in international markets, and so on.

Counting with international collaboration in accelerators and incubators in emerging economies, especially in Latin America, is important because it can infuse in these entrepreneurs since the very beginning, the required DNA to compete in global markets. Accelerators and Incubators play a key role in the setup of innovation clusters and having advisors/mentors that can help entrepreneurs to reach global markets since the inception of the new companies is critical to the success of the cluster. In many circumstances a developing country may be short of a local base of advisors/mentors; that is when an acceleration/incubation program like the one established by Telefonica (Wayra), where developed-developing collaboration is central in the model, can help to foster innovation in developing countries. In this particular case the benefits of collaboration are even more evident for entrepreneurs in the developing economies where Wayra is operating, because they can be able to access Telefonica's technological know-how through the company's research and development center in Spain in areas such as future communication in mobility, virtualization, cloud computing, advanced user modeling, smart cities and smart grids, and new video technologies.

7.3. Universities as Accelerators/Incubators

One successful example of what Universities that are near to or are part of developed clusters can do to **foster innovation-driven startups in emerging economies** is the MIT-India Initiative, whose primary mission is to foster collaboration between the faculty and students at MIT, and faculty and students at academic and research institutions in India. Among the specific goals are enabling the creation of long-term projects involving groups from both MIT and Indian institutions; and promoting inclusive growth, sustainable development, educational leadership, entrepreneurship, new models of governance, and advanced results-focused research in India.

There are many efforts that ought to be pursued by countries in Latin America to become potential partners of an educational center linked to a developed cluster. Among others, it is important to develop e institutions interested in doing research in high-technological areas, and a broad base of researchers, software developers, and entrepreneurs, all of them very well interconnected with their peers in developed clusters. The forces that trigger collaboration between developed and developing clusters may appear in many dimensions and it is not clear to discern when to apply a certain approach. In general the recommended action to be taken by developing clusters, at least in Latin America, is to adopt a strategy of trial and error to fine tune and find out the components of the model that better adapt to the country. Another of these components that is part of the collaboration model here proposed is the participation of the developing cluster in a partnership of collaboration between developed clusters and clusters moderately developed. That is the case I propose in chapter 10, where the foundations for a potential (and feasible) partnership among MIT, Amsterdam (Holland) and Medellin (Colombia) are explained. Emerging economies like India and China are huge markets that are attractive to any developed cluster. With the exception of Brazil, Latin American markets are not big in size and they have to root their attractiveness to developed clusters in different features. In the case of Medellin, showing itself as part of a much larger cluster where the city of

Amsterdam is part of, would increase its chances to reach collaboration with developed clusters and therefore to become a global player.

Programs like the MIT-India Initiative are rooted in many years of relationship between the Institute and the emerging country. Some other types of relations can be implemented in a much shorter term to help foster innovation and startups in developing countries, especially in Latin America. Aimed at helping in this relationship between University-Entrepreneurs are the programs where students at Universities near to developed clusters, can work together with entrepreneurs in developing countries. One of those examples are the Action Learning Labs, which are based on the idea of learning-by-doing, helping real organizations around the globe, translating classroom knowledge and theory into practical solutions. Each Lab features classroom sessions coupled with a real-world project. One of these Action Learning Labs is the G-Lab (Global Lab) that is part of the training that management students can pursue at MIT. Under this program Host Companies (HC) in developing economies work with students in the MIT Sloan School of Management to find solutions to a particular problem the company is facing. The G-Lab program has helped more than 250 start-ups and growing companies in emerging markets.

However, for a program like this, which has enormous benefits for entrepreneurs in the developing cluster, to foster in Latin American countries, Universities in these countries have to take a more active role. Alliances of local education and research institutions with similar institutions in a developed cluster would help to create collaboration, increasing the likelihood of nascent companies to succeed in global markets. For example establishing alliances with the MIT Sloan School of Management would allow students in the G-Lab program to have access to a broader set of projects in countries like Colombia, Peru or Ecuador, just to mention some, and at the same time, students from the local universities can nurture from the perspective offered by the G-Lab students. But the most important benefits are from

the entrepreneur, who can take advantage of a group of talented and yet diverse group of young management students, who can offer the entrepreneur a global perspective and help about how to insert the company into the international markets.

One variant of the University-acceleration program is what we find with BizCorps, which is a US-based non-profit program that connects MBA graduates with SME entrepreneurs in emerging markets. BizCorps teams work with businesses for up to one year to develop business plans and other growth strategies. BizCorps recruits a group of graduates from top American Business Schools, then train them during two weeks in Washington and two weeks in the respective countries, and finally deploy them in the targeted emerging market. Once in those countries, they will work under the supervision of a country manager, who has at least 15 years of experience in that market.

Starting in 2013 BizCorps will launch its programs in Colombia and Kenya. In Colombia will work with Endeavor Global³⁴ and the Development Bank of Latin America (CAF)³⁵.

7.4. Global Network of Mentoring Programs.

A third component of an innovation process consists of a global network of mentors willing to help entrepreneurs that have shown promising ideas. These mentors provide counsel in best management practices, as well as contacts, access to international markets and ultimately, capital. In fact, a network of entrepreneurs is important because it participates in many stages of the innovation funnel: during the ideas generation, talking to entrepreneurs and sharing their concepts about what ideas may be more promising than others; during an acceleration process, helping

³⁴ Endeavor Global is a program that identifies and helps to accelerate the growth of high-impact entrepreneurs through mentoring and strategic advice.

³⁵ This is known in Spanish as Corporación Andina de Fomento (CAF)

entrepreneurs define the features that can contribute the most to make a product successful; and finally, in the incubation process mentors are important either participating in the board of directors or helping as external advisors with management solutions.

As is the focus in this thesis, what is important is how the actors within a developed cluster can collaborate with actors in a developing cluster and vice versa. In that sense, a key requirement for this network of mentors is that their members must have experience working with developed clusters, so that they are well positioned to teach clusters of innovation in developing countries what was done in that developed clusters when they faced a similar problem, what ideas worked and what did not. That experience in developed clusters could be as managers, coaches, academics, or even as students in one world-class education center.

Many mentorship programs related to innovation (and particularly to high tech innovation), are referenced in the literature, but almost all of them are very regional, that is, are comprised by mentors that help entrepreneurs to develop their ideas only when by chance or by design, the startup and the mentor are placed close from each other. In other words, very few of the existing mentorship programs in the high-tech dimension are truly based on collaboration between developed and developing clusters. Certainly this is one of the areas of the innovation ecosystem where more efforts have to be deployed, trying to connect experienced mentors from developed clusters with entrepreneurs in Latin America, helping them as members of their Boards of Directors or connecting them with new markets. Below are some of the mentoring programs that exist in the United States but that nevertheless have not been able to reach a global collaboration scope:

- **The MIT Venture Mentoring Service (VMS).** This program was founded in 2002 and supports innovation and entrepreneurial activity throughout the MIT community by utilizing mentors to educate early-stage innovators. The scope of

the VMS is only the greater Boston area. Even though this program as such is intended only for the MIT community, and hence is not designed to be a global mentoring program, its design and structure can be reproduced in some other clusters, especially developing clusters, to help with the support and experience entrepreneurs need. The MIT VMS Outreach Programs are designed at several levels:

- **Outreach Hands-on Immersion Training** - Jump starts your program. Users say this training has helped them adopt practices that would have taken 3-5 years to develop independently.
 - **Outreach Extension - Outreach Global - Customized Consulting** - Designed for those who have taken Outreach Immersion and are customized to meet the needs of their institutions or agencies.
 - **Outreach Overview Workshops** - Participants learn the benefits of establishing a formal venture mentoring program for their entrepreneurs and their institution or agency, and gain understanding of MIT VMS methods.
 - **Venture Mentoring User's Group** - Annual User's meeting to share experiences and engage in group learning.
- **Kindle Mentoring Program in Boston University.** This is a program where seasoned entrepreneurs and business executives help members of the BU community, faculty, students or alumni, to transform their ideas into companies. The program is administered by the BU Technology Development Office in collaboration with the BU Institute for Technology, Entrepreneurship, and Commercialization.
- **The Mentor Programs of the University of Missouri-Kansas City.** These mentors commit more than 10 hours monthly to work with students in developing sustainable businesses. The Institute has 33 mentor programs helping students in areas like: Information Technology, Health Care, Wireless Telecom, Media, Consumer Electronics & Accessories, Entertainment, Financial Services, Energy,

Real Estate, Venture Capital, Clean Technology, Household-related products, Computer and Software Products, Games and Toys, Wireless Communication, and Investments.

7.5. International Venture Capital (VC) Funds

In this case I refer to VC funds that have investments mostly in companies that are part of developed clusters, but that also have an interest – although it could be a minor one – in companies in developing countries that are working on innovation. These funds have raised capital mostly from investors that are part of a developed cluster. A variant of this model is a VC fund established in a developing country where at least one of the General Partners (GP) has experience working with the development of innovative technologies, with funding coming from both local and international investors.

This is for instance the case of Telefonica's Amerigo funds, a group of three VC funds established in Colombia, Brazil and Chile for a total investment of US\$300 million. In this particular case Telefonica identified the potential to develop new technologies through developers in these emerging economies, but under the leadership of people that had worked for very successful VC funds globally. This case is also important because Telefonica was not the only Limited Partner (LP), but also invited other local players, which certainly would be important to develop a local culture of innovation and investment in Venture Capital in these Latin American countries, especially Colombia where Venture Capital is still an infant industry.

This model may be particularly effective to create innovation-driven companies in emerging markets that can spread that knowledge out to eventually become a cluster of innovation and unleash a startup revolution in these countries. A fund with ties in developed clusters as well as in developing clusters may lead to the contribution of

experienced people from developed clusters to be part of the Board of Directors in companies created in emerging clusters. This contribution is important not only because may facilitate the transmission of best management practices to developing clusters, but also because may help to expand the markets for those startups into a global scope. Two problems faced by innovation-driven startups in Latin America are lack of capital and access to international markets. Having General Partners (GPs) from these international funds with a broad experience in global markets seated in the boards of the startups in developing clusters would help them to create a global vision and a global strategy for the companies. Wright et al. (2005)³⁶ also mentioned that the difficulties in assessing managerial capabilities and the short private-sector experience of entrepreneurs in developing economies “necessitate reliance on foreign business education or work exposure to Western business practices as alternative signals of managerial capability”.

The importance for developing clusters to have ties with local people that have access to entrepreneurs in developed clusters rests in that they can overcome the geographic distance between these clusters in the developed country and the developing cluster, so that having access to valuable information that otherwise will not be available. This concept is based on the work of Bell and Zaheer (2007)³⁷ and commented in Gupta, Tesluk, and Taylor (2007)³⁸ who analyzed the effects of geography in the flows of information. In this study the authors conclude that their findings offer support for the emergent effects of social networks on innovation at the firm level. In other words, participation of local members in the network of innovation clusters in developing economies who may contribute with links to other networks of

³⁶ Wright, Mike; Pruthi, Sarika and Locket, Andy. International Venture Capital Research: From Cross-Country Comparisons to Crossing Borders. *International Journal of Management Reviews*. (Sep. 2005). Vol. 7, Issue 3, pp. 135-165.

³⁷ Bell, Geoffrey G. and Akbar Zaheer. Geography, Networks and Knowledge Flow. *Organization Science*. Nov. 2007. Vol. 18, No. 6, pp. 955-972

³⁸ Ibid footnote 2.

innovation in developed economies are valuable to facilitate the development of such innovation-based clusters.

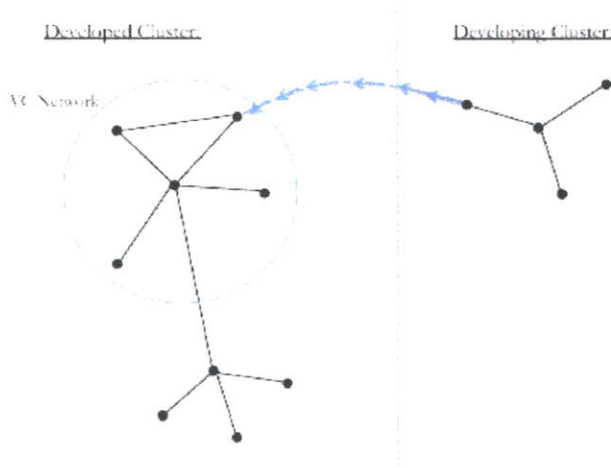
The internationalization of the VC industry is not a new phenomenon. In Europe, for example, the share of inflows of VC funds from non-domestic sources more than doubled to 45% of the market. But this is not only a European phenomenon. In 2002, 26% of investments in Asia involved cross-border deals. The literature, though, is very focused on the internationalization of VC funds on a developed-developed country basis. Very well documented is the expansion of VC funds in the United States to the European and Asian countries, and later on, how VC funds in those countries expanded to the U.S. market. However, considering that VC investors are struggling to find high returns in developed countries and competency there is turning fierce, there are not a few incentives for VC funds in those developed economies to turn their attention into Latin American markets. Some funds have already started to look at the giant emerging markets – China and India –, but not yet to Latin America. This fact is strengthened if the developing countries are able to improve their legal and regulatory systems, which gives investors more reasons to trust in the country as a receptor of their investments.

Any collaboration between developed and developing clusters of innovation that may arise from Venture Capital funds presumes collaboration from the former in the establishment of an innovation ecosystem in the latter. Many VC fund managers in developed clusters are very well aware of how the economy is flourishing in countries like Colombia and Peru, but yet almost none has made the leap towards these markets. They systematically argue that even though the economy is doing well, there is not an ecosystem of innovation and therefore there is not fertile land to plant their seed of innovation. The argument that there is not a well-developed ecosystem of innovation is true, but somehow that is what makes these Latin American markets attractive: the possibility to contribute to the development of innovation and

therefore establishing long-lasting and sustainable bones with local players. This is not saying that local players in developing clusters do not have to take the leadership in developing their own cluster of innovation, but that they require collaboration and for developed clusters the payoff may be high. This is a radically different strategic approach to obtain the high returns that investors in these types of funds are expecting, approach that can be summarized as follows: compete in a blue ocean where numerous opportunities are to arise but where many efforts have to be spent in the development of ecosystems of innovation, instead of competing in a red ocean where there are many competitors looking at the same type of companies and therefore it is more costly to obtain home-runs.

Another form of international VC funds that can lead to innovation in Latin America is the incorporation of Venture Capital funds by U.S.-or-European-trained immigrants that return to their home country. These fund managers would have developed a vast network of contacts in developed clusters that can be transferred into the developing cluster in the form of potential customers for their products/services or the participation of experienced people in the Board of Directors of companies in developing clusters. It has to be said that this model of VC funds creation is in general applicable to the creation and development of any phase of the innovation funnel, especially to the creation of incubators and accelerators. The reason is that this model is based upon the networks that a national from a developing cluster can establish in a developed cluster and then is able to build on those connections to start a new network in her country or origin. This new network is quite different from the existing ones in the developing cluster in that this is tightly linked to developed clusters whose members are in turn interested in collaborating to the development of a new cluster of innovation in a developing market. This type of cluster collaboration is described in the graph below.

Exhibit 8 - First Step:

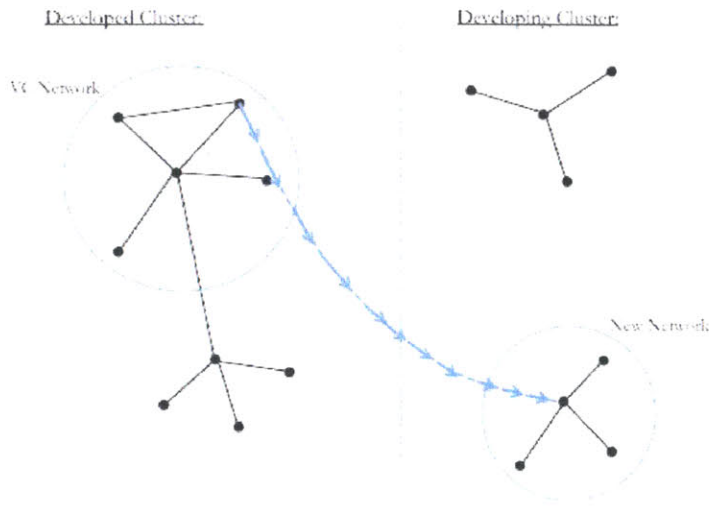


In the First Step a member of the developing cluster inserts into a developed cluster, either because she is a scientist, an entrepreneur with contacts abroad or a student in a top education institution, establishing networks and connections that later on will leverage in the development of the cluster of innovation in the developing cluster. This idea is based on the concepts of Diaspora Networks³⁹ whose benefits were highlighted in *The Economist*⁴⁰: “Immigrant networks are a rare bright spark in the world economy. Rich countries should welcome them”. In this case I am only considering one individual that establishes networks in a developed cluster and then return to the country of origin. However, for this individual it is much easier to establish networks in a developed cluster if there is an existing diaspora network. In general, when I refer to an individual it can also be understood as a group of persons that share the same interest, cultural values and in many cases the same technical skills.

³⁹ Diaspora networks are defined as networks of individuals linked by a shared identity. These common interests and culture generate higher levels of trust than for non-affiliated individuals. They are not government economic development agencies, nor extensions of diplomatic missions. Some examples of Diaspora Networks include TiE (The Indus Entrepreneurs), Turkish American Association for Business, Chile Global, Global Scots (Scotland) and Open Karachi (from the city of Karachi in Pakistan).

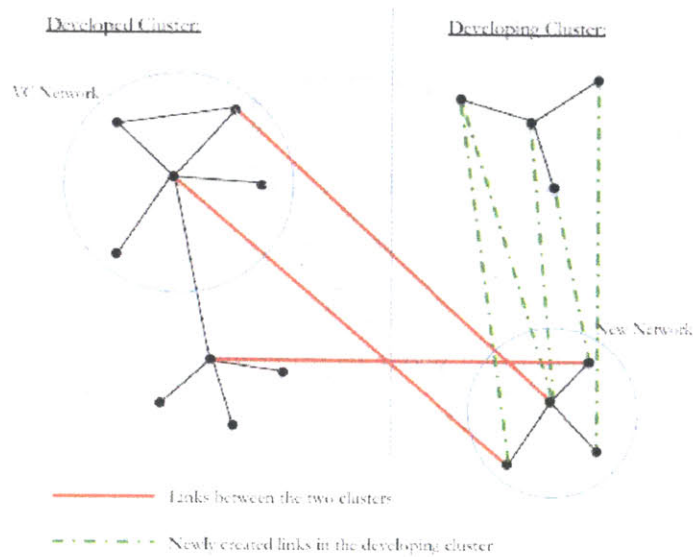
⁴⁰ *The Economist*, November 19th 2011.

Exhibit 9 - Second Step:



In the second step this member of the developed cluster that came from the developing cluster was able to establish networks and extended her connections to almost all the rest of the cluster. Now is prepared to come back to the country of origin, helping in the development of the cluster on innovation over there. The most likely step adopted by this new player is to initially establish a new and independent (disconnected) node in the developing cluster. She will start to expand this network, creating new linkages with other existing players in the developing cluster or attracting new participants that had been apart from the existing clusters. This arising node in the developing cluster differs from the existing linkages in that this is highly connected with the developed cluster, so that increasing the likelihood to start a relationship based on collaboration. Those connections and the perspectives to create truly global companies is what attract a new talent in the developing cluster to become part of an innovation ecosystem. People that before only considered the possibility to work for a big corporation now have incentives to participate in the development of a cluster of innovation. These “repatriated” will start bringing in people from abroad to help them to educate local entrepreneurs, government and Universities in issues related to innovation and entrepreneurship.

Exhibit 10 - Third Step:



Step Three represents the interconnection of the emerging networks in the developing cluster with preexisting nodes in that cluster, including the local government, Universities and entrepreneurs. Additionally, the new cluster is expanding its linkages with the developed cluster and those connections are extended to touch the older nodes in the developing cluster. More and more resources will flow into the new network, making it even more appealing to participants in the developed cluster to collaborate with the new developing cluster.

As many of the models of collaboration, this particular case exhibits some degree of hysteresis in the sense that an individual who belongs to a developing cluster of innovation is able to insert into a developed cluster, either because of her technical skills, or the network created after having gone to school there. Once being part of the developed cluster this individual is able to strengthen and expand her network and being knowledgeable of the conditions and opportunities in her cluster of origin, and now decides to come back there to establish a VC fund. In so doing has to help to develop an ecosystem of innovation (generation of ideas, acceleration, incubation) but at the same time is able to serve as a bridge between the local incipient ecosystem and the much-developed cluster where she comes from. This individual has to find a

local group to work with, characterized mainly for their technical or managerial skills, local network of contacts or global thinking. This way that individual will link her group with the developed cluster in a process whose most probable outcome is the creation of a bigger, cross-border cluster, even though its level of development is not homogeneous throughout its nodes. With more and more participants from both sides collaborating, the results would look more like those previously presented, including expansion of markets, new source of ideas, and lower cost of development - among others - for the developed cluster, and a wider technological knowledge and discovery of new markets to the developing cluster.

In this model it is of the utmost importance that the individual of group of individuals coming back to their developing cluster of origin maintain their connections with different participants in the developed cluster. It is not enough to trust only in their knowledge and local connections to pursue the goal of creating a cluster of high-tech innovation. It is important to keep nurturing their linkages with the developed cluster and explore different ways to involve them with the developing cluster. Now that it has been explained how collaboration between developed and developing clusters may evolve from ideas generation to the funding of new ventures, the following chapter covers how collaboration may arise among firms that sprung out from the innovation funnel.

8. Collaboration Among Firms Generated in an Innovation Ecosystem

Once companies in the high-tech space in an emerging economy have reached a certain size, some of them may be ready to insert into the value chain of a developed cluster, especially when the company in the developing cluster is the outcome of an ecosystem that has received the influence (collaboration) of players in a developed

cluster⁴¹. Exhibits 11 to 13 show the three different steps that ultimately permit the insertion of companies in developing clusters into high-tech developed clusters.

8.1. The Three-Step Model of Collaboration

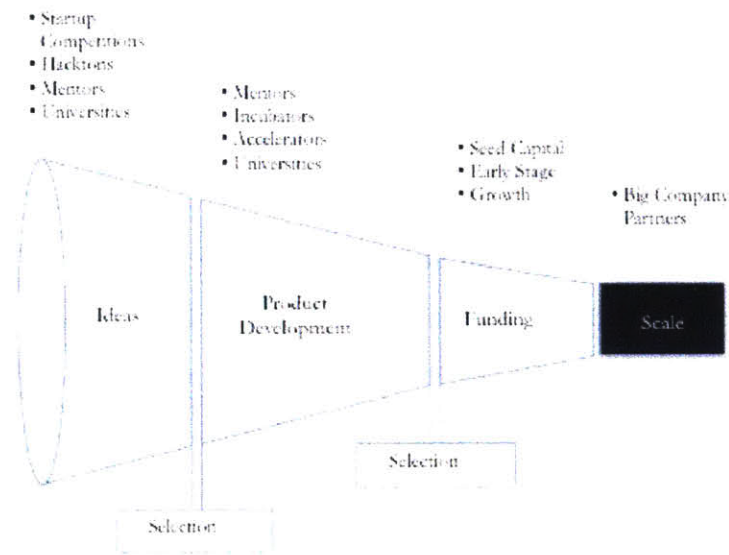
Step 1 corresponds to the individual efforts of the developing cluster to develop its own innovation ecosystem. As was mentioned before, local players in a developing cluster of innovation have to take the leadership in creating the conditions to develop an innovation ecosystem and collaboration will follow. This step is characterized by a reduced group of entrepreneurs who initially foresee some opportunities mainly in the local market. Local and national government as well as Universities also have a key role in trying to develop this ecosystem, especially through the generation of ideas and programs of acceleration/incubation. This step is quite important because encourages companies in developing clusters to be part of such cluster rather than working in an isolated fashion. The work of Giuliani et al. (2005)⁴² offers important insights for the idea of collaboration between clusters that are distant geographically. They recognize that the existing literature has often neglected the importance of external linkages and by external linkages they are referring to the integration of enterprises and clusters in value chains that “often operate across many different countries”.

This model is framed in the same matrix collaboration model presented earlier in chapter 3.

⁴¹ Notice that this point refers to companies in developing clusters working with companies in developed clusters. This is certainly a required step that companies in a developing cluster must accomplish previous to creating their own *developed cluster*.

⁴² Giuliani, Elisa; Pietrobelli, Carlo; and Rabellotti, Roberta. Upgrading in Global Value Chains: Lessons From Latin American Clusters. *World Development Journal*. Vol. 33, No. 4 (Apr. 2005), pp. 549-573.

Exhibit 11 - Step 1:



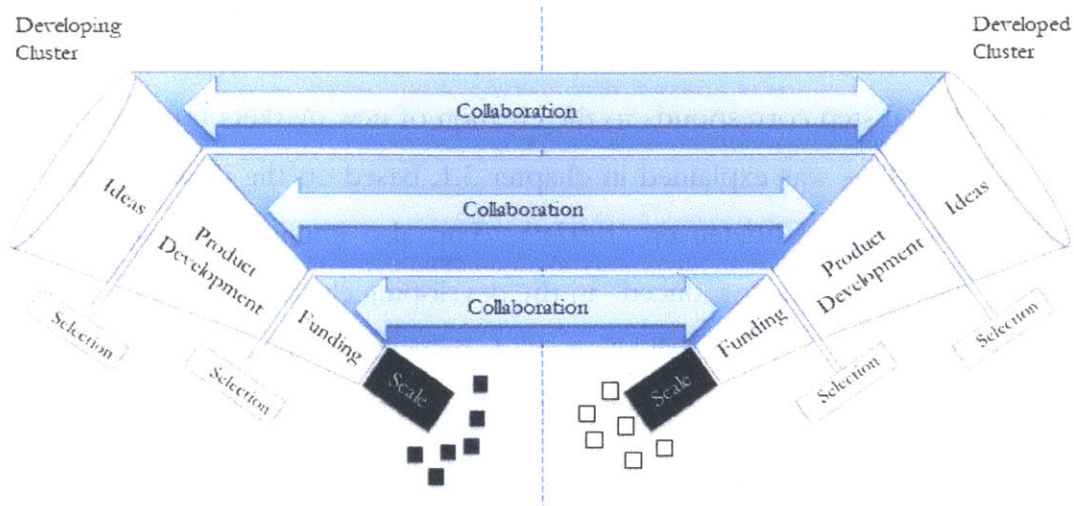
The first lesson to be learned by entrepreneurs in Latin America is that any model of collaboration between their clusters and clusters in developed economies has a higher likelihood to exist and is more sustainable in the long run when the entrepreneur in the developing country is part of a cluster rather than working isolated.

Pietrobelli and Rabellotti (2004)⁴³ found that “small and medium enterprises located in clusters have a competitive advantage with respect to isolated firms because of their higher collective efficiency (joint actions)”.

The first step represents the efforts accomplished by local players to develop their own cluster of innovation. The minimum requirement for a developing cluster to become appealing to a developed cluster is a marked interest and commitment of locals to develop their own cluster of innovation. Ideas generation, acceleration, incubation, network of mentors, VC funds, angel investors, Universities and big companies for alike have to push in the same direction to start generating a wave of innovation and the formation of what is known as the innovation funnel.

⁴³ Pietrobelli, Carlo and Rabellotti, Roberta. Upgrading in Clusters and Value Chains in Latin America: The Role of Policies. Inter-American Development Bank (Jan. 2004)

Exhibit 12 - Step 2:



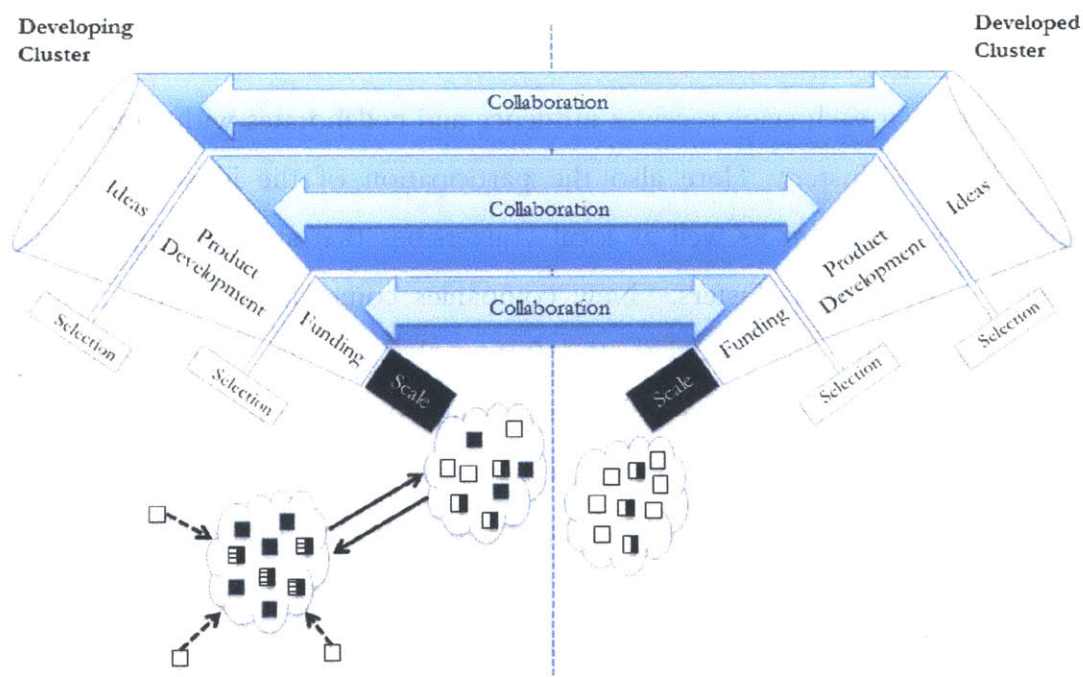
The second step is characterized by collaboration from the developed cluster in each of the three components of the innovation ecosystem as was described in Chapter 7. It is important that each stage receives influence and collaborates with similar actors in the developed cluster. Here also the participation of the local and national governments is important as well as local Universities that already cooperate with their peers in developed clusters. New companies come out from both clusters (small squares at the bottom), with the feature that the new companies in the developing cluster have received influence through each phase of the innovation funnel from a developed cluster. Collaboration at this point may be stronger from the developed cluster to the developing cluster, but in general is a bilateral beneficial relationship. A common denominator for both clusters is that through the interaction arisen from collaboration, an international workforce is created and as is pointed out by Engel et al. (2009)⁴⁴, an international workforce provides startups, from their beginning, with a global perspective. Even though entrepreneurs in a developing cluster may be motivated to foster the creation of an innovation ecosystem thinking in exploiting an opportunity foreseen in the local market, the

⁴⁴ Ibid footnote 1.

companies coming out from the cluster will be prepared and have the mindset to compete globally.

The third and final step corresponds to the creation of new markets for companies in developed clusters, as was explained in chapter 3.1, based on the ideas of *empowering innovation* developed by Christensen (1997)⁴⁵. This also implies the insertion of at least one of the companies “produced” in the developing cluster, into the value chain of the developed cluster, which will allow the former to understand the dynamics of global markets and receive knowledge transferred from the latter.

Exhibit 13 - Step 3:



Steps one and two are necessary but do not guarantee that companies in developing clusters are able to be part of the value chain of a developed cluster with world-class standards. Step 3 is required because represents a continuous training in the world leagues and is the only form to guarantee the constant transfer of knowledge to

⁴⁵ Ibid footnote 13.

assure the health of the cluster that is developing in the emerging economy. Step 3 also represents the numerous benefits that collaboration produces when is done through all the steps of the innovation funnel. This last step represents the emergence of new companies in high technological areas in the developing cluster, but also the possibility for companies in the developed cluster to find new markets in the developing economy they are collaborating with as well as access to other markets where the company in the developing cluster has contacts established, as is represented by the dotted arrows in the left side of the graph.

8.2. *Upgrading of New Ventures in Developing Clusters*

Participation of developing clusters in one or some parts of a world-class value chain like the one shown above facilitates the integration of that developing clusters into more complex processes or products because that integration helps the developing cluster to receive signals on what the needs and trends of the world-class value chain are. These signals help innovators and entrepreneurs to focus on what can be more effective ideas. With a progressively more skilled human capital and with first-hand information about the needs of the world-class value chain, the developing cluster can *upgrade* to participate in more complex processes or products.

The benefits for developing innovation companies that have been commented here are described in Kaplinsky (2001)⁴⁶ and Porter (1990)⁴⁷ as *upgrading*, and Giuliani and Pietrobelli (2005)⁴⁸ argue, “Upgrading is decisively related to innovation”. Upgrading is defined as the capacity of a firm to innovate in order to increase the value added of its products and processes. The best entrepreneurs in Latin American countries can do to gain competitive edge in the value chain of innovation-driven high-tech

⁴⁶ Kaplinsky, Raphael. Globalization and Unequalization: What Can Be Learned From Value Chain Analysis?. *Journal of Development Studies* (2000). Vol. 37, No. 2, pp. 117-146.

⁴⁷ Porter, Michael. *The Competitive Advantage of Nations* (1990). Macmillan, London.

⁴⁸ Ibid footnote 42.

products is to upgrade. It is not enough to be part of one of these global value chains just because costs are lower or even because these are appealing markets to developed clusters. In order to achieve a long-term competitive edge, it is important that companies in developing clusters of innovation master some processes or sub-products and make them better and more efficiently. That, ultimately, will lead them to move into more skilled activities.

The four types of upgrading that are described below can be achieved when entrepreneurs in developing clusters are able to insert in the value chain of companies in developed economies:

- *Process upgrading*: consists in transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology.
- *Product upgrading*: is moving into more sophisticated product lines in terms of increased unit values.
- *Functional upgrading*: consists in acquiring new, superior functions in the chain, such as design or marketing or abandoning existing low-value added functions to focus on higher value added activities.
- *Intersectorial upgrading*: applying the competence acquired in a particular function to move into a new sector.

Models like Carley's (1991)⁴⁹ are widely used because they allow to model why some agents are attracted to partners due to similarities in their respective knowledge. However, for the purposes of this thesis, I will refer to a different network model where a pair of partners are collaborating, but there is a clear difference in the level of knowledge that each member has: one is a high-tech company competing in a developed cluster whereas the other one there is a firm established in a developing

⁴⁹ Carley, Kathleen. A Theory of Group Stability. *American Sociological Review*. Vol. 56, No 3. (Jun. 1991), pp. 331-354

market, perhaps in the same industry but with a lower knowledge or degree of development.

The link between these two clusters extends internationally and may be relatively weak at a first stage, but as is pointed out by Cowan, Jonard, and Zimmermann (2007)⁵⁰, over time the link formation process results in an emerging structure representing an industrial network. The work of Cowan, et al. (2007) is paramount in the analysis presented here, considering that they address key issues that are relevant to understand the networks that govern collaboration between clusters. One is that they analyze the level of “decomposability”⁵¹ of the innovation process, which is critical to understand under what circumstances, for instance, a developing cluster can insert in the innovation process of a developed cluster. The other question addressed by the authors is “the relative importance of relational versus structural embeddedness in determining the probability of success of collaboration”. This is very relevant to understand whether a successful model of collaboration between the two kind of mentioned clusters should be based more on purely a relational advantage of some agents in both clusters or on the contrary, should be more structural.

In terms of the level of decomposability of the innovation process, the more decomposable it is, the higher the incentives for high-tech companies in developed clusters to find partners to work with, and in that sense I argue that the higher the likelihood for entrepreneurs in developing clusters to work in partnership with entrepreneurs in developed clusters. The partnership that ought to arise at a first stance is between two developed clusters of innovation. In other words, it seems no

⁵⁰ Cowan, Robin; Jonard, Nicolas; and Zimmermann, Jean-Benoit. Bilateral Collaboration and the Emergence of Innovation Networks. *Management Science*, Vol. 53, No. 7, Complex Systems (Jul. 2007), pp. 1051-1067.

⁵¹ Decomposability refers to the fact that the tasks can be decomposed into a small number of less complex sub problems, connected by a single structure, and independent enough to allow further work to proceed separately on each of them.

clear why a company in a developed cluster may have any incentive to work with a company in a developing cluster. However, given that the more two partners interact, the more they become similar and therefore the less complementarities they find, it is reasonable that developed clusters tend to find partners in developing clusters that participate in some steps of the value chain and at the same time, after the development of the developing cluster, increase the number of potential partners to interact with in the medium term. When dealing with collaboration between entrepreneurs in developed and underdeveloped clusters, the first thought is that their differences are so big that according to the theory of firm cooperation, there will not be enough pints to share and collaborate. However, as Cowan et al (2007) comment, there are situations in which firms that have nonstandard network positions do better, in terms of knowledge accumulation, than others. They conclude that this suggest that there are situations when firms should operate against what seems to be the natural tendency.

8.3. Framework for Collaboration Between Firms

As was mentioned previously, Latin American countries are devoting many efforts to develop industries that can be competitive in the global markets and therefore can add high value. With that objective in mind, some countries are trying to foster innovation that derives in the creation of high-tech companies. Here I have analyzed the importance that entrepreneurs creating such kind of companies in Latin America work as part of a cluster rather than isolated. However, clusters are not created out of nothing and cluster initiatives should only be attempted where clusters already exists⁵². It is clear that for a cluster to exist it has to pass the market test and in that sense it may seem hard to shorten the gap with clusters in developed economies. Here rests a big portion of the argument that I have presented so far: collaboration between innovation clusters in developed and developing economies would avoid the

⁵² Muro, Mark and Katz, Bruce. The New 'Cluster Moment': How Regional Innovation Clusters Can Foster the Next Economy. Metropolitan Policy Program at Brookings. September 2010.

requirement for a developing cluster to pass the market test. Being part of the supply chain of a developed cluster, companies in developing countries can understand what the trends in the market are and what the requirements necessary to make a product successful are. On the one hand, entrepreneurs in developing clusters working with their peers in developed clusters do not have to pass the market test, because it was already passed by latter, but on the other hand, can have access to new technologies and processes that can spring innovation in the developing cluster.

However, being part of the supply chain of a company in a developed cluster has to be complemented with “ownership collaboration”, and for that I refer to the possibility for companies in developing clusters to have participation in the results of the new venture in the developed cluster. This is important to align the interests of entrepreneurs in developing clusters with those of entrepreneurs in developed clusters. Moreover, this would help to forge a more sustainable relationship among these entrepreneurs. The topic of ownership-related incentives between developed and developing clusters is so complex and large that a whole thesis could be written on that. Herein I just want to highlight its importance.

8.4 Characteristics of Processes/Products That Lead to Partnership Among Firms in Different Clusters.

In general terms (but not so clear in partnerships between two firms or cluster of firms geographically separated with evident differences in the level of development), the foremost characteristic of a potential partnership is the *complementarity* between the two firms. This complementarity is bidirectional but different, though, for each of the two players. Whereas for the developing cluster complementarity means transfer of knowledge, for the developed cluster may signify cost reductions in the short term and the possibility of a tighter integration (including knowledge sharing in both directions) in the long run.

One source of information for companies that want to find partners is *referrals* from other firms. However, by default, here we are dealing with companies that want to become part of a world-class cluster but that still are not. In other words, this refers to companies that have not worked with each other in the past and therefore do not know each other. However, while it is true that referrals may not work well in the case of collaboration between developed and developing clusters, there exist ways to overcome this hurdle. For companies in developing clusters to be in the radar of companies in developed clusters, and therefore with the potential to become partners, a good starting point is to work with Universities or research centers close to or part of developed clusters. An example of this is the potential collaboration that may surge between companies in the Boston area and companies in developing clusters, if the latter are able to find ways to work with management students from any of the Universities placed in the developed cluster like MIT, Harvard, Boston University, Babson College, or Northeastern University, among others. One specific case of collaboration could arise between entrepreneurs in Latin America and the Global-Lab program at MIT Sloan School of Management, as is mentioned in more detail in chapter 7.3.

Decomposability is another factor that may lead to stronger collaboration between developed and developing clusters of innovation. Decomposability refers to the possibility to partition tasks between different players in a manufacturing process. Sobrero and Roberts (2001)⁵³ consider decomposability between a manufacturer and its suppliers. In this case I refer to decomposability as the level of partitioning of tasks between a developed and a developing cluster that are related to an innovation process or product. Cowan et al (2007)⁵⁴ analyze the effect of *decomposability* of the innovation process in the efficacy to find partners. They argue that “when

⁵³ Sobrero, Maurizio and Edward B. Roberts. The Trade-off Between Efficiency and Learning in Interorganizational Relationships for Product Development. *Management Science*, Vol. 47, No. 4. April 2001, pp. 493-511.

⁵⁴ Ibid footnote 50.

innovation is decomposable into separate subtasks, networks tend to be dense”. The main conclusion is that when the innovation process is more decomposable, the number of *acceptable partners* increases for the dominated firm. In this case a dominated firm refers to a firm that underperforms other in any type of knowledge. This conclusion is interesting because means that when the innovation process is more decomposable, it is more likely for a firm in a developing cluster to find a partner in a developed cluster.

In other words, as innovation becomes more separable (in other words, if the process can be separated into different parts), and as structural embeddedness becomes more important, firms can find more partners. This is especially relevant for the developing clusters because they should focus more on processes or products that are more separable and less on integrated ones, if they want to increase the probability to find a partner in a developed cluster to work with. Another reason that adds to this conclusion is that when the process is more decomposable, firms tend to be more generalists. However, specialization is still important and companies in developing clusters can provide that.

9. Case Studies: Greater Boston Area (developed cluster), Amsterdam (developed cluster) and Medellin (developing cluster)

There is one very well developed innovation cluster that will be considered in this case: the Greater Boston Area (GBA). Then there is one that is not as developed as the former, but is in the process to become a world-class cluster, in Amsterdam, Holland. And there is one innovation cluster developing in the city of Medellin, Colombia. I want to review who the main players are in these three clusters and how the city of Medellin could become an important player with these two developed clusters that ultimately would help this Latin American city to reach a higher level of development in its innovation cluster.

9.1. City of Medellin

The cluster of innovation in the city of Medellin is comprised by the local government, which is involved in promoting innovation both directly and indirectly through some other institutions that are linked to the central government like the utilities company (EPM⁵⁵) and the local telecom company (UNE⁵⁶). In order to promote innovation, the mayoralty of Medellin in conjunction with EPM and UNE created in 2009 Ruta-n, an institution aimed to promote the development of innovative businesses based on technology to foster competitiveness in the city and the region. Through Ruta-n the mayoralty of Medellin is creating a fund for innovation in the seed stage. The role of Ruta-n is to be the link among several institutions and generate capabilities of innovation, and through its fund, provide capital to develop some initiatives in the city. Ruta-n sponsors conferences and programs based on innovation.

In terms of accelerators and incubators there is still a long way to go in the cluster of the city of Medellin. The only efforts that have made some progress are Spacio, defined itself as an entrepreneurial center, and the Incubator of Companies in Antioquia⁵⁷. In terms of funds, the only VC focused on high-tech based in the city of Medellin is Progresia Capital, managed by Promotora. Capital Medellin, a recently-created VC fund with capital from the Mayoralty of Medellin, a local Family Compensation Fund and the Incubator of Companies in Antioquia, is dedicated to

⁵⁵ EPM for its initials in Spanish Empresas Publicas de Medellin. Medellin Utilities Company in English.

⁵⁶ UNE is part of the Group EPM. UNE is the telecommunications arm in EPM.

⁵⁷ Its name in Spanish is Incubadora de Empresas de Antioquia. This is part of the INFODEV program of the World Bank. INFODEV is intended to foster collaboration and exchange of best practices in entrepreneurship in more than 80 countries. Incubadora de Empresas de Antioquia is backed by the private sector (Nutresa, Suramericana, Argos, Leonisa, Grupo Mundial, Fundacion Corona, and Movistar Telefonica) and the public sector (Metro de Medellin – public massive transportation system -, and the National Coffee Growers Federation). Incubadora de Empresas de Antioquia helps SMEs in the Antioquia region through different phases: from elaboration of the business plan, to help with finding funding, to acceleration.

promote early-stage companies with an innovative business model, but is not constrained only to high-tech companies.

Universities are maybe the component of this innovation cluster that more are doing in generation of ideas. The Antioquia School of Engineering (EIA) counts with an innovation department and have a 7-month training program in innovation and entrepreneurship called Campus BT. EAFIT, another of the top tier Universities in the city created the CICE (Center for the Innovation, Consulting and Entrepreneurship), which is working with entrepreneurs to help them create new ventures. The University of Medellin is also contributing its part. They created the Center for Innovation and Entrepreneurship Development, which is focused on social innovation and projects related to high-tech. The University of Antioquia, one of the public Universities in the region, and perhaps the most important in the city of Medellin in terms of research and academic publications, is highly involved in promoting innovation and entrepreneurship jointly with the Mayoralty of Medellin, leveraging the capacity of the University to create ideas through research as well as through programs in areas related to entrepreneurship and innovation.

Exhibit 14. Map of the Innovation Ecosystem in the city of Medellin

	Quality of the Component		
	Good	Moderate	Poor
Ideas Generation			X
Acceleration			X
Incubation			X
VC Funds		X	
Network of Mentors		X	
Involvement of Local Government	X		
Universities		X	

Exhibit 14 shows a map of the innovation ecosystem in the city of Medellin, ranking the quality of each step and its contribution to the creation of new companies, from the point of view of its collaboration with other developed cluster of innovation. It is

remarkable how the local government has taken the leadership in these matters, above other participants like the private sector.

In terms of international collaboration, especially in aspects related to acceleration and incubation, it is remarkable the initiative adopted by multilateral institutions to help to develop clusters of innovation in emerging markets and particularly in Medellin. As was mentioned before, BizCorps is an initiative aimed to help SMEs in the city with funds mainly from the Latin American Development Bank (CAF) and is receiving support from Proantioquia, a non-for-profit organization founded to foster the development of Antioquia, in finding a set of small to medium sized entrepreneurs with high potential to grow their companies. BizCorps fits into the model of collaboration proposed here in the sense that it is working with MBA students from the most renowned Universities in the U.S. so that helping to spread out in developing economies the management thought and best practices they have learned during their studies.

Now let us analyze the innovation cluster in the city of Medellin, including an assessment of each of the local participants as well as an analysis of the different models of collaboration the city could pursue with developed clusters, using as a reference the model here proposed.

- Local government: Both the mayoralty of Medellin and the governorship of Antioquia⁵⁸ are highly committed to the creation of a cluster of innovation in the city of Medellin. The local government has established relations with other governments in developed clusters. For instance, the sign of the agreement between Colombia and Massachusetts opened the doors for the collaboration between the northeastern State in the U.S. and the city of Medellin. But also some companies partially or fully owned by

⁵⁸ Colombia's main administrative and political divisions are Departments (somehow equivalent to States in the U.S.). In turn, Municipalities comprise Departments. Antioquia is a Department and Medellin is a Municipality, which in turn is the capital city of Antioquia.

the municipality are having an active role in fostering innovation. The most notorious case is EPM through its participation in Ruta-n.

- Universities: There is almost no collaboration between universities in the city of Medellin and world-class universities in areas related to innovation. This may be the area where the cluster has to devote the majority of its efforts. In the framework of analysis mentioned in this research, it was mentioned that collaboration between clusters is a matrix where collaboration is given between similar institutions (government-government, university-university, etc.). However, given the low collaboration that universities have reached with their peers in developed clusters, the local government has tried to fill this gap, connecting directly with those universities. However, a better approach is to foster the creation of innovation centers in local universities, and then those universities should contact their peers in developed clusters. Certainly the local government has to be more committed with the public university, widening the scope of entrepreneurship and innovation at every level of the society.
- Entrepreneurs: At a national level the government of Colombia has created Innpulsa to foster innovation. At a local level the government of Antioquia has launched Ruta-n. These institutions are extending their scope to the promotion of many of the steps in the innovation funnel, from ideas generation to the creation of VC funds. The role taken by these governmental institutions is overlapping with the role that is expected to be taken by other participants like entrepreneurs. They are the ones called to develop their own networks that end up with the creation of accelerators, incubators, angel investors and VC funds.

It is always appealing for a government to promote innovation and entrepreneurship. It certainly is something that contributes to build up a good reputation among voters. However, if Universities and

entrepreneurs are not making substantial progress in establishing contacts with their peers in developed clusters, someone has to take over that role and in the case of Colombia, the national and local governments are the institutions that are taking the leadership in this area.

- Big Private Companies: Some linkages aimed at promoting clusters of innovation have been established between big private companies in Medellin and their peers in developed clusters, but those linkages are still very weak, though. Perhaps the most promising example is the creation of Amerigo, the VC funds setup by Spanish Telefonica described previously in chapter 3.2, where local companies like Bancolombia have participated. Certainly there are strong efforts that have to be deployed in order to foster collaboration in this critical step of the innovation funnel. The private sector in Medellin and Antioquia has helped in the creation of many of the institutions related to innovation and entrepreneurship in the region, contributing to position the city and the region as the hub for entrepreneurship and innovation in Colombia even over the capital city Bogota. Institutions and organizations like Proantioquia and Incubadora de Empresas de Antioquia are contributions of the private sector to the city in terms of innovation. However, the private sector in the region still has many things to contribute with for the development of the innovation cluster in the city, including its networks with other private companies in developed clusters where they are selling their products. Certainly this would be a valuable contribution to help local entrepreneurs to connect with and find new markets in developed clusters.

Along this work I have used Chile as the reference point for innovation in Latin America. Now I want to compare Colombia and particularly the city of Medellin with what Chile has done in terms of cluster development and consequently of

innovation. Based on the view of The Department of Energy, Science and Technology, and Innovation (DECYTI⁵⁹), attached to the Ministry of Foreign Affairs, this South American country decided firstly to develop the clusters where the country had a clear natural competitive advantage⁶⁰. Perhaps the most renowned is the Astronomy cluster, to the point that today Chile has 42% of the world's astronomical infrastructure. Chile's quality of skies caught the attention of astronomers around the world who became interested in deploying there the largest telescopes in the world. But this was not the only science-related cluster in Chile. For instance, this country also decided to invest in the infrastructure necessary for the study of the Antarctica. Others scientists got interested in headquartering in Chile in order to take advantage of the more than 6,000 kilometers of coast and study natural phenomena like tsunamis. All these clusters were built up using financial resources coming from the proceeds from the cluster generated around copper, Chile's most important natural resource. Once the sight of the scientific community turned to Chile to work in the mentioned fields, the government helped to create the connections and resources necessary to start developing other more technical clusters like LifeSci, ICT, green tech, and renewable energies.

This is a brief description of the strategy followed by Chile to foster innovation in the country, but yet is enough to identify a pattern like the one that was described in chapter 6.1, which is based on the use of existing clusters (second-generation clusters) to incentivize the creation of technological clusters (third-generation clusters), rather than thinking on starting an innovation in high-tech domains from scratch.

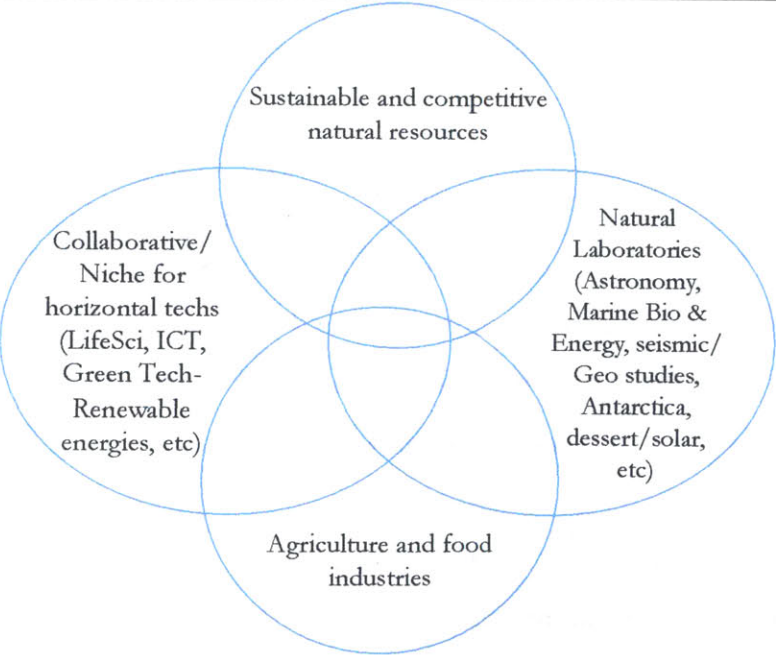
Should the city of Medellin decides to follow the same strategy, has to focus on how to convert its most competitive and value adding cluster into a world-class cluster and from that point, start building up the new generation of clusters, with more technological content. The cluster of fashion and textiles was already mentioned in

⁵⁹ DECYTI for its acronym in Spanish Departamento de Energia, Ciencia y Tecnologia e Innovacion.

⁶⁰ See DECYTI, Bulletin 6, April 2012.

this paper, but it is important to bring it back because is the best-articulated cluster in the city with a big international component (mainly through exports) and is already positioned in the world markets. Like Chile, Medellin has the possibility (and actually is doing it) to develop a cluster of medical treatments related to beauty. After that, a cluster of medicine in general may follow, emphasizing the creation of centers devoted to the research in that area. This in fact may play the same role that Astronomy, Antarctica and Oceanography played in Chile, acting as anchors to attract scientists and researchers around the world in related fields. In the case of Medellin, the eventual development of a cluster in medicine would help in the creation of clusters related to medical devices, biomedicine and perhaps others like surgical instruments, imaging, etc. Around these potential new high-tech clusters the city can start to develop collaboration with developed clusters like the one established in the city of Boston, home of one of the best medicines in the world.

Exhibit 15. Most Developed Clusters in Chile



Source: Chile, an innovation hub in Latin America by CORFO

It is important to bring to the analysis these three regions because Amsterdam could be seen as a reflex of how Medellin could evolve in its aspirations to become a cluster of innovation. Moreover, it would be critical for this purpose if there could exist a link between these two cities able to channel the progress reached in Amsterdam toward the city of Medellin. In other words, it would be critical that the links created between the cluster in Amsterdam and the cluster in the Greater Boston Area can be extended to reach the city of Medellin. There are already some efforts aimed at bonding the connections between the GBA cluster, especially in MIT, and the Amsterdam cluster. The city of Medellin could leverage its efforts to create an innovation cluster becoming part of this triad. The benefits obtained from this collaboration will flow in both directions. For the GBA cluster, collaborating with the other two clusters mean the possibility for universities and research centers to expand the number of projects to work on and for companies to increase their markets, especially in the rapidly growing Colombian economy. Collaboration between Amsterdam and Medellin may even start with, but not restricted to, collaboration between their textiles, fabrics, and fashion clusters where both cities have had presence for many years. Collaboration in this economic sector would help to strengthen the links between the two cities but also collaboration may start in more technological sectors. In this model of collaboration, each player has to develop its role, avoiding the over participation of the governments.

Summarizing, Colombia, and particularly the city of Medellin are devoting a lot of efforts to build up a truly innovation ecosystem. However, the majority of these efforts are not well connected to each other and the result is that there is no general consensus about where to focus on the efforts or how to position the advantages that the country and the city have. It is clear that the city authorities want to position Medellin as a leader in technology, but the question still floating in the air is what kind of technologies. What are the benchmarks? Ruta-n and EPM are promoting the creation of a VC fund, which will add to the efforts already undertaken by

Promotora de Proyectos in the development of a VC industry in the city. But how to have a VC industry without material progresses in the early stages, namely, ideas generation, acceleration and incubation? This lack of synchronization demands the presence of a “coordinating device”, an entity, organization, or simply a common interest, able to take the flags of change and become the point of reference for everyone interested in contributing to the development of the cluster of innovation. For the city of Medellin, a model of collaboration that includes the GBA (especially MIT) and Amsterdam have the potential to become the coordinating device able to mobilize the most critical participants towards the common goal of converting Medellin into the hub of innovation not only in the country but also in Latin America.

9.2. Greater Boston Area (GBA)

The Greater Boston Area is perhaps the second largest innovation ecosystem in the world, after Silicon Valley. There are many participants in each of the steps involved in the development of an innovation, even though not all of them are aimed at helping to promote innovation in other geographies. Following there is a summary of some of the most important participants in each process, from the generation of ideas to the large VC funds. Those that are interested only in being local players are marked with an L and those with a global scope that eventually can help to build innovation clusters in other places of the world are marked with a G.

a. Generation of Ideas

- MassChallenge (L): This is a non-profit startup competition that has become the largest startup competition and accelerator in the world.
- MIT \$100K Competition (L): this is a year-long series of events that consists of three contests focused on different skill sets from idea generation to a full business plan: the Elevator Pitch Contest, the Executive Summary Contest, and the Business Plan Contest.

- IDEAS Boston (L): Its mission is to promote innovation and contribute to the economic vitality and competitiveness of the region. IDEAS Boston organizes conferences where entrepreneurs can share ideas and cutting-edge thinkers across sectors are connected. It helps to build the region's brand.
- Boston World Partnerships (G): created by the Mayoralty of Boston to help business leaders around the world understand and access Boston's competitive advantage.

b. Accelerators and Incubators

- The MIT Regional Entrepreneurship Acceleration Program – REAP (G). This is one of the most global of all the participants in the region. REAP is a 2-year program that promotes economic development and prosperity across the globe through team-based collaboration, education, and a data-driven approach. REAP is aimed to promote innovation-based entrepreneurship globally. In REAP entrepreneurs can learn from the expertise and knowledge that MIT has of the Cambridge/Boston ecosystem. It is a cross-region model of collaboration among entrepreneurs.
- Harvard Innovation Lab (L): this lab intends to foster team-based and entrepreneurial activities among Harvard students, faculty, entrepreneurs, and members of the Allston and Greater Boston community.
- Babson Venture Accelerator (L): established at Babson College to support and advance student entrepreneurs.
- Betaspring (L): It is a 12-week acceleration program for technology and design entrepreneurs who are ready to build a product, and launch a company.

- CriticalMass (L): this provides early-stage entrepreneurs with a place to work, learn, collaborate and start new companies.
- Dogpatch Labs (L): It offers desk space, bandwidth, coffee, and lunch to aspiring entrepreneurs for a maximum of six months.
- Cambridge Innovation Center – CIC (L): CIC offers startup and emerging companies, very good facilities and technical services in a package designed to meet the needs of small and growing businesses.

c. Angel Investment

- Angel Capital Association (L): Is the trade association of leading angel investment groups in North America. Provides its members with investments and angel group operational best practices, and opportunities for networking, syndication and collaboration.
- Angel Capital Education Foundation (L): this foundation is devoted to education and research in the field of angel investing.

d. Venture Capital Funds

There are more than 100 VC funds in the Greater Boston Area, many of them specialized in technology, whether it is Biotech, Internet, Media, Digital or Clean Energy. Some others are specialized by type of investment: seed, early or growth. As of 2012 these funds were funding around 4,000 companies, almost all of them in the United States. Only a few of them invest in Emerging Markets and none in Latin America. I consider that the funds that already invest globally are more prone to collaborate with less developed clusters around the world, especially in Latin America, because in their mindset is imprinted the gene of internationalization and as has been argued here, internationalization is a condition to collaboration between developed

and developing clusters of innovation. Some of the VC funds in the Greater Boston Area that invest globally are:

- Argo Global Capital
- Bessemer Venture Partners
- Cedar Fund
- Founder Collective

The case of Cedar Fund is quite interesting because it is based in Israel as well as in Boston, but invests only in Israel-related companies in the sectors of enterprise software, Internet, mobile, digital media, CleanTech, networking and telecommunications. This is important to remark the investment strategy of a fund like this, because is precisely the kind of fund that represents a collaborative model between two regions. Any VC fund that embarks collaboration between an innovation cluster in a developed country and one in a developing cluster must have a similar structure, whether are investors from the developed cluster setting up a VC fund with investments in companies in a developing country, or preferably like Cedar Fund, a VC fund with capital from a country in Latin America, set up in a developed cluster (e.g. Boston), investing mostly in companies in the emerging economy but also eventually in companies placed in the developed country. That way the GPs of the fund can be in permanent contact with the actors in the developed cluster, helping to develop the ideas originated in Latin America.

9.3. Amsterdam, Holland

Among the players in the innovation cluster in Amsterdam are:

- **Amsterdam Innovation Motor (AIM)**: this is an institution working to increase the capacity for innovation in the Amsterdam area. AIM invests in all stages of the innovation process, backing new ideas and supporting

new ventures that stimulate entrepreneurship. One important feature of the AIM is that it aims at innovation, cooperation and new activities in the following sectors: Creative Industry, Information and Communication Technology (ICT) and New Media, Life Sciences, Sustainability, and Trade and Logistics. There is a whole cluster around ICT activities, which includes ICT companies, research institutions and governments.

- **Science Park Amsterdam**, currently accommodating 10 startups, it is a facility dedicated to scientific research, IT and Life Sciences and is also home of the University of Amsterdam faculty of Science.
- **Rockstart Accelerator**: this program provides up to \$15,000 in funding, six months of office space, around 100 mentors and a 1-month Silicon Valley Program. Rockstart Accelerator represents another example of the kind of component of an innovation cluster that is aimed at fostering collaboration between clusters. This program is open to worldwide entrepreneurs. For startups in Latin America this is a good opportunity to get in contact with other companies from around the globe, therefore helping these entrepreneurs to compete in the world leagues. The one-month program in Silicon Valley is also crucial because the CEOs of the companies in the program can have the opportunity to work with other entrepreneurs and investors from what can be the most competitive innovation cluster in the world.
- **Startup Bootcamp** is a European accelerator with offices in Haifa, Amsterdam, Dublin, Berlin, and Copenhagen. This is another good example of cluster collaboration, even though there is no participation of any emerging economy. Under this model, a global network of mentors and advisors work closely with entrepreneurs in all of these countries, helping to spread out good management practices and connecting them with markets in Europe.

- **The Ecocluster Amsterdam.** It is another good example of a developed cluster, which includes energy, waste, mobility, creative industry, IT, and materials. The energy group is working to develop renewable energy solutions. The Waste cluster is looking for new ways to handle waste and improve the amount of waste that is recycled. The Water group is promoting drinking tap water instead of bottled water as a way to avoid the production of plastic bottles. Regarding Mobility, the city is working on electric transportation. According to the expectations for the city, “by 2040 the city of Amsterdam expects that almost all cars in the city will be electric vehicles, powered by renewable electricity”. Creative Industry refers mainly to cluster of the fashion industry in Amsterdam, which includes the utilization of sustainable fabrics and recycled materials like old bike tires to make bags, or creating clothes also from recycled materials. In IT, Amsterdam is creating a cluster called Green IT Program, which is aimed at exploring the use of sustainable energy sources and improve energy efficiency in houses and offices. The Materials cluster is working on the development of new materials to be used in the future.

The Ecocluster Amsterdam collaborates with other clusters in Europe and with some others in the rest of the world. However, there is no a systematic collaboration between Ecocluster Amsterdam and clusters in Latin America.

- **AmsterdamPark Capital (APC):** is a Dutch independent privately-held entrepreneurial family-office investor. APC makes early-stage technology related investments and participations in a select few revenue generating companies. APC provides growth capital and management services to guide companies and individuals to take their products and ambitions to next levels.

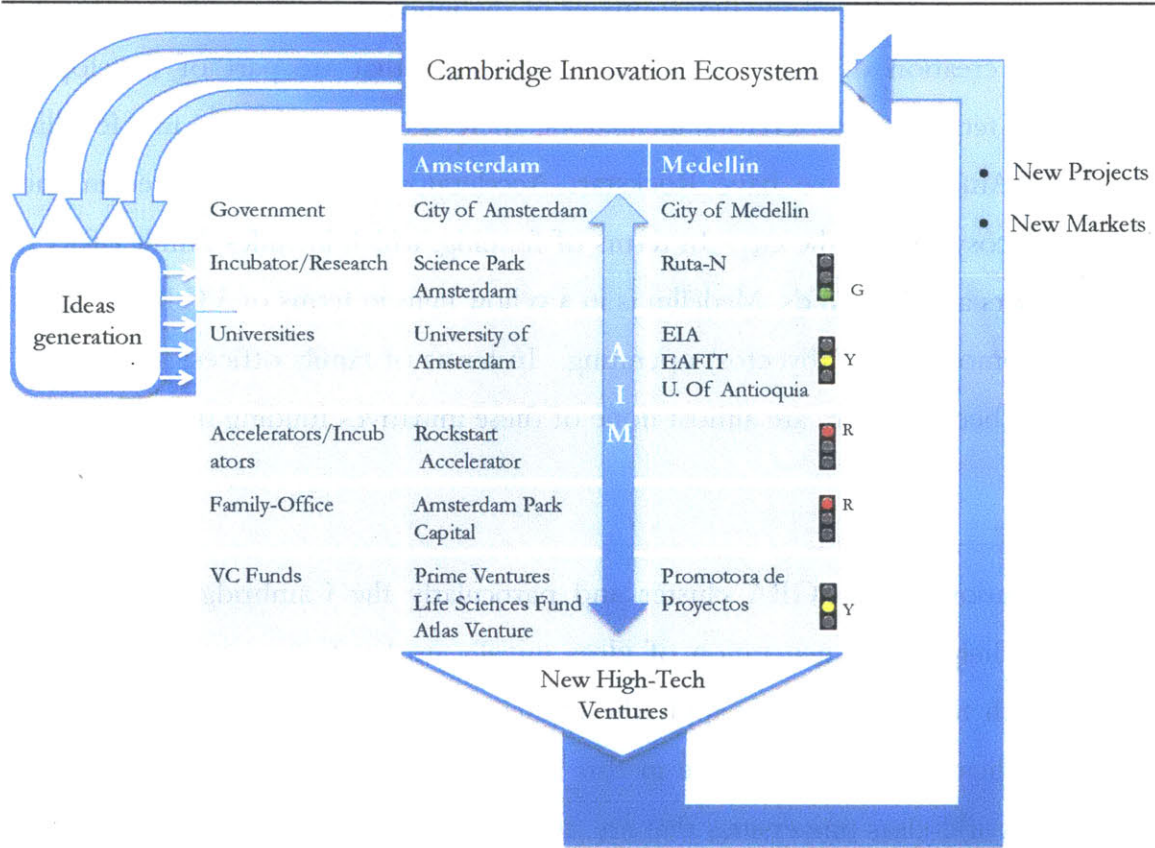
- **Prime Ventures**: this is a venture capital and growth equity firm focusing on investing in European companies in the technology and related industries trying to make them global competitors.
- **Life Sciences Fund Amsterdam**: The Life Sciences Fund Amsterdam is an independent venture capital fund focusing on early stage companies and (university) spin-outs in the biotechnology and biomedical field with a presence in the Amsterdam Metropolitan Area
- **Atlas Venture**: This VC fund invests in the earliest stages of technology and life sciences innovation.

9.4. Collaboration Among the Three Clusters

Collaboration between Amsterdam and Medellin would help to create truly global companies since their inception. During its first stages, collaboration between these two diverse cities should help Medellin to fill in the gap that is separating the city from its goal of becoming a complete innovation ecosystem. The governments in the region of Antioquia and the city of Medellin have been committed to innovation and education since a while ago, achieving some successes in the formation of new companies, even though not in the high-tech space. The city is also known for having a strong entrepreneurial bias among its citizens, but yet no world-class companies have emerged and it seems the city is still far from that goal. There are certainly many leads to work on before having a developed innovation cluster, as has been touched throughout this thesis. However, one of the most important aspects that are not allowing unleashing that entrepreneurial revolution in the city is the lack of global thinking among its citizens. Entrepreneurs have to learn that their market is not the city of Medellin, and not even Colombia. Their market is global and they have to startups their companies prepared to compete in an international environment.

However, to reach out that objective it is important that participants in the city like the private sector have a more active participation. So far the initiative to develop an innovation ecosystem has come mainly from the government but the private sector is who has to lead the efforts to develop a sustainable ecosystem that could be attractive to other innovation clusters around the world, in this case to Amsterdam and Cambridge.

Exhibit 16. A Comparison of Clusters in Medellin and Amsterdam



Amsterdam is placed in between Cambridge and Medellin in terms of the development of its innovation ecosystem. With the creation of Ruta-n, Medellin counts with a good incubator and research center, even though this is a job that should preferably be conducted by private companies. However, some other steps already taken by the city of Amsterdam are suited to be implemented in the short

term in Medellin, which would greatly help to develop its cluster of innovation. For instance the Latin American city requires an initiative like Amsterdam's AIM that helps to coordinate the efforts of the different actors.

The Universities in the city of Medellin are just starting their efforts to have an entrepreneurship practice and in that regard have many things to learn from the University of Amsterdam, which is leading the innovation ecosystem in Amsterdam. I have assigned a yellow light to Medellin in terms of its Universities, hoping for them to be more committed with the development of the innovation ecosystem, especially through the creation of links with other Universities that are part of developed clusters. In terms of accelerators/incubators, there is almost nothing in Medellin whereas in Amsterdam we have Rockstart Accelerator, also a key player in the innovation ecosystem of the city. In terms of funding, which includes family offices, angel investors and VC funds, Medellin is in a yellow light in terms of VC funds, with just one (Promotora de Proyectos) operating. In terms of family offices, Medellin is in a red light because there are almost none of these initiatives funding new high-tech ventures.

The contribution of the GBA cluster and particularly the Cambridge innovation cluster is to help in the generation of ideas initially in Amsterdam and later on in Medellin, with the possibility to apply the model in other developing clusters. The Cambridge cluster would participate in this stage mainly through centers in one or some of its world-class universities that are devoted to the development of new ideas and turn them into new companies. In this category we can include the MIT Media Lab and the MIT Center for Entrepreneurship. In a model of bidirectional collaboration like the ones proposed here, these Labs could benefit from the creation of strong bonds with big companies in the other two clusters, which can expand their operations in those rapidly growing economies. The developing cluster could benefit because collaboration with these high-level Labs implies the participation of local

researchers or developers, who would be exposed to the technological knowledge and in some degree to other nodes within the developed cluster of innovation, which ultimately will help to the formation of a highly qualified local group of innovators with the potential to expand the scope of the cluster and create new companies.

10. Conclusions

Collaboration between developed and developing clusters of innovation has to be considered by the formers as a strategic tool to reach even higher levels of development, through the expansion of markets, the possibility to explore new technologies, reduce cost and expand their network. Once this ecosystem reach certain degree of development, the links created between the developed cluster and the developing cluster are very strong and the developed cluster would become a reference point for the entire developing cluster.

Collaboration in turn is the most effective way for emerging clusters to produce world-class high-tech companies. Through collaboration developing clusters can nurture from the experience, best management practices, new technologies and access to markets from developed clusters. All this knowledge, experiences and contacts imprinted in startups in developing clusters would generate companies that since their inception have a global mindset, prepared to compete in the sophisticated developed markets where their partners in developed clusters are used to competing.

Even though collaboration may produce enormous benefits for both, developed and developing clusters of innovation, this is not a spontaneous process. There has to be incentives for the establishment of a network of collaboration. This is the role of government, Universities and big private sector to create the incentives, especially in the developing cluster, to be appealing to a developed cluster. These incentives include the development of a world-class generation of researchers and academics,

able to develop new ideas and also the creation of the conditions necessary to transform those ideas into startups. And the best way to create those conditions involves collaboration with similar institutions across clusters. In other words, governments able to establish networks of collaboration between governments in developed clusters, or big private companies able to contribute with funding and international contacts for entrepreneurs in the developing cluster or entrepreneurs able to collaborate with their peers in developed clusters, have the highest chances to produce successful developing clusters, able to grow and work jointly with other players in developed clusters.

A key element in this model of collaboration is how to create the conditions in a developing cluster to become appealing to a developed cluster. One way to reach that goal is to work with other clusters that are midway between developed and developing clusters. In this relies the model of collaboration proposed for the city of Medellin in Colombia and the city of Amsterdam in Holland. For the former it would be its gateway entrance to the sophisticated markets in Europe and access to new and promising technologies. For the latter this collaboration would represent access of its companies to the growing Latin American markets and also access to different technologies and/or applications of existing technologies. Once the proposed linkages between Medellin and Amsterdam are well developed, the Latin American city can insert into the linkages that can develop between Amsterdam and MIT. For the Institute being part of a structure of collaboration like this is rewarding because can give access to new ideas, new markets and new perspectives from two distinct reference points, the European market and the Latin American market.

Another argument that has to do with the fact that collaboration is not a spontaneous process is the model here proposed of cluster evolution, where even high-tech clusters in emerging economies are created out of existing, less-developed clusters. This is what I called here the three-generation types of clusters. A first generation,

comprised by very basic clusters, based on primary products (commodities), where collaboration with similar clusters in developed economies is nonexistent; the second generation of clusters, which may spring out of the first-generation clusters. The second-generation clusters are adding more technological value to the products related to the production process of the first-generation clusters. Finally we have the third generation of clusters, where high-technological companies may arise, especially in sectors that are somehow related to the second-generation clusters. These second-generation clusters are able to establish networks with developed clusters, and the third-generation clusters have to be able to elaborate on those relationships to establish their own networks.

Finally, collaboration between developed and developing clusters has to include all the different components of the innovation ecosystem, including organizations devoted to the generation of new ideas, Accelerators, Incubators, Venture Capital funds and operating startups. There are many of these players that are designed to work more on a local basis and are not suited to collaborate with developing clusters in a cross-border relationship. Nevertheless, some others have a strong international component and those are the ones more likely to collaborate with developing clusters. Further ideas to complement the content of this thesis have to be developed in areas related to regulation and additional roles that can be undertaken by some of the players in an innovation ecosystem. A proper regulation is crucial in developing clusters to help to generate confidence in developing clusters. As part of a new regulation, the issue of intellectual property rights has to be addressed. An open collaboration demands that entrepreneurs and investors on both sides of the line feel confident to allocate resources and incorporate companies in the country of the developing cluster. I have also mentioned several aspects that are fundamental to develop a cluster of innovation, some of which require a more detailed analysis. Aspects to revisit include how Universities in developing clusters can follow the example that Northeastern University did with WCCP to develop new and stronger

bonds with participants in a developed cluster of innovation. Along this thesis I explained some of the benefits presented to developed clusters when they collaborate with their peers in developing clusters. However, this is a very extensive field that is open to much more research. One of the main arguments pointed out here has to do with why it may not be a reasonable strategy for developing clusters to target directly clusters like Boston or San Francisco. It was argued that appointing clusters that are halfway to become world-class clusters like Amsterdam (Boulder, CO is another good example) is a more effective strategy for developing clusters to approach the highly developed clusters mentioned above. Finally, in chapter 8 I touched on the topic of ownership in companies created in developing clusters by entrepreneurs from a developed cluster. Specifically the argument was that ownership participation to entrepreneurs in developing clusters would help to align interests with those of entrepreneurs in developed clusters. However, much more research has to be done to analyze the best models of “ownership collaboration” that can generate long-term relations between entrepreneurs in these two types of clusters.