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ROLES, VALUES, AND SOCIAL DYNAMICS
A new model to describe and understand economic ecosystems

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BRIEF DESCRIPTION

This paper presents a new approach, based on social and business sciences, to describe and model the complex dynamics of interaction between the actors of an economic ecosystem, focusing on entrepreneurial ecosystems in particular. It enables the identification of the types of actors that constitute such an ecosystem, the roles they play, and the value they contribute to the ecosystem's strengthening.

The description can be used by organizations, public policymakers and entrepreneurs, among other types of actors, in order to intervene strategically and contribute to the development of the ecosystem itself.

Written by Marcelo S. Tedesco
In collaboration with Tania Serrano,
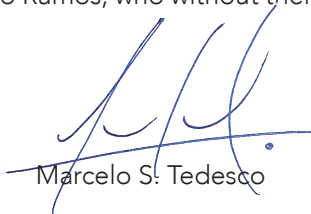Contributions by Francisco Ramos and Guadalupe Fabre
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CONTENT

INTRODUCTION

Knoweldge of the history of a place provides a starting point for understanding the social reality that exists in that place, but often we need more precise and empirical analysis in order to develop truly innovative solutions to the challenges that are faced. With this in mind, for years, it has been suggested to approach social reality as if it were an ecosystem, given that it is a natural description and that it has been relatively easy to establish analogies between biology and human behavior; including its different actors and, of course, its environmental conditions. At the same time, many years ago we began to understand the impact social ecosystems have over the terrestrial ecosystem. Social systems are complex and adaptive (Marten, G. 2001), complex as many parts and many connections conform and take place within them; and adaptive as their feedback structure allows them to change in ways that promote survival in a fluctuating environment[1].

In this sense, some academics have a adopted a life sciences approach that allows stakeholders to understand the functioning of their own environment. There's a lot of work surrounding this, principally on the economic arena and its effects on development. For some years diverse authors have focused on understanding and explaining the behavior of these social systems —particularly in what refers to entrepreneurship— on understanding the systems of actors that interact in a rapidly evolving political, economic, physical, and cultural environments (Bloom and Dees, 2008).

As ecosystems grow, they develop a higher degree of complexity resulting from the integration of new actors and social dynamics. This process generates challenges, such as the need to bring together the members of the environment, to create fast and effective communication channels, and to identify areas of opportunity within the ecosystem. Entrepreneurs face overwhelming challenges as well while attempting to position themselves within this complex network of interactions in search of structural support for their ventures.

José Pacheco, Co-Director of the Master's in Advanced Manufacturing and Design at MIT and Founder and Chair of the MIT Enterprise Forum Mexico, usually draws on an axiomatic phrase, "if you want to be part of an ecosystem, you need to contribute to it"[2]. The question that follows this axiom is: Why should we be part of an economic ecosystem? As Hoffecker responds in an article published at Stanford Social Innovation Review[3]: because certain kinds of ecosystems, such as innovation ecosystems, provide benefits to their members and to society that individuals alone cannot produce.

In other words, those within an entrepreneurship ecosystem are also within a society that contains it, so we as intellectuals, academics, leaders, organizations, or entrepreneurs are the main beneficiaries of cultivating our own ecosystems.

The benefits of mature and solid entrepreneurship ecosystems have been addressed by different authors, from Moore (1993), Porter (2000), Bloom and Dees (2008), Gradl and Jenkins (2011), Hoffecker (2018), or Leitão, Alves, Krueger, and Park (2018). Regarding entrepreneurship ecosystems, the available literature focuses mainly on the role of the entrepreneur and its needs. This ultimately answers to the fact that the entrepreneur constitutes the dynamizing motor of an ecosystem. In the same way, there's a vast body of literature on the necessary conditions for entrepreneurship to successfully emerge.

However, very little has been written about the organizations that constitute the central structure of an economic ecosystem, including the entrepreneurship ecosystem, and even less about the role that each of these organizations should undertake within their ecosystems, the value they contribute, and the social dynamics among them that consequently propitiate the possibility of growth of a mature ecosystem.

[1]Marten, G. (2001). *Human Ecology, Basic Concepts for Sustainable Development.* New York, NY: Earthscan
[2]Serrano, T. y Tedesco, M. S. (2018). *Oaxaca, Tierra Fértil para la Innovación* (Documental). Oaxaca, OAX: MITEF México.
[3]Hoffecker, E. (2018). *Why Cultivating Your Innovation Ecosystem Is Worth the Work.* Stanford, CA: Stanford Social Innovation Review.

This essay seeks to contribute to these last three conditions, from the perspectives of both sociology and the business sciences, presenting a new way, including a visual model, that allows us to describe and understand ecosystems from the role that each actor must play and the value each of them brings to the ecosystem.

In this way, we focus on three main sections:

Ecosystems This term has become almost a buzz-word worldwide. However, it has become part of the common lexicon of entrepreneurship without stopping to think about what it means, its origins and its components. The essay will cover different definitions and will make the distinctions we have considered relevant between different types of economic ecosystems.

Existing Models In the spirit of contributing to understanding and clarification, universities and private organizations have made significant efforts in order to create models and frameworks of reference so we can understand current and future needs. In this essay, the reader will find the best-known models used at the moment as a reference to the work done. However, we'll also focus on differentiating between two main approaches: the *sectors-based* approach known as the triple or quadruple helix and the *actors-based* approach.

Model of Roles and Values Having its origin in the actors based approach, we develop a framework that deepens on the analysis of the actions and the products of the work of the organizations that compose an economic ecosystem. We describe the origin of this model, its inspiration, its theorization, its mathematical validity —something not usually found in other model proposals— and empirical validations and finally in the results that can be found in reality at the time of mapping, not only the actors of an ecosystem, but also the social dynamics that take place among them.

The dissemination and democratization of entrepreneurship can result not only in more developed economies but also in freer people, enabling them to create and develop innovation in a durable and sustainable way. But in order to bring forth the economic benefits that can be achieved through local entrepreneurial development, it is necessary, as Pacheco points out, to contribute to that ecosystem. However, as with any game[4], it's not possible to contribute to the ecosystem if we don´t know the role we play in it. Nor is it possible to develop efficient strategies without knowing not only our role, but also the role of all the actors that make up the ecosystem. This hypothesis is framed both within game theory[5] and in the new proposals of organizational strategy[6]. Both fields have provided sufficient studies and evidence to understand that knowledge on the role and needs of players or stakeholders (actors in both cases) is essential to create joint and integral strategies that allow for the development of an ecosystem and, consequently, the social and economic growth of its community. However, the role and value produced by each actor is a field yet to be addressed in pursuit of the understanding of economic ecosystems and more specifically of entrepreneurship ecosystems. Here lies the focus of the essay, as a proposal to build knowledge that permits finding more precise ways to understand and support the development of entrepreneurial ecosystems, through collaboration as the central axis of any healthy and sustainable social dynamic.

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[4][From the point of view of sociology] "The advantage of game theory lies in that it analyzes decision-making in a context characteristic of many social phenomena: situations in which the result of the actions of each decision-maker depends crucially on the actions of other decision-makers. In a game, there is a set of "players" involved in such a situation that the result obtained by each one of them depends not only on their own decisions but on the decisions of all the others. Since the decisions of other players, acting according to their own wishes, influence in the result of a player's actions, this must consider the wishes of those players when making his decisions. These strategic interactions are important in many social problems" Fernández Ruiz, J. (2004). *Game theory in the social sciences. Sociological Studies*, Vol. 22, No. 66. P 625. Mexico City, CDMX: El Colegio de México.

[5]5Shubik, M. (1984). *Game Theory in the Social Sciences, Vol. 1: Concepts and Solutions*. Cambridge, MA: MIT Press. Shubik, M. (1987). *A Game-Theoretic Approach to Political Economy (Game Theory in the Social Sciences, Volume 2)*. Cambridge, MA: MIT Press.

[6]6Porter, M. Kramer, M.R. (2011). *Creating Shared Value*. Boston, MA: Harvard Business Review.
Porter, M. (2012). *Strategic relationships between companies and society, Spotlight (Interview)*. New York, NY: World of Business Ideas,
Tedesco, M. S. (2011). *For what businesses exist*. Mexico City, CDMX: World of Business Ideas.

In the words of MIT professors, Nightingale and Srinivasan, "All stakeholders must be satisfied enough to want to continue collaborating."[7]

ECONOMIC ECOSYSTEMS

Before moving forward with any model, we first need to understand what an economic ecosystem is and why it is important. In 1980, a group of European and American academics founded a new discipline called Ecological Economy, which studied the interdependence and evolution of the human economy and natural ecosystems, while treating the economy as a subsystem of the Earth's[8] entire ecosystem. This puts in perspective not only the importance of treating human-social activities as an ecosystem in itself but also the effect they have on nature. Indeed, the impacts of human intervention over biological ecosystems cannot be understood without first studying social dynamics as ecosystems. Although we don't fully explore these implications, as it is not the objective of this essay, it must be clear that all human, or organizational, interactions have a real impact beyond the socio-economic domain.

With this in mind, all economic activities can thus be described as a system, and when these system organizations get in contact with individuals and other tangible and intangible elements, we encounter an eco-system. This definition is an allusion to the terrestrial ecosystem, defined as a biological system made up of a community of living beings and the natural environment they inhabit. A biological ecosystem can be as small as a fish tank or as large as the sea; the same applies to social ecosystems. In the same vein, we know that all sub-ecosystems, regardless of their type, interact between them.

The level of impact these sub-ecosystems have over other sub-ecosystems, and over both the complete economic and biological ecosystems, will depend on the level of connection and influence between them.

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[7]Nightingale, D. Srinivasan S. (2011). *Beyond the Lean Revolution: Achieving Successful and Sustainable Enterprise Transformation*. New York, NY: AMACON.
[8]Xepapadeas, A. (2008). *Ecological economics. The New Palgrave Dictionary of Economics 2nd Edition*. New York: Palgrave MacMillan.

Illustration 1. Ecosystems Integration Model
Marcelo Tedesco, based on the Concept of Ecological Economy

Similarly, each sub-ecosystem is inhabited by the ecosystems of the entrepreneur, executive, or innovator themselves. Let's call them *economic units of value*, notwithstanding the organizations that give structure to the ecosystem, its culture, or public policy preferences. At the same time, these businesses/organizations, that don't exist either for nor after the ecosystem, interact with economic units of value for their own purposes as shown in the illustration below.

Perhaps the most important thing to recognize from this concatenation of ecosystems is the fact that they all interact and are positively or negatively affected by the actions of one another, depending, as mentioned above, on the level of interaction and influence; with the results of that impact displayed over the social and terrestrial ecosystem that contains us all.

Regarding the different sub-ecosystems within the economic ecosystem, Moore was the first to refer to one of these, alluding to the business ecosystems; for which he provided the following definition:
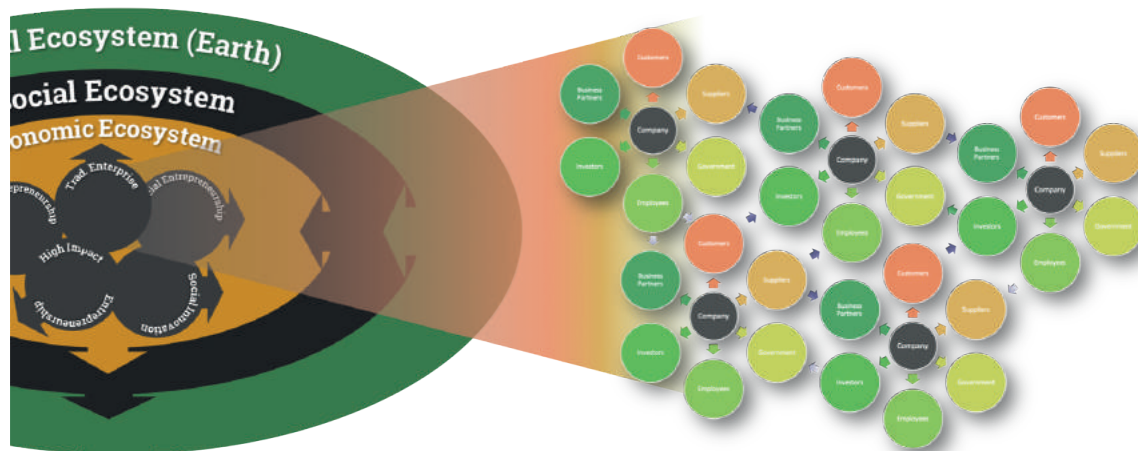

Illustration 2. Model for the Integration of Socioeconomic Ecosystems and Individual Ecosystems (Stakeholders)
Marcelo Tedesco, based on the concept of Ecological Economy

An economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles. [9]

From this definition, any other sub-ecosystem can be addressed. However, it is important to recognize that the processes and resulting products of an ecosystem may vary from one to the other. As a result of this, the differences between diverse types of ecosystems are often misunderstood.

Perhaps the most common example of this confusion lies in the differentiation between innovation ecosystems and entrepreneurship ecosystems. Although there is a tendency to think they are the same —while terms such as "innovation and entrepreneurship" are jointly used—, the products of each of them are different and the processes of innovation and entrepreneurship are not the same. Putting it in simple terms, everything that refers to entrepreneurship regardless of addendums: *high impact, innovation-driven, scientific, social, etc.* stems from business-economic theories and is analyzed from that perspective, while innovation by itself comes from a process and a series of entirely different studies[10.]

Entrepreneurship produces a tangible economic good (including services), while innovation does not hold that objective. Therefore, they cannot be approached from the same perspective.

Concerning the second term, it's Elizabeth Hoffecker who has most clearly addressed the concept of innovation ecosystems through her research in different parts of the world.

The "Local Innovation Ecosystem" is described by Elizabeth Hoffecker as "a community of interconnected actors, based on a specific place, that interact in order to create innovation and support innovation processes along with the infrastructure and enabling environment that helps them develop and disseminate solutions to local challenges."

From a practical point of view, this definition does not vary much from the one concerning entrepreneurship ecosystems, it's simply necessary to bear in mind that the research and bibliography set for each of them is different. In that sense, the products of innovation and entrepreneurship are different in economic terms, although not necessarily in social terms.

This last concept comes from the idea that the final objective of any business must be to produce value for society (understanding it as all its interest groups as a whole), just as the purpose of innovation must be to create yet another type of value for society, alas value at last. This concept allows, in practice and from the perspective of either ecosystem or public policy decision-makers, to use models that are found in different domains.

At the same time, Hoffecker proposes one of the most complete ecosystem models that has been developed to date. The reason being that not only does it take as its basis the best currently available literature, but also her research and field practice. One of Hoffecker's most interesting contributions is the inclusion of natural resources as part of the innovation ecosystem (in her case), being equally interesting in practice for entrepreneurial ecosystems.

[9]Moore, J. (1996). *La muerte de la competencia: liderazgo y estrategia en la edad de los ecosistemas de negocios.* Nueva York, NY: Harper Business.
[10]Hoffecker, E. (2019). *Understanding Innovation Ecosystems: A Framework for Joint Analysis and Action.* Cambridge, MA: MIT D-Lab.

It is not possible to separate the impact of human activities on their social ecosystems from their biological context. As stated by Ecological Economy, we are part of a much larger ecosystem called Earth.

In addition to identifying the natural environment as an inalienable resource to ecosystems, the model also highlights four key resource types and three components of the enabling environment that constitute integral elements of the ecosystem.

Each of the components identified by Hoffecker exists and interacts in complex ways to produce results; which can be diverse, controlled, collateral, or intentional, either with a specific purpose or as an unconscious consequence of the dynamics themselves.

For the purposes of this essay, as well as the subsequent ones that we'll develop through new research, our Roles and Values model will be built over the contextualization of Hoffecker's model, due to the integrity, complexity, and theoretical support behind its construction; the integration and its usefulness is explained towards the end of this essay.

SECTORS BASED ECONOMIC ECOSYSTEM MODEL

Traditionally, ecosystem actors used to be classified according to the triple helix model: academia, government, and private sector, with organized civil society being added as a fourth helix in recent years. This model has been used for decades, mainly by governments, for the generation of public policy. Created more than fifty years ago by Innovation Professor Etzkowitz and Sociologist Leydesdorff (1966); this model continues to be used as a framework to foster open innovation and other innovation mechanisms[11].

This model is very useful to provoke, up to a certain level, the involvement of some types of actors of an ecosystem and has been widely used for its ability to provoke high-level conversations.

Quadruple Helix Model

Government

University

Industry

Organized Civil Society

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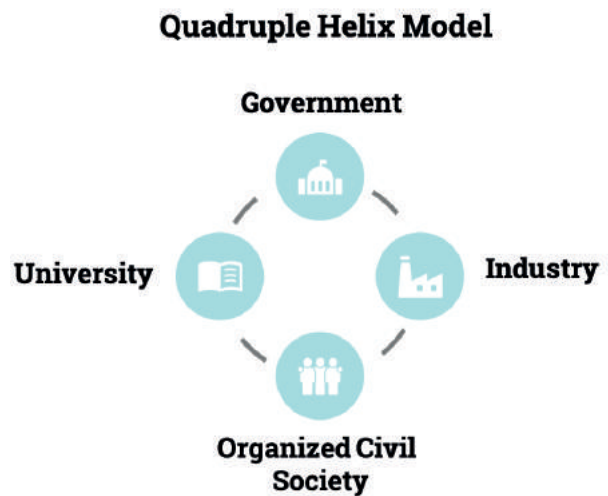
[11]Etzkowitz, H. and Leydesdorff, L. (2000). *The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university-industry-government relations, Research Policy, vol. 29, n.o 2, pp. 109-123.* Cambridge, MA: Elsevier

However, this classification can result insufficient at the time of attempting to deepen the understanding of the complex dynamics that take place in modern entrepreneurial ecosystems, since it places emphasis on sectorial labels rather than on the functions actors perform within the ecosystem.

This model was created even long before James Moore coined the term *ecosystem*[12] in order to explain the relationship dynamics that exist at the interior of private organizations and between them and their environment. Nevertheless, it remains the most widespread model today; whether that's due to the fact that for many years it proved to be the easiest to use as a means to promote collaboration between economic sectors, or because the popularization of the idea of *ecosystem* in the world of entrepreneurship and innovation is extremely recent, or by virtue of social dynamics between organizations being so complex that public policymakers prefer to use a model that can give them results in the short term. in this paper, we argue that in order to increase the level of collaboration, maturity, and development of our economic ecosystems, modern models that combine the approaches of economic and sociological disciplines are required, with the capacity to yield deep and appropriate explanations with which public policymakers and the actors of an ecosystem themselves can understand the role they *play* within the ecosystem that contains them.

The case of startup incubators is an example of the limitations that can arise while appealing to the quadruple helix model in pursuance of identifying ecosystem actors. These incubators can be found in the public sector as part of a government program, in the private sector, in the academic sector as incubators belonging to private universities, or even non-profit incubators in the sector of Organized Civil Society (OCS). That's why we seek to transcend the helix model, as these labels limit themselves to mention the sector of origin and do not engage the fact that all these incubators actually fulfill the same role; which is to enable more solid ventures regardless of the sector they're found in through a series of determined resources they make available to the ecosystem and its entrepreneurs. Therefore, this classification presents value limitations in scenarios in which many other actors are seeking opportunities for collaboration and in which entrepreneurs seek access to resources and strategic allies. In short, attempting to analyze an ecosystem from the vision of the quadruple helix provides a limited perspective of the ecosystem itself.

Another peculiarity, at least from what we've been able to learn by observing reality, not as a result of a limitation of the model itself, but due to vices in its application, is that the actors summoned to promote collaboration or innovation, as designed by the *quadruple helix,* tend to be the most prominent members of the most prominent organizations. This doesn´t guarantee them being the most relevant actors, not even the most active, as we refer to university rectors, governors, ministers, leaders of social organizations, and presidents and directors of chambers of commerce. We have also learned, mainly in countries of the developing world, that decisions taken at these levels are unlikely to be implemented at the floor level.

Due to these limitations and understanding the environment of entrepreneurship as a true ecosystem, we seek to propose a new model focused on the function that each actor plays within its ecosystem, taking into account the real value it generates in it: an Entrepreneurship Ecosystem Model based on Actors, Roles, and Values.

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[12]Moore, J.F. (1993). *Predators and Prey A New Ecology of Competition.* Harvard Business Review, pp 71, 75-86. Boston, MA: Harvard University

ACTOR BASED ECONOMIC ECOSYSTEMS MODEL

Our proposal is certainly not the first one to introduce an actor-based approach to the description of ecosystems, although it is one of the first to consider the roles and value contributed by the actor towards the ecosystem and its users: the entrepreneurs. Similarly, even though it's not the only one that can be used to map ecosystems and their social interaction dynamics, it is a model designed for this purpose, heeding the call made by Bloom and Dees in their renowned article "Cultivate your Ecosystems. "[13]

The authors emphasize that social entrepreneurs must not only understand the broad environment in which they work, but must also alter those environments to support their goals, whenever possible. One of the tools that has become extremely useful as a means to fathom these ecosystems is the so-called *mapping,* an effort that can be titanic for social, high impact or any other kind of entrepreneur, who should be using that time and resources for impact generation instead.

It's for this reason that in 2015, my colleague Tania Serrano took on the inspiration of Bloom and Dees' proposal, identifying the need to create an ecosystem model that can be used to identify the ecosystem's actors, the roles they play, and the values that each one brings to it. Beyond the fact that entrepreneurs could take better advantage of the resources of their ecosystems, this could function as a tool meant to identify collaboration opportunities between organizations (actors) that exist for and after the ecosystem.

It can be easy for ecosystem scholars, actors, and entrepreneurs themselves to get lost in the *glamour* of developed and world-renowned ecosystems, such as Silicon Valley, Boston, London, Tel-Aviv, and Singapore among others, where financial and infrastructure resources abound. However, the reality of countries in the developing world —in emerging economies and even in some non-innovation-based developed econ-

omies— is that these resources tend to be scarce, and when economic resources and infrastructure are lacking, the most valuable tool for developing an ecosystem is collaboration. Therefore, comprehending the dynamics of interaction, roles, and values becomes necessary. If we are not able to understand our role and the value we can contribute, we'll hardly be able to achieve significant changes in our environment.

Returning to the importance of knowledge within these complex social contexts, we have a model that considers actors (categorization), roles (approach), values (the needs of all those involved in the ecosystem), and a categorization of the types of actors found in the ecosystem (validated both mathematically and empirically).

In conclusion, our proposed model, as we will detail below, has the objective to support the development of innovation-based entrepreneurial ecosystems (or any other for which it is useful), relying on collaboration through the understanding of all actors present in the ecosystem, the role each one plays, and the value they bring to each other and the entrepreneur.

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[13]Bloom, P. and Dees, G. (2008). *Cultivate your Ecosystem.* Stanford Social Innovation Review, pp 47-53. Stanford, CA: Stanford University.

Ecosystem models that identify actors

Koltai's Approach
Entrepreneurship Ecosystem Model
The model consists of six pillars and six types of actors. The six pillars are: identify, train, connect, sustain, finance, enable, and celebrate. The six types of ecosystem actors are the following: NGOs, foundations, academia, investors, corporations, and government.

This model has the purpose of promoting the importance of interaction and collaboration between the actors of an ecosystem, as a means to propitiate the creation of a suitable environment for the growth of the ecosystem and its entrepreneurs. It was developed by Steven Koltai, creator and director of the Global Entrepreneurship Program for the U.S. Department of State from which the Global Entrepreneurship Summit —a global meeting of public policymakers— was derived. The model was developed in Ghana's specific context and it is being used today, in different contexts, to understand more about entrepreneurship ecosystems, however, it's entrusted with interesting elements that can be applied to different ecosystems. Koltai performs a quite complete approach that allows for the identification of many of the actors that conform an ecosystem; however, it simultaneously leaves out other actors of prime importance and does not identify the values associated with each role.

While focusing on the actors, this model leaves out other intangible components of the ecosystem.

The Kauffman Model
The Kauffman Foundation's model defines some already known components in a way similar to other proposed models in so far as the intangible components of ecosystems are concerned. It also defines some types of actors and the role they play in the ecosystem. Most roles are focused on entrepreneur empowerment and ecosystem articulation, yet leave out other relevant entrepreneur-enablers as well as other existing roles in the ecosystem. This approximation doesn't count with a graphical model that allows it to be understood visually.

The components, actors, and roles present in an ecosystem, as proposed by the Ewing Marion Kauffman Foundation (2014), include the following:

+ Entrepreneurs that aspire to create and develop new businesses, and the people that support entrepreneurs.

+ Talent capable of supporting businesses' growth.

+ People and institutions with knowledge and resources to help entrepreneurs.

+ Individuals and institutions that advocate and champion for entrepreneurs and the ecosystem.

+ Access points to the ecosystem so that anyone can participate.

+ Intersections that facilitate the interaction between people, ideas, and resources.

+ Stories told by people about themselves and their ecosystem.

+ Culture rich in social capital - collaboration, cooperation, trust, reciprocity, and emphasis on the common good.

Babson's Approach
Entrepreneurial Ecosystems Model
It is one of the most complete models currently available, remaining useful for the identification of multiple relevant actors in an entrepreneurship ecosystem.

Developed by Babson University (2010), this model was disseminated worldwide through the prestigious report "Global Entrepreneurship Monitor." One of the limitations of the model is that it's not designed to map ecosystems or the interactions that take place between its actors. However, since 2010 through its initiative BEEP, Babson has focused on the elaboration of a series of content centered on the development of entrepreneurship that has spearheaded the creation of a culture conducive to entrepreneurial ecosystems around the world.

The three models presented here are perhaps the most widespread, without demerit to many others that may be in use around the globe as local efforts to understand particular ecosystems.

This is not intended to be a space for criticism, not even for a profound analysis of their benefits, but rather as a way to comprehend that the most important thing is the exhortation to which Professors Bloom and Dees invite so as to understand our ecosystems.

The following is a new proposal, which was not designed based on any other model in order to create something completely original, capable of contemplating the description of social dynamics and the mapping of ecosystems as fundamental tools for the understanding of economic ecosystems, while at the same time encouraging and inviting to the collaboration of the actors involved.

Since its creation in 2015 to date, some modifications have been incorporated from the learning emerged from the four ecosystems analyzed with the model and the 468 actors that have been identified using this model. The reports generated from the model by the MIT Enterprise Forum Mexico can be consulted directly on its official website (www.mitefmexico.org).

New additions may emerge in the future, depending on what we learn now as a research project affiliated with MIT D-Lab, and from work being done in six other ecosystems in Latin America, Europe, and Asia.

MODEL OF ECONOMIC ECOSYSTEMS BASED ON ACTORS, ROLES AND VALUES, A NEW APPROACH
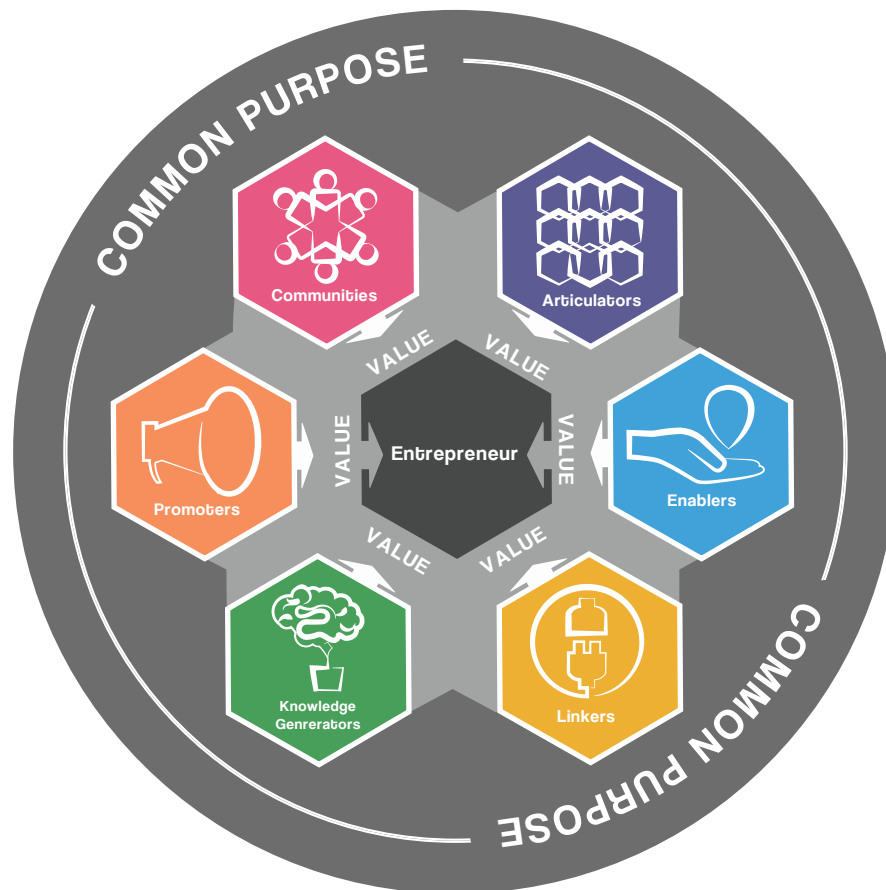

Illustration 3. TE-SER model of high-impact entrepreneur ecosystems based on roles and the value added to the ecosystem

Model Theorization

As already mentioned, the model initially proposed by my colleague Serrano and I was intended to bring clarity to the identification of the stakeholders for whom a particular strategy was being developed. However, considering the evolution of the project and from an academic point of view, we have framed the theoretical support of the model within proposals that do not focus exclusively on the entrepreneurial ecosystem, but also those of social innovation, local innovation, or high-impact entrepreneurship among many other varieties. The advantage of a model as proposed, based on roles, actors and values lies in the possibility of using it in any economic ecosystem that produces social value. This was achieved by supporting the model on proposals that part from sociology, such as game theory, social network analysis, social dynamics[14], social anthropology, and business dynamics[15], combined with tools from business science, such as market segmentation theory[16], business intelligence, and business strategy among others.

I make a pause at this moment so as to recognize the lessons learnt from combining these powerful theories around the practice of marketing —which Serrano combined with her field experience—, once again shading light on the fact that it is from interdisciplinarity and collaboration that the best ideas emerge. We thus took Moore's definition of ecosystems, without qualifications, and substituted *businesses* for organizations of any type and *client* for society.

"A community supported by a base built on the interaction of *organizations* and *individuals*. The economic community produces goods and services of value *to society*, who are members of the ecosystem. Member *organisms* include suppliers, producers, competitors, and other stakeholders as well. Over time, they co-evolve their capacities and functions and tend to align with lead established by one or more central *organizations*

"Those *organizations* with leadership roles may change over time, but the ecosystem leadership function is valued by the community as it allows members to move toward shared visions as a way to align their investments and to find mutually shared roles."

Although the model has been used to describe and understand various types of ecosystems —of either the social innovation type, the innovation-driven entrepreneurship or traditional entrepreneurship, while it can also be used to approach a variety of economic ecosystems—, for the purposes of this paper, the definitions (mainly regarding the types of actors referred) will be focused on high-impact[17] entrepreneurial ecosystems.

It is important to emphasize that what we have defined are minimum roles, which seem to be the minimum required in order for an ecosystem to work consistently, but it cannot be ruled out that in different ecosystems there may be other roles that we have not identified.

Nevertheless, the incorporation of a new role does not endanger the congruence and solidity of the model, as the work would only consist in adequately defining that role and typifying the types of actors (organizations) that tend to assume it, as well as the differentiating value they contribute through it. With that said, it's also necessary to consider that the types of actors typified as roles for the high-impact entrepreneurial ecosystem may vary or disappear in an innovation-driven or traditional entrepreneurial ecosystem or any other economic ecosystem.

Finally, as we have already discussed, the model is based on broad social theoretical proposals —and even though each context varies—, so for this paper we'll focus on Hoffecker's description of the components of an ecosystem so as to have a framework of reference to contextualize the results.

[14]Durlauf, S. N and Young, H. P (2004). *Social Dynamics*. Cambridge, MA: MIT Press
[15]Sterman, J. (2000) *Business Dynamics: Systems Thinking and Modeling for a Complex World.* New York, NY: McGraw-Hill Education.
[16]Wedel, M. and Kamakura, W. A. (2012). *Market Segmentation: Conceptual and Methodological Foundations, Second Edition.* New York, NY: Springer
[17]Ács, Z.J. (2008). *Foundations of High Impact Entrepreneurship, Foundation and Trends in Entrepreneurship. Vol 4. No 6. Pp 535-620.* Hanover, MA: Publishers Inc.

A multidimensional model

The model can be broken down into four dimensions, typified as follows:
Purpose > Categorization of Actors/Roles > Values > Entrepreneurs

Purpose

Although the purpose appears as the first layer of the model, it was recently added in response to a suggestion made by Hoffecker and from conversations on systems theory based on the publications of MIT researcher Donella Meadows. Specifically, Meadows states that a system without a purpose is not a system, but a series of agents and connections. In that sense, in order to be considered a system, such a structure must have a purpose[18].

The idea of a purpose for entrepreneurs has been recently popularized by different authors. However, few have taken it beyond the philosophical realm and turned it into a tool for achieving cohesion in collaborative objectives. The purpose of an ecosystem must thus be to serve the needs of the society to which it is integrated.

Ecosystems not intended to satisfy the needs of the society they belong to are not ecosystems, they're bubbles. On the other hand, the physiognomy of a purpose[19] is also relevant, not only for an entrepreneur, an enterprise[20], or an ecosystem but for nations themselves. It's possible to find a correlation between a nation's purpose and its level of human development[21]. If interested, the reader can find more about these concepts in the cited references and other authors.

In terms of ecosystem mapping, the incorporation of an understanding of the purpose constitutes an invitation to the collaboration among its actors; being that the mere fact of searching for agreement to define a common purpose ends up as an enriching experience for all involved. While methodological recommendations for ecosystem mapping are currently in progress, Hoffecker has already developed several tools that can be very useful in helping ecosystem actors map the purpose of an ecosystem.

In the case of Mexico, these tools were put in practice for the first time in the *Ecosystem Mapping Workshop* held in December 2018.

The Entrepreneur

When we refer to the entrepreneur as the main user or consumer of the ecosystem, we do so from a focus on ecosystems that are developed *top-down*. That is, ecosystems whose growth is driven by initiatives or concrete public policies that are focused on supporting the growth of these. We have seen that's usually a characteristic of ecosystems in emerging economies, though not exclusively, since it's also possible to observe it in developed economies that are governed by economic models centered on the production of social welfare.

On the other hand, there are some ecosystems whose development is generally bottom-up, where entrepreneurs take a much more preponderant role in their construction. We can observe this mainly from Hoffecker's research in developing economies, where it is the entrepreneur who drives the development of the ecosystem, given the absence of structure, infrastructure, and organizations that support it. Similarly, this behavior is not limited to ecosystems in underdeveloped economies since we can find very famous ecosystems, such as those of Silicon Valley, Philadelphia, or Kendall Square in Cambridge that were also built mainly by the impulse of entrepreneurs. The reasons why these phenomena occur are intimately related to the country's economic policy approach, culture, and, of course, its social dynamics.

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[18]Meadows, D. (2008). *Thinking in Systems: A Primer.* WRJ, VT: Chelsea Green Publishing.
[19]Tedesco, M. S.(2011). *Ruta Profesional.* Ciudad de México, CDMX: Paidos
[20]Tedesco, M. S. (2012). *La Responsabilidad Social Como Centro de la Estrategia Empresarial.* Guadalajara, JAL: TED
[21]Tedesco, M. S. (2013). *El Origen de la Grandeza.* Ciudad de México, CDMX: TED.

Categorization of Actors, Roles, Values, and Entrepreneurs from the Perspective of the Model

The categorization of actors represents an evolution from the traditional quadruple helix based on the sectors of the economy towards a classification that emphasizes the role and value that organizations bring to the entrepreneurship ecosystem; this in the context of an effort to increase the collaboration between its actors, placing always the entrepreneur as the center of the ecosystem and the main user of it.

The six categorizations that constitute this new model are: articulators, enablers, linkers, knowledge generators, promoters, and communities. Each of these are described below.

Articulators (ART)

They bring coherence and stability to the ecosystem by creating an appropriate environment for high-impact entrepreneurship and innovation to develop.

The role of the articulators is to ensure the creation of spaces and platforms that allow and encourage different actors not only to "talk" to each other, but to actively collaborate in joint initiatives, by means of the creation of public policies that encourage such collaboration.

Articulators tend to be public or private organizations with the required faculties and competences for the generation and execution of public policy, such as Secretaries of State, entrepreneurship institutions, diverse NGOs that generate and execute public policies, and entrepreneurship/innovation based municipal institutions among others. This kind of public policies have a public and social interest and are therefore not limited to a specific sector of the economy.

Linkers (LIN)

They connect entrepreneurs, companies, and actors within the ecosystem in order to create new relationships.

These relationships foster collaboration and the sharing of knowledge on best practices and market-information, while allowing institutions to face opportunities and problems together, strengthening their mutual position.

The linkers are usually public or private organizations that focus on connecting institutions with similar interests to strengthen their position by the establishment of common objectives, such as chambers of commerce, business or industrial councils, second-floor foundations, and organizational networks among others.

Promoters (PRO)

They disseminate and promote high-impact entrepreneurship —locally and internationally— as a means to support the scalability of ecosystems and to foster a culture of entrepreneurship and innovation.

Promoters are those ecosystem organizations that focus on disseminating entrepreneurial activity and on telling stories at either the national or even the international levels.

Promoters are usually public or private institutions, such as print or digital media, among others.

17

Enablers (ENA)

They provide resources in order to support the generation and development of new high impact and innovative projects, either within the ecosystem itself or outside it.

Enablers are all those who provide all kinds of tools and monetary or in-kind resources, such as training, talent, consulting, financial resources, infrastructure, and coworking spaces, among others. These allow the ecosystem to increase the level of resources available so that both actors and entrepreneurs can reduce the natural entry-barriers to the ecosystem or market. Regardless of monetary investments, enablers provide resources as strategic as the funds themselves.

Enablers are usually public, private, academic or civil society organizations focused on offering tools to entrepreneurs, such as incubators, accelerators, investment funds, training centers, consultancy firms, non-scientific universities, coworking spaces, and foreign trade offices among others.

Knowledge Generators (GEN)

Public and private institutions that generate new knowledge, which, in turn, can drive the creation of new projects, technologies, innovation, and high-impact entrepreneurship.

Knowledge is not only generated or found in academic institutions but in any organization that has a strong focus on creating scientific-technological or scientific-social-based knowledge, which can in turn be used through entrepreneurship to solve the great challenges of a country or the world.

Knowledge generators are usually public, private, academic, or civil society institutions focused on research, such as research centers, development centers, design centers, innovation centers, research and development departments of universities and/or private enterprises among others.

Communities (COM)

These actors are formal or informal civil organizations that share knowledge, collaborate, and give dynamism to the high-impact entrepreneurial ecosystem.

Communities, although they belong to civil society, are generally unorganized at birth, since they aren't born as formal institutions but as entities with the sole purpose of sharing knowledge, exerting mutual support, and enriching each other based on unique common objectives. They're the organizations that persist beyond public policies —propitious or not for development— and beyond temporally-constrained governments or institutions, they're thus the actors that give sustainability and continuity to the ecosystem.

Communities can exist inside or outside institutions of all kinds, such as public, private, or academic, are always autonomous and act as a fundamental part of civil society, being NGOs or not.

This model of entrepreneurship ecosystems is flexible and adapts to the characteristics of each ecosystem. Organizations that in one ecosystem are only an interest group may also be, in another ecosystem, active actors with a specific role in the ecosystem. Likewise, organizations within the same ecosystem can transform and acquire different types of roles throughout their trajectory, as well as simultaneously play a primary role and a secondary role.

Some special cases worth mentioning that we have learned from the reports generated by the MIT Enterprise Forum Mexico are the following:

+ Universities as Enablers: In practice there are few universities, in the case of the developing world and emerging countries, that generate knowledge or new technologies, since the natural emphasis of most of them is placed on the transmission of already existing knowledge and in the development of different skills among their students. In this sense, knowledge generators can be found in the research departments or innovation centers of some universities, while the rest of the university as such acts as an enabler.

+ Technology Transfer Offices as Enablers: Similar to what happens with universities, TTOs do not generate new knowledge but enable other actors through the access to technologies already developed by a third party.

+ Business Councils and Chambers of Commerce as Linkers: Although there's business councils and chambers of commerce —in contact with all the levels of government— promoting different public policy proposals, they're not cataloged as articulators for the reasons that follow:

  + Their focus and reason to be is the linkage between its members, which, in turn, aids the development of projects and initiatives for the benefit of the network.

  + Their participation in public policy-making aims at the attainment of benefit for its members, economic sector or for entrepreneurs as a particular group of interest, not for society as a whole.

  + Despite designing and proposing public policies, they lack the attributions necessary to participate in their execution.

+ Coworking Spaces as Enablers: The characteristics of coworking spaces make them natural promoters and seedbeds of communities. While some of these spaces do manage to generate their own communities based on their members, their main function is to enable a physical space for others, so they act as an enabler that often becomes the home of other communities.

+ Microecosystems: Complex organizations of great size like universities, ministries, or state secretaries may count with several departments that, despite being part of the same organization, individually become actors who fulfill different roles in the ecosystem. Within the same university, for example, the business incubator, the technology transfer office, the internationalization department, or even its investment funds may act as enablers; the business linkage department, as a linker; the research department, as a knowledge generator; the technology magazine published by the university, as a promoter; and the social entrepreneurship student group as a community. For a better understanding of the ecosystem, it's necessary to identify each of the actors that exist within these micro-ecosystems, since both their objectives and the value they contribute to the entrepreneurial ecosystem differ in each case.

We have also learned that when actors in an ecosystem fail to prioritize the activities through which they generate the main value associated with their roles, resource inefficiency, duplication of efforts, and lack of focus are often manifested. This phenomenon is recurrent in ecosystems that find themselves in the process of consolidation, where there's still not enough actors to perform each of the six roles described or when, despite having an adequate critical mass, the actors remain disconnected and without a real understanding of the other actors that are participating in the ecosystem or of the value that each one is contributing to it.

Table of Roles and Values

Categories	Role	Value	Types of actors*
Articulator	Creates and executes public policies and articulation strategies.	Coherence and stability to the ecosystem as a means to create an appropriate environment for entrepreneurs.	Secretaries of State, Municipal Institutions, Government Organizations focused on Entrepreneurship, Science and Technology
Enabler	Provides monetary or in-kind resources, knowledge or talent-wise.	Enabling entrepreneurs and innovators that are capable of creating new products and services that can reach society or the market.	Incubators and Accelerators, Investment Funds, Training Centers, Universities, Coworking Spaces, Consultancy Firms.
Linker	Connects the ecosystem and influences sectoral public policy.	Connection between entrepreneurs and actors within the ecosystem, giving visibility to the interests of the group.	Chambers of Commerce, Industrial Councils, Organizational Networks, Clusters.
Knowledge Generator	Develops new technologies and knowledge.	Generation of new knowledge that supports the creation of new projects, technologies, and entrepreneurship.	Research Centers, Development Centers, Innovation and Design Centers, Research Departments within Universities or Businesses.
Promoter	Tells the stories of the ecosystem and disseminates new technologies, innovations, or discoveries.	Dissemination and promotion of entrepreneurship and innovation, both locally and international. Development of a culture of entrepreneurship and innovation.	Traditional media, digital media, specialized magazines among others.
Community	Shares and disseminates knowledge among individuals integrated as a group.	Dynamism in the ecosystem through the generation of spaces that render collaboration and the transmission of knowledge more agile.	Communities of Entrepreneurship, Technology, or Innovation.

*This table refers exclusively to Types of Actors within High Impact Entrepreneurship Ecosystems, does not include innovation ecosystems, traditional entrepreneurs or other economic ecosystems.

Interest groups (Stakeholders)

In addition, a seventh role is also considered, which must be in turn differentiated from the actors proper: the interest groups. Not all the organizations that form part of an ecosystem can be considered actors, since to be considered as such, their reason of existence should be to support the innovation-based entrepreneurship ecosystem in some way. Interest groups, on the other hand, may affect and be affected by the ecosystem, but do not have a determining function within it; nor do they exist for or after the ecosystem, being able to emerge even without the existence of any entrepreneurial ecosystem. For example, the Internal Revenue Service is a relevant organization with which the entire entrepreneurship ecosystem has contact in a certain way, and whose actions affect said ecosystem. However, the purpose of the activities it carries out is not the promotion or support of entrepreneurship in the region. This is

generally the case of organizations such as trade unions, political groups, philanthropic associations, and companies from various sectors.

Although the model does not contemplate their identification, it's necessary to take them into account so as to create strategies of attention and containment, depending on the level of disturbance these interest groups are capable of.

It's also important to differentiate the usage of the concept of stakeholder (Pitman, 1984) in entrepreneurial sciences as previously addressed, which alludes to actors of entrepreneurial ecosystems, to the use of *stakeholder* in economic ecosystems and in social sciences in general, in which they're presented independently of the actors.

EMPIRICAL AND MATHEMATICAL VALIDATION OF THE MODEL

After having generated the model through business intelligence (BI) methods for the classification of "agents," the original method for classifying actors into one of six possible categories consisted in asking multiple-choice questions to the organizations addressed, linking the answers directly to one of the six categories. However, to verify that the categories detected were appropriate, the following validation was carried out:

A. A. The general description of 41 organizations in Hidalgo was acquired from the database of the Entrepreneurship Directory of Mexico's National Institute of Entrepreneurship (INADEM). The descriptions of the organizations included their approach/services, which determines their category.

B. B. A quantitative dimensions mapping of the descriptions was applied. The mapping was carried out as follows:

1. The vector space model or term vector model was applied to turn each word into a vector. This is an algebraic model for repre-

senting text documents and any object in general as identifier vectors, such as index terms. It is used in information filtering, information retrieval, indexing, and relevance classifications.

2. The representative vector of each description was the average of the representative vectors of each word.

3. Principal component analysis (PCA) was used to detect the most important dimensions of these vectors.

4. The descriptions were projected onto the first two components that are observed in the following figures.

C. If the categories are adequate, organizations of the same classification should be in a cluster.

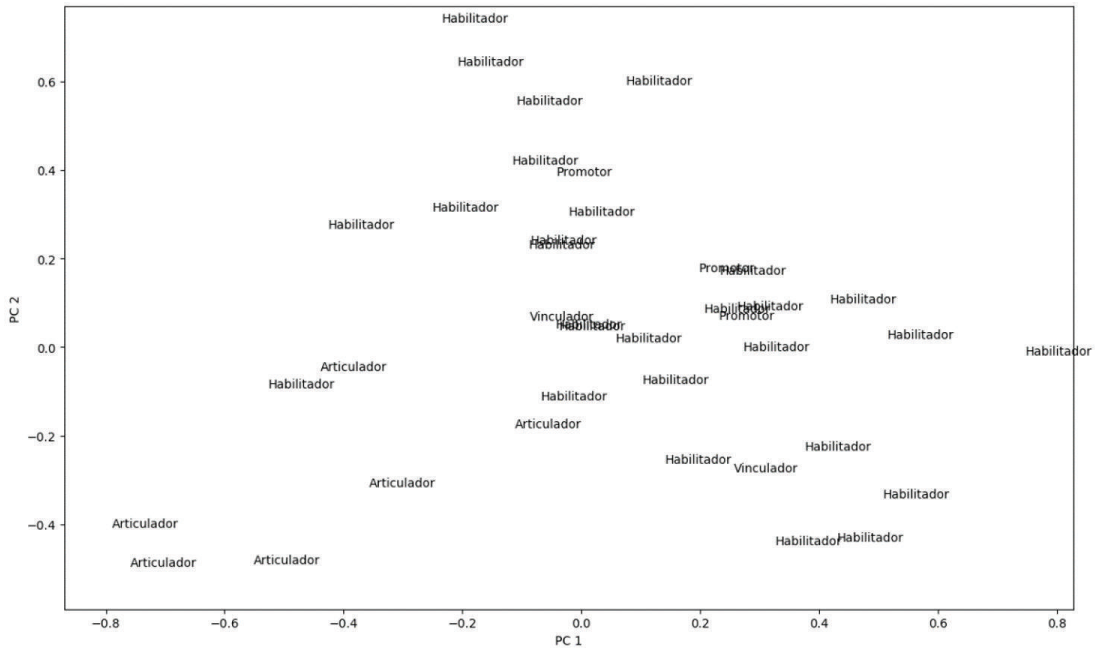D. The following illustration shows the projection of the 41 organizations

Illustration 4. Projection of the 41 organizations according to their description.
Guadalupe Fabre, MIT, (2018)[22]

As can be seen, the Enablers category is wide-ranging; however, clear groupings of the organizations of other categories can be observed.

Based on the clusters identified, the proposed categories are validated as appropriate.
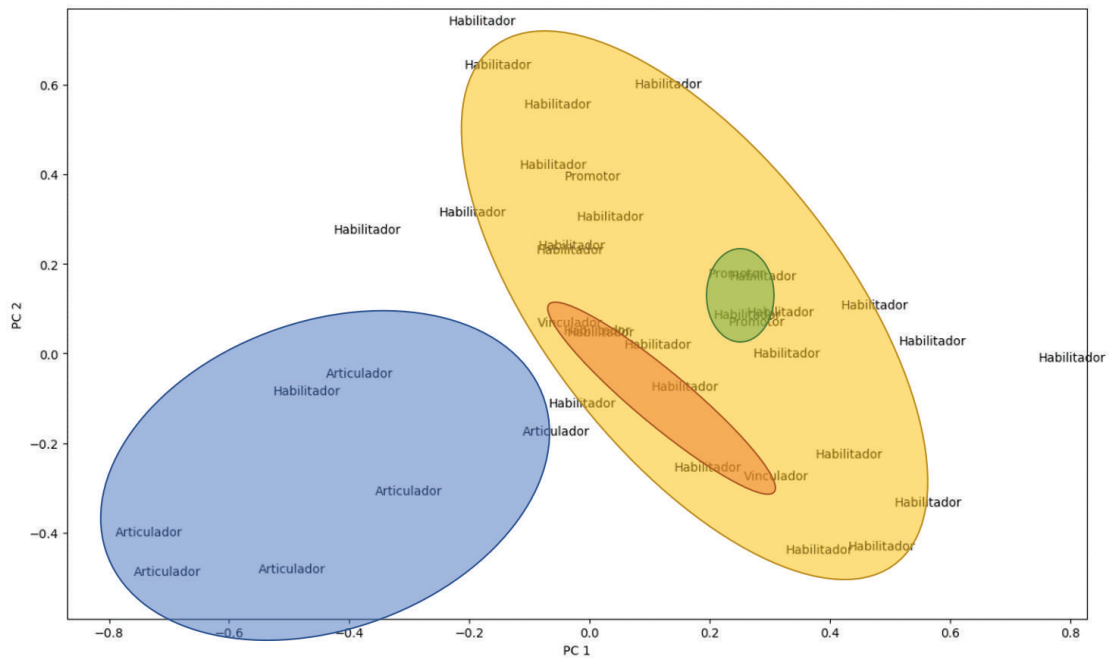

Illustration 5. Projection of organizations identifying clusters.
Guadalupe Fabre, MIT, (2018)[23]

[22]Tedesco, M. S. Serrano, T. Fabre, G. Ramos, F. (2018). *Report of the Ecosystem of High Impact Entrepreneurship of the State of Hidalgo.* Guadalajara, JAL: INADEM - MITEF México
[23] Idem

Due to the fact that the database used didn't contain enough information so as to identify organizations with the roles of Knowledge Generators and Communities —and with the objective of reinforcing the validation of the model from another method— a direct profiling was carried out through the application of questionnaires to 175 actors of the ecosystems of Hidalgo, Oaxaca, Aguascalientes, and Guadalajara, between 2016 and 2018. This profiling exercise correctly categorized the actors in the six proposed roles in 94% of the cases, validating again the proposed model and giving way to the generation of results and conclusions from it.

Through the model, 468 actors of the entrepreneurship ecosystem in Mexico have been identified, and this same work is in progress, as already mentioned,

in six other countries at the moment. Having already identified these actors, the model developed by Guadalupe Fabre (2016) has been reapplied using the vector space model and principal component analysis, giving the result shown in the following graph. In this representation it's possible to find all the types of actors of a business ecosystem, proved once again as validated categories. Role clusters are more neatly defined as a result of the bigger number of actors participating in the sampling. This process was executed with the complete base of 468 actors, lending precise and defined results. However, in order to present a more reader-friendly visualization, the exercise with a total of 150 actors is shown below.
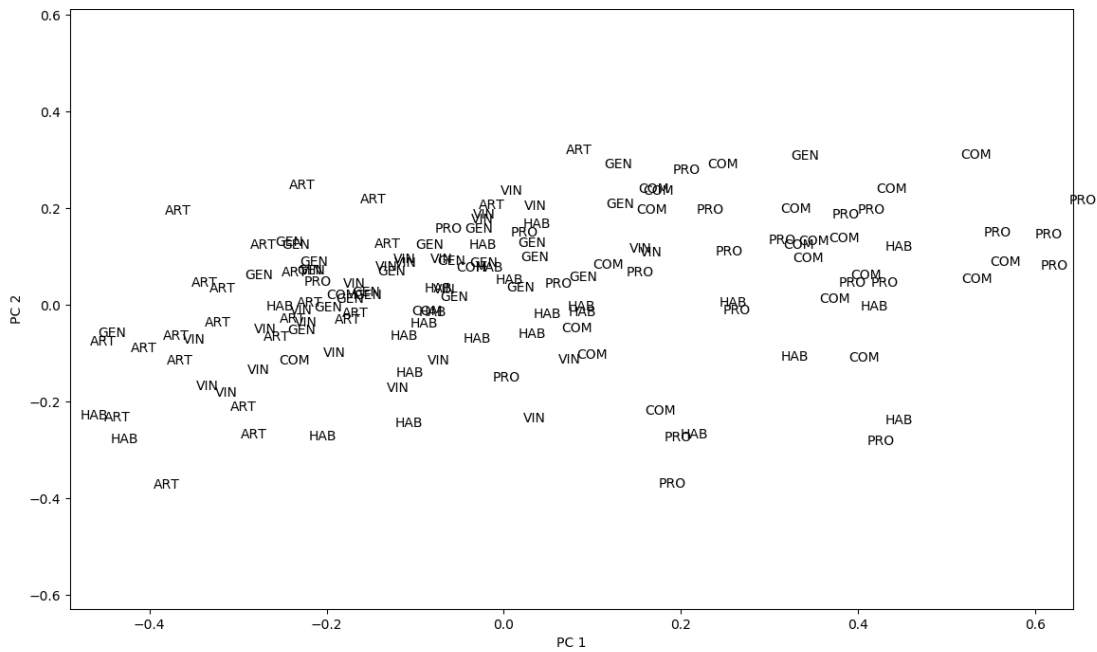

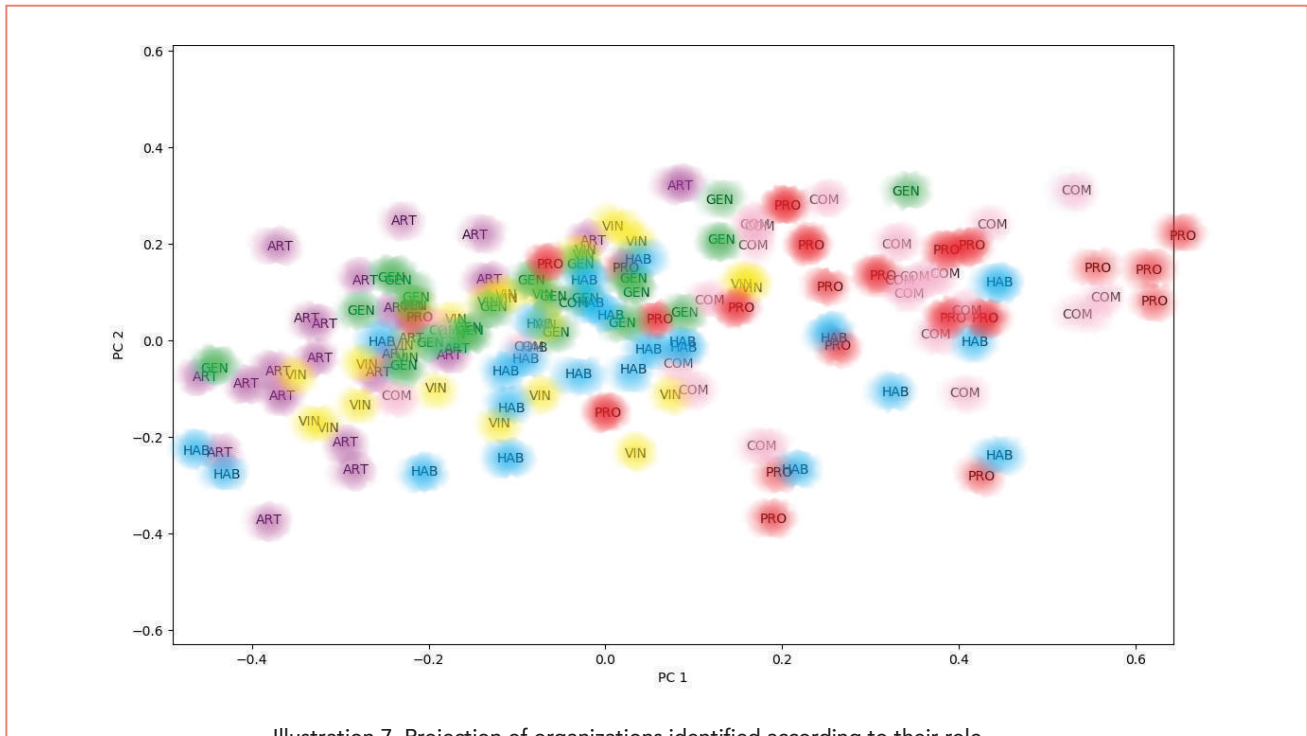Illustration 6. Projection with 150 organizations according to their described.

Illustration 7. Projection of organizations identified according to their role.

(ART) Articulators | **(VIN)** Linkers | **(PRO)** Promoters | **(HAB)** Enablers

(GEN) Knowledge Generators | **(COM)** Communities

It's important to point out that in this new visualization we can not only see how the roles group themselves in a defined way, but also what we witnessed on the field, the intersection of secondary roles for each actor. This is relevant given that —as we have commented— although all actors have a main role that produces a unique value, it's possible to consistently find a secondary role that strengthens their position in the ecosystem. At the same time, this secondary role is recurrent for each type of actor. This means that an actor with a specific role generally shares the same secondary role with the members of its group. An example that we have constantly seen is the case of articulators and linkers. Both types of actors, according to the proposed definition, share the role of generating public policy: in the case of the former as its main role and in that of the latter as a secondary role. This same coincidence is found in the mathematical representation of the model. It should also be noted that the exercise of articulating necessarily entails the act of linking, therefore this intersection is expected as well. This explains why some linkers are included in the cluster of articulators, or why promot-

ers and communities also share regions, as both aim, through different paths and with different preponderance, to share knowledge and telling stories. Finally, it's important to mention that the graph displays several actors that don't maintain a defined position in their corresponding cluster. This answers to the fact that these actors have not correctly defined their role, and the description they present does not coincide with the description of the role itself, recurring on the same phenomenon that took place during the empirical validation exercises.

Each component shown below represents a set of related characteristics. For this visualization two components (PC's) are taken; the numbers in the axes represent the correlation that exists between these components (vectors). Therefore, it's expected that if two actors have the same role (primary or secondary), the correlation between their components must be the same, or for real purposes, very similar. In this way, clusters of actors are definitively built.
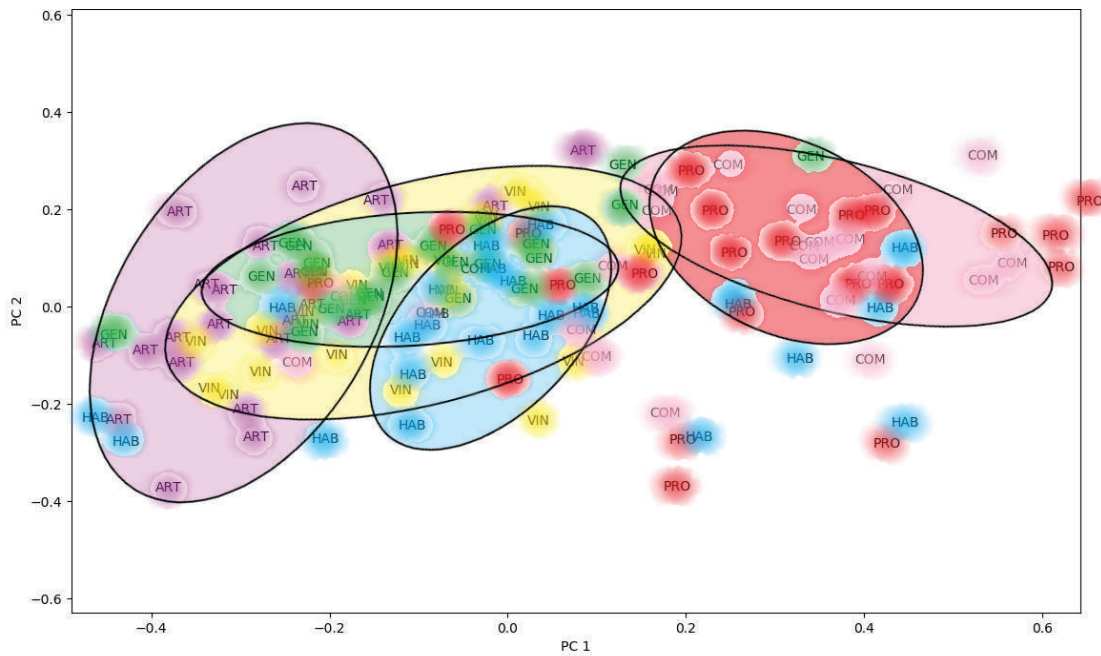
Illustration 8. Projection of organizations identifying clusters

APPLICATION OF THE MODEL-CASE MEXICO

Based on this model and after contextualizing the situation of the states in which the different analyzed ecosystems are located, reference analyses that considered both quantitative and qualitative elements were carried out.

The analysis was developed on the basis of an eclectic methodology, consisting of a mathematical model and numerical valuations interwoven with in-depth interviews and social networks analyzed from a critical perspective of entrepreneurship. This approach draws from the premise that the social reality meant to be addressed cannot be understood in terms of an exclusively quantitative or qualitative perspective, but through the mixture of both; so it must be reality itself who dictates the methodology used in order to apprehend it.

From a theoretical point of view, the mixed methodology can be broken down into different sub-processes. As part of this methodology, statistical and descriptive methods are used to approach reality. Techniques such as empirical mapping of ecosystem actors, workshops, thematic content analysis, and interviews are introduced as well. Finally, from a prac-

tical point of view, the reports made use of different tools such as forms, statistical analyses, graphs, and sociograms.

The process then consisted of three stages:

1. Identification of strategic actors of the entrepreneurial ecosystem in collaboration with local allies.

2. Information gathering through previously designed instruments, applied to a diverse group of actors identified as part of the ecosystem during a workshop in which the convened attenders participated on a single occasion.

3. From the answers obtained through the survey, results are normalized, a detailed analysis of each indicator is executed, and the mapping of collaborations is generated in the form of a sociogram.

Following this methodology, 1,293 interactions between 468 actors in four different ecosystems have been analyzed: Aguascalientes, Guadalajara, Hidalgo, and Oaxaca. These 1,293 analyzed interactions include collaborations for which the various indicators of each report were evaluated (971), interactions in which an actor acted only as a link or intermediary (100), and connections between the interviewed actors and the organizations recognized as key for their establishment and growth in the ecosystem (222).

In addition to these interactions, some others were discarded from the analysis due to any of the following factors: the interaction involved an organization that did not meet the definition of *high-impact entrepreneurial ecosystem actor,* or the interaction represented a duplicate.

The list of the 468 actors identified in these four ecosystems is made up of:

+ 51 Articulators
+ 34 Communities
+ 38 Knowledge generators
+ 218 Enablers
+ 59 Promoters
+ 68 Linkers

Of these 468 identified actors, 175 answered a categorization profiling questionnaire, resulting in a "Categorization-Type of Actor" validation with a 94% of assertiveness. Regarding the actors who showed a deviation in their understanding of the role they actually played in the ecosystem (6%), through an additional interview we learned that this perception was given either by duplication of work (1.5%), focus on multiple activities (3.5%), or ignorance of the purpose of the organization (1%).

Example of a Resulting Mapping (Guadalajara)

The following is an example of an ecosystem mapping performed through the application of the model.

The case of Guadalajara is examined since it was proposed for this particular work as a platform to validate the usefulness of the model for the mapping of ecosystems, which as we previously pointed out, is one of the main reasons for which it was created.

This pulls it apart from the reports made by the MIT Enterprise Forum Mexico, which were used to support the creation of useful strategies for the articulators of the ecosystems analyzed.

It's worth mentioning that Guadalajara is the most important innovation based entrepreneurship ecosystem in Mexico, concentrating the largest number of actors and startup communities per capita, in addition to the most important public and private research centers in the country, such as one of the three largest INTEL development centers in the world, as well as the Continental, TATA, or Bosch innovation centers, among other major actors.

In the same way, it's also necessary to recognize that there have been other efforts carried out by both the government and local researchers to understand Guadalajara's ecosystem. Such is the case of the work carried out by Silva and Pedroza in 2015, which represented an initial approximation to the social dynamics of the local ecosystem, an academic work that was innovative from multiple angles, being one of the first to make use of Social Network Analysis in Mexico[24], shedding light on many questions. However, it focused mainly on the path an entrepreneur has to follow in order to be successful in the context of the local ecosystem, and although it remains an interesting proposal, we state again that for a critical mass of solid ventures capable of impacting the economy and society to develop, a robust entrepreneurial ecosystem is needed, and this depends mainly on the organizations that conform these ecosystems. We emphasize once again the importance of the proposal made, which focuses on a complete ecosystem, regardless of its type of product (companies, high-impact or social enterprise, or innovation only).

Going back to the case we developed as an example for this work, in Guadalajara 474 interactions were analyzed among a total of 188 actors identified as part of this ecosystem. During the information gathering, 34 ecosystem actors participated, representing 18.09% of the total number of actors identified; which included articulators, enablers, linkers, knowledge generators, and communities among the participants. The fact that there's a five-fold increase in the number of mapped actors versus the participants in the exploration dynamics if proof of the model's capacity to map actors far beyond those more easily identified.

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[24]Silva-Flores, M.L. y Pedroza-Zapata Á.R. (2015). *Una aproximación a las dinámicas sociales del ecosistema de emprendimiento e innovación de la zona metropolitana de Guadalajara (ZMG)". XVI Seminario Latino-Iberoamericano de Gestión Tecnológica*. Porto Alegre, RGS: ALTEC.

The interactions included in the study were subjected to a statistical and descriptive analysis based on the Social Network Analysis method (Barnes, J.A., 1954) for the indicators of key organizations, intensity of collaboration, number of interactions required to collaborate, percentage of success in collaborations initiated versus percentage of failures, as well as percentage of collaborations that never materialized, collaboration agreements, search of directionality, and reason for collaboration. Following these evaluations, graphs that allow deepening in the peculiar dynamics among the actors of the ecosystem are generated, assessing their real contributions to it and the relations generated between them

For the graphic mapping of ecosystem relationships and collaborations, nodes (ecosystem actors) and edges (social dynamics) were entered in the open-source Gephi platform, a software widely used in the academic world for the generation of socio-grams[25] (diagrams that visually represent collaborations between actors), making use of the Social Network Mapping method and graph theory[26]. Algorithms that distribute the nodes according to a linear model of attraction-repulsion and distance between the different actors integrating Barnes Hut simulation[27], degree-dependent repulsive force, as well as local and global adaptive temperatures[28] are also applied. This model of attraction-repulsion allows us to identify what we have referred to as the gravitational centers of the ecosystem.

Gravitational Centers

We denominate as *ecosystem gravitational centers* the organizations that play a preponderant role in the ecosystem, not only because of their level of influence but also because of their capacity to connect organizations and generate collaboration with a critical mass of actors, becoming stabilizers of the ecosystem itself.

The identification of these gravitational centers becomes essential for the comprehension of the dynamics of the ecosystem, while it also allows us to acquire an idea of the level of maturity of the ecosystem; which depends on the quantity and variety in the roles of these particular actors.

We've learned that a mature ecosystem tends to have more connected, rounded, and compact structures, with a large number of gravitational centers that give stability to the ecosystem without also becoming indispensable for its functioning. In spite of this, in the early stages of entrepreneurial ecosystems in the developing world, it's possible to take advantage of a solid and proactive gravitational center to coordinate the first collaborative efforts for development, looking for strategies that could help strengthen the rest of the nodes. They would thus be able to continue to drive the ecosystem development, depending less and less on a single articulator. On the other hand, identifying the rest of the actors that begin to cast themselves as possible gravitational centers is key, since these organizations are already making significant efforts for the ecosystem and can expand their potential with a lesser amount of resources since they're already highly motivated.

[25]Grunspan, D. (January 23, 2014). *Understanding Classrooms through Social Network Analysis: A Primer for Social Network Analysis in Education Research.* Bethesda, MD: Life Sciences Education

[26]Otte, E and Rousseau, R. (2002). *Social network analysis: a powerful strategy, also for the information sciences, 28 (6): 441–453.* Thousand Oaks, CA: Journal of Information Science.

[27]Barnes, J. and Hut, P. (1986). *A hierarchical O (N log N) force-calculation algorithm. Nature, pp 324 (4): 446-449.* San Francisco, CA: International Journal of Science

[28]Meghanathan, N (2016). *Advanced Methods for Complex Network Analysis.* Hershey, PA: IGI Global

Map of Social Dynamics of Innovation Based Entrepreneurial Ecosystems

The following graph shows an example of the result of mapping an economic ecosystem using the TE-SER (Tedesco-Serrano) model to describe its social dynamics.
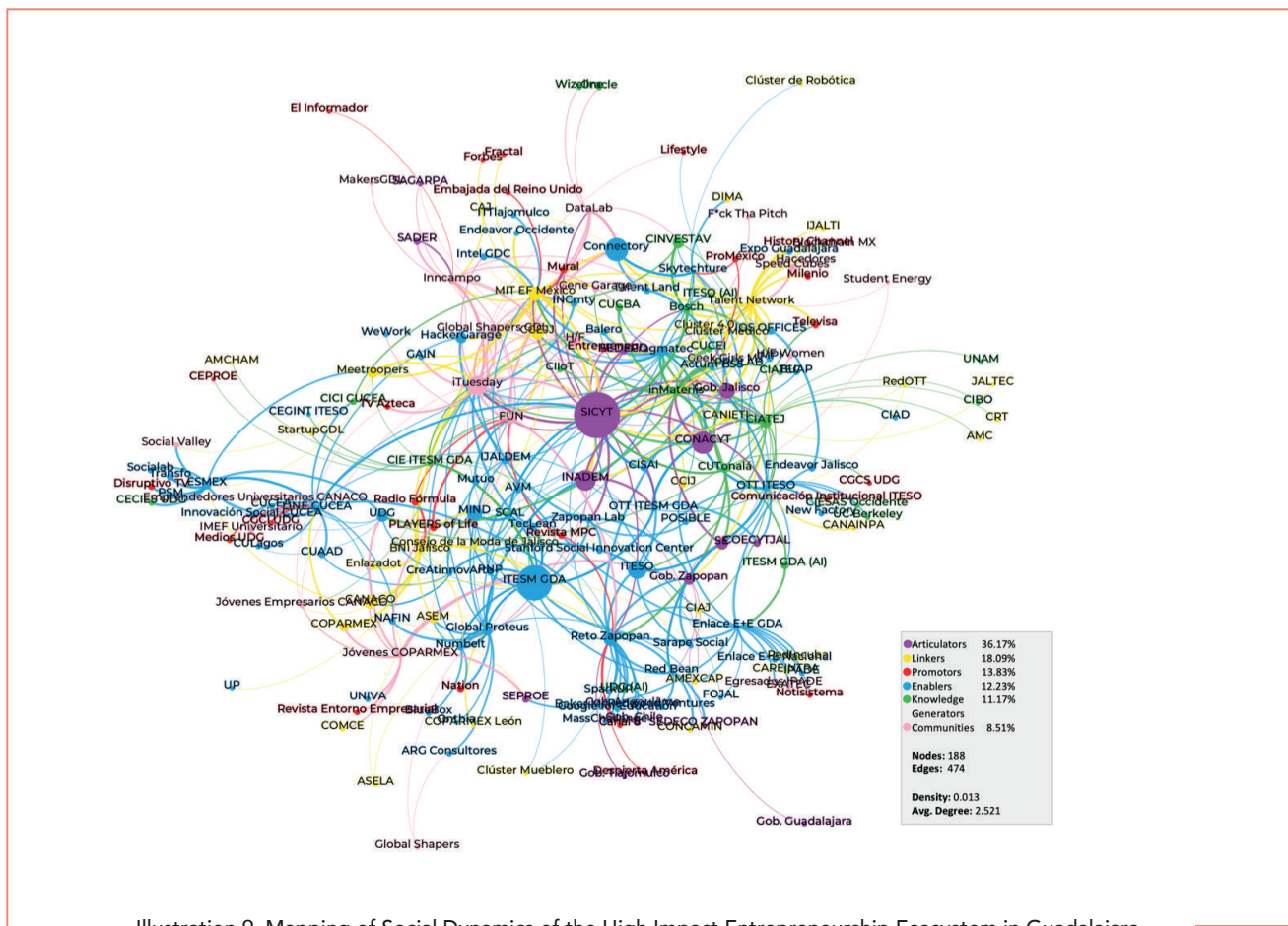

Illustration 9. Mapping of Social Dynamics of the High Impact Entrepreneurship Ecosystem in Guadalajara.

It is not the aim of this paper to explain the social dynamics of this or any other ecosystem. That will be a part of another series of studies. However, we can highlight some useful elements. As can be observed, Guadalajara is an ecosystem that is active at the linkage level with a complete range of each one of the actors proposed by the model, being that it not only has an important number of gravitational centers but that these belong to a complete range of varied roles, which is indicative of a high maturity. An ecosystem that develops its actors, independently of their role, is an ecosystem that will present itself solidly and regardless of the public and economic policies of the future. On the other hand, this type of graphical representation does not only allow actors to understand their referential position in the ecosystem but also the perception that other actors have of them. We must not lose sight of the fact that an actor is only

an actor if the ecosystem (its peers) considers it so.

In the case of Guadalajara, it was possible to observe actors of great renown that, while are commonly present in the tables of the quadruple helix, for the ecosystem in itself are not that relevant. This is observable mainly for certain universities and chambers of commerce.

This type of visualization allows each actor to clearly understand the work to be done if he or she wants to be considered a relevant actor in the ecosystem and what is even more important, to increase the quantification of the value contributed to it.

INTEGRATION INTO OTHER MODELS AND CONCLUSIONS

Hoffecker proposes an integral ecosystem model that not only contemplates the actors but the whole environmental context; our model complements the previous one by focusing, as we already said, mainly on the relations between the actors, how they interact, and the result of that interaction.

Each of them may have different specific objectives, though they contribute to similar purposes, and both can be used independently of each other, depending on the result sought. Nevertheless the simultaneous application of the two of them can provide relevant and useful knowledge, both for entrepreneurs as well as for policymakers, ecosystem builders, investors, and any other actor that wants to contribute to the ecosystem.

As we mentioned before, there's not a single model useful for the description of an ecosystem; being that from different angles, initiatives, and organizations, constant efforts are made to improve knowledge.

Built from the need for information that would allow an organization to meet the needs of its stakeholders and based on a mainly sociological approach, this new model emerges as a contribution to the dissemination of knowledge and to the tackling of the great challenges faced by our countries.

For this reason, we extend an invitation to the academic community —and to all those who persist on attempting to contribute value to their ecosystems— to try our models, to modify them, to create knowledge, to share it and to work with other colleagues and organizations in order to produce economic and social value. This constitutes a new, exciting, and promising field of research and there´s still much work to be done and knowledge to be created.

The entire world currently finds itself in the midst of a social upheaval as we have never seen before: an individualistic counter-reaction emerging as a real consequence to people's unmet problems and needs. However, history has shown the solution is never to be found in individualistic thinking, nor in isolation, mainly because, as we have explained in

this paper, the world does not function that way, biology does not function that way, and society as a whole does not function that way.

Each of our individual actions impacts irremediably on the other and have an echo far beyond what we're capable of imagining. That's why ecosystem thinking presents itself as a sustainable response, not only economically and socially, but also in physical terms, in the context of our planet Earth.

Finally, the development of entrepreneurship, innovation, or any other economic ecosystem is neither the responsibility nor the work of a single organization; the problems we face are so great and challenging that they requires the work of all the organizations and individuals that conform these ecosystems.

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APPENDICES

Illustration 4. Projection of the 41 organizations according to their description. Guadalupe Fabre, MIT, (2018)22
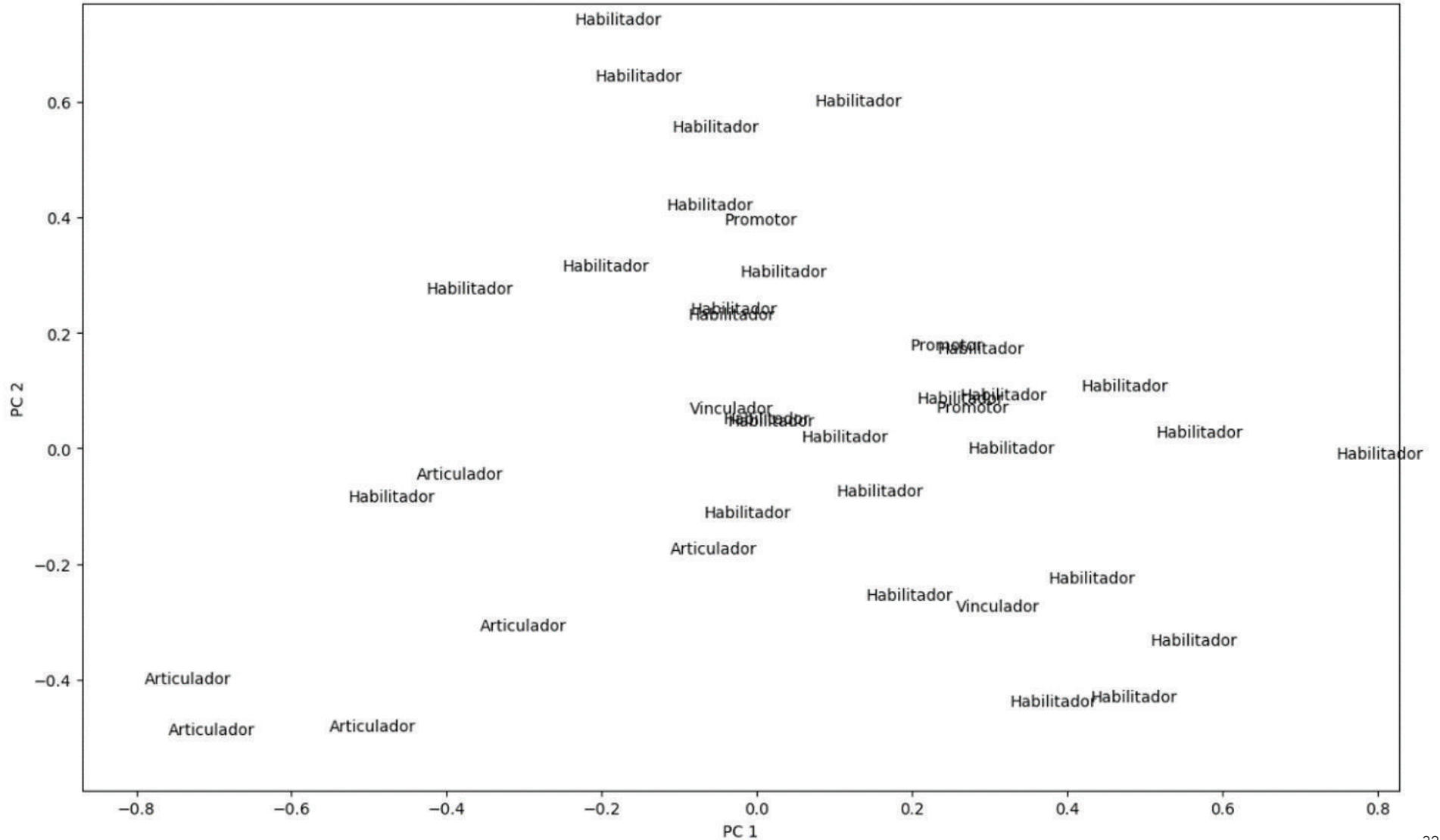
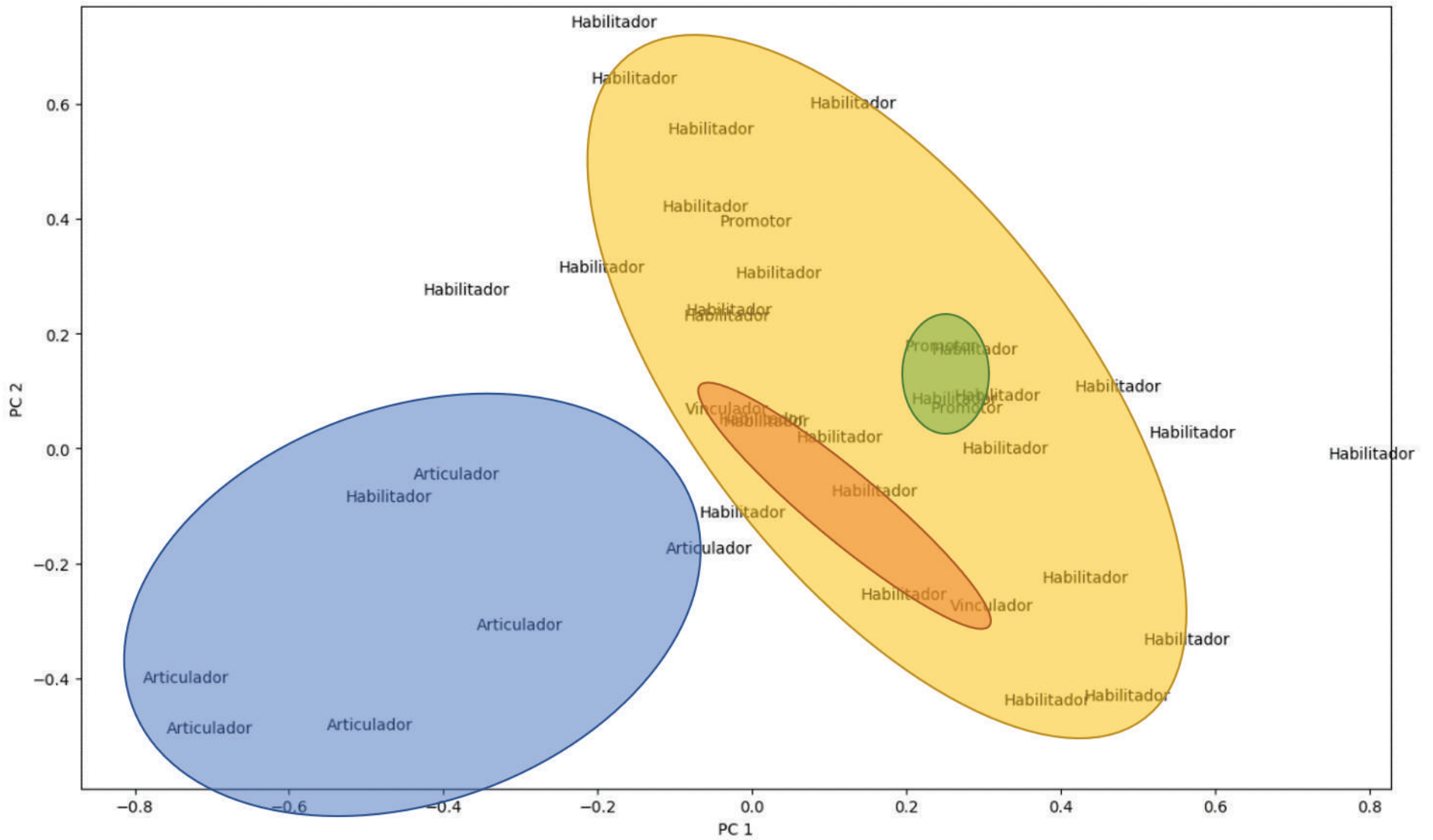Illustration 5. Projection of organizations identifying clusters. Guadalupe Fabre, MIT, (2018)[23]

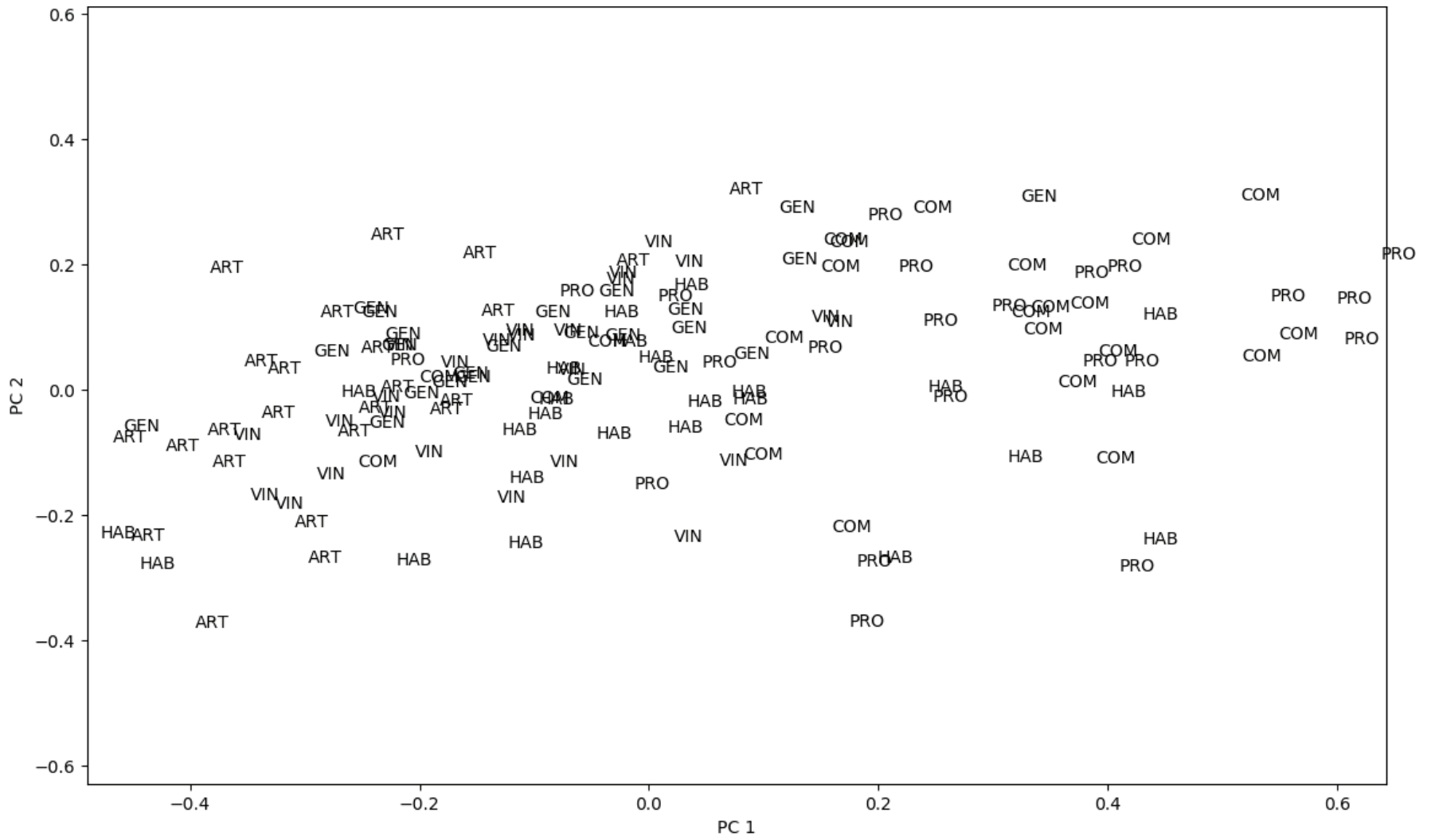Illustration 6. Projection with 150 organizations according to their description.

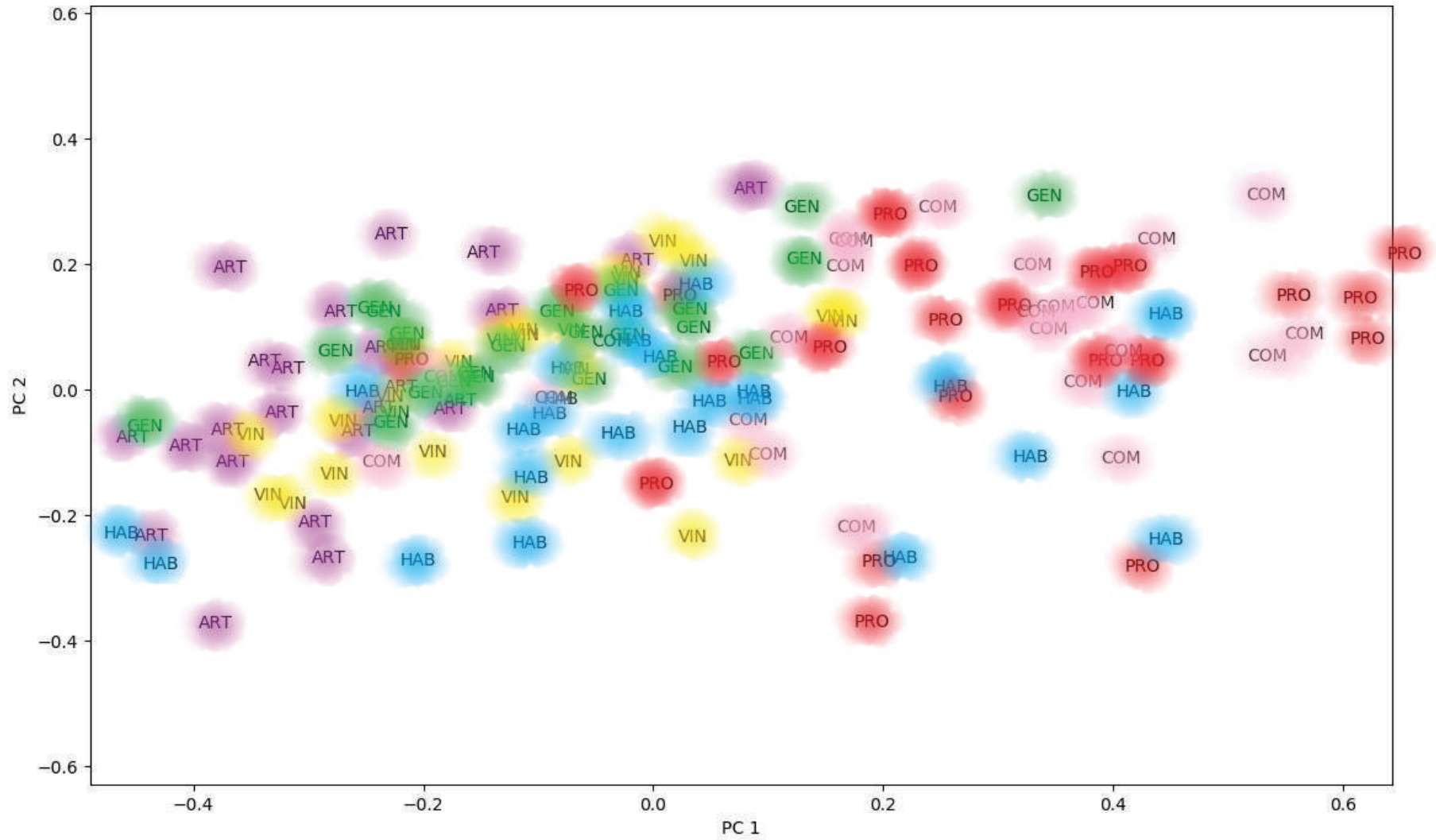Illustration 7. Projection of organizations identified according to their role.

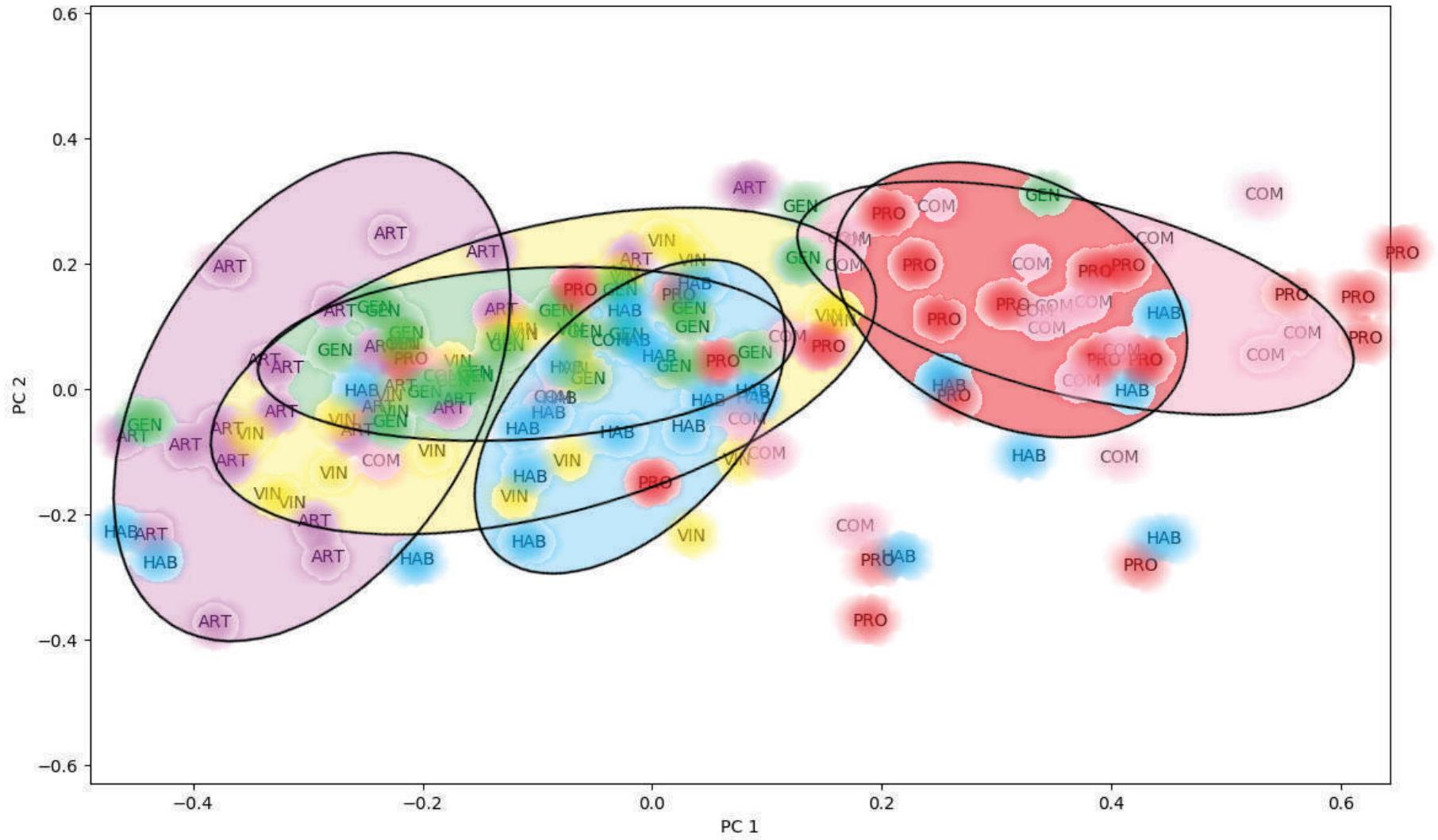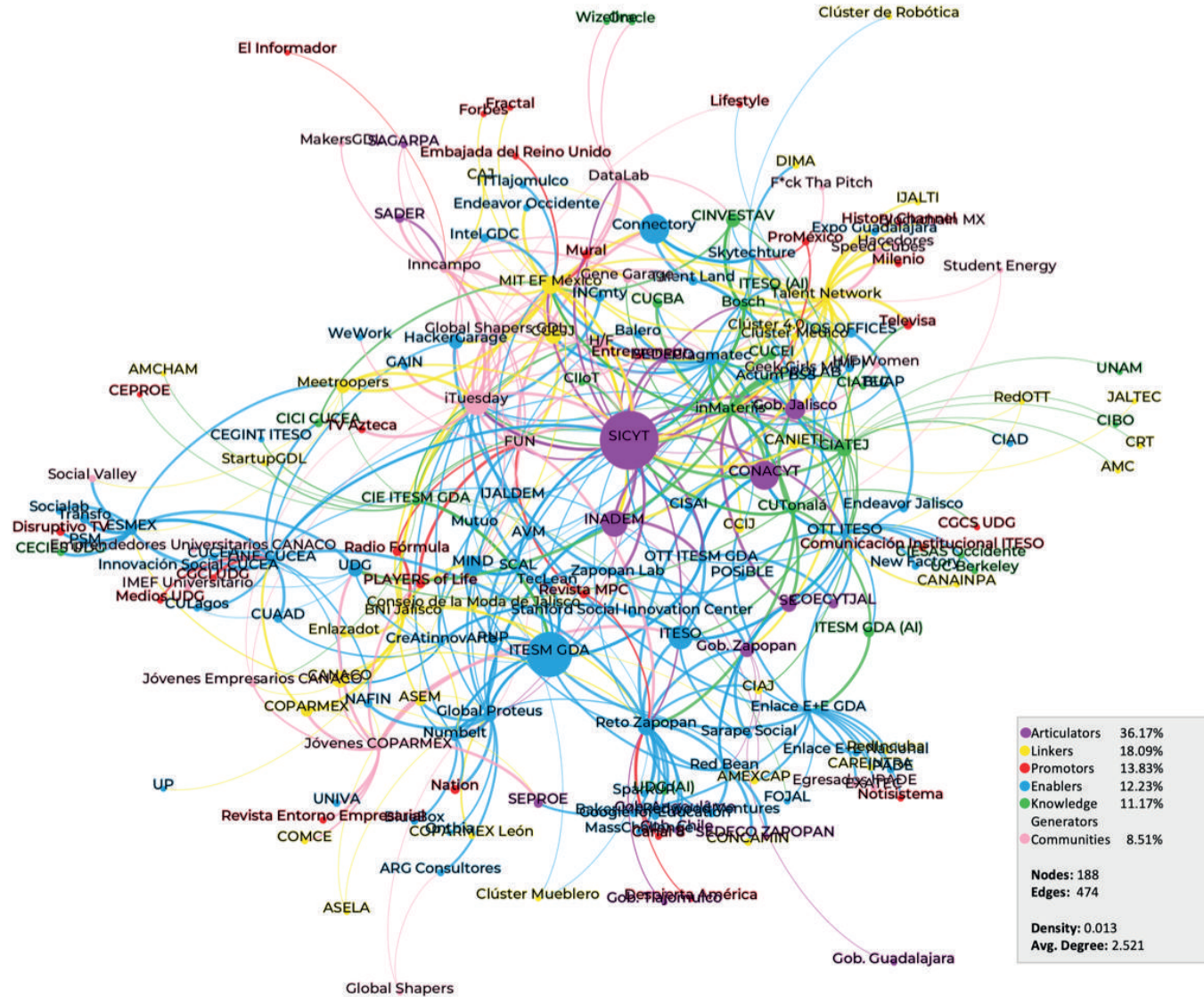Illustration 8. Projection of organizations identifying clusters.

Illustration 9. Mapping of Social Dynamics of the High Impact Entrepreneurship Ecosystem in Guadalajara.

ECONOMIC ECOSYSTEM MODEL
BASED ON ACTORS, ROLES AND VALUES.

Communities

These actors are formal or informal civil organizations that share knowledge, collaborate, and give dynamism to the high-impact entrepreneurial ecosystem. Communities, although they belong to civil society, are generally unorganized at birth, since they aren't born as formal institutions but as entities with the sole purpose of sharing knowledge, exerting mutual support, and enriching each other based on unique common objectives. They're the organizations that persist beyond public policies —propitious or not for development— and beyond temporally-constrained governments or institutions, they're thus the actors that give sustainability and continuity to the ecosystem.

Promoters

They disseminate and promote high-impact entrepreneurship —locally and internationally— as a means to support the scalability of ecosystems and to foster a culture of entrepreneurship and innovation.
Promoters are those ecosystem organizations that focus on disseminating entrepreneurial activity and on telling stories at either the national or even the international levels.
Promoters are usually public or private institutions, such as print or digital media, among others.

Knowledge Generators

Public and private institutions that generate new knowledge, which, in turn, can drive the creation of new projects, technologies, innovation, and high-impact entrepreneurship.
Knowledge is not only generated or found in academic institutions but in any organization that has a strong focus on creating scientific-technological or scientific-social-based knowledge, which can in turn be used through entrepreneurship to solve the great challenges of a country or the world.
Knowledge generators are usually public, private, academic, or civil society institutions focused on research, such as research centers,
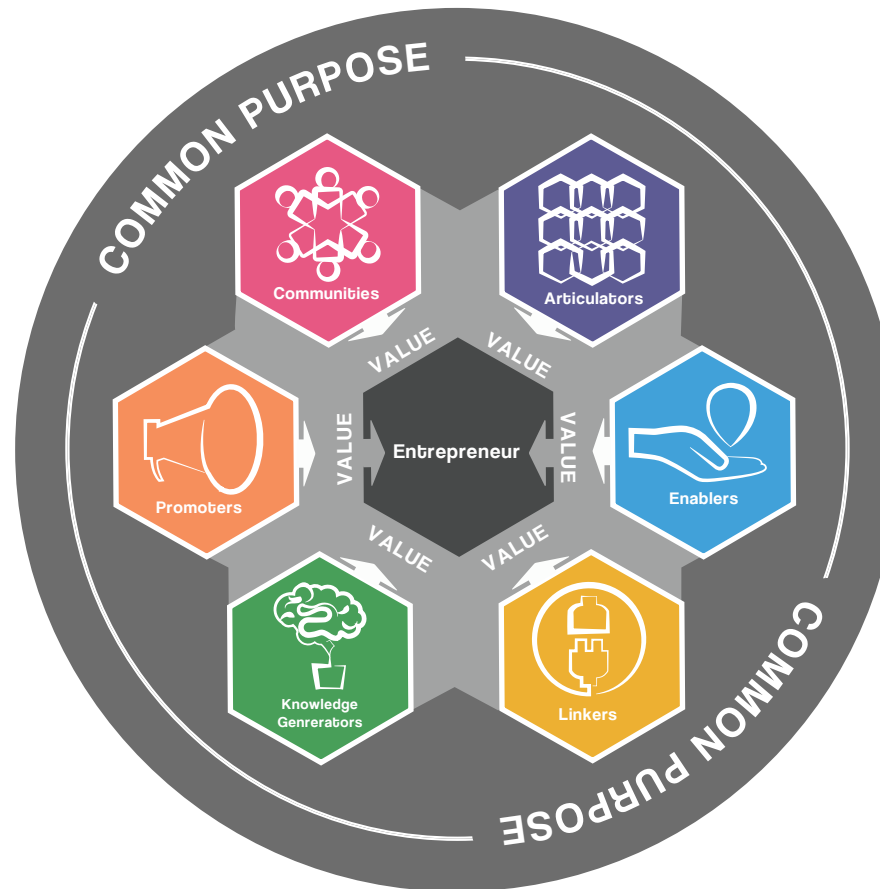
Articulators

They bring coherence and stability to the ecosystem by creating an appropriate environment for high-impact entrepreneurship and innovation to develop.
The role of the articulators is to ensure the creation of spaces and platforms that allow and encourage different actors not only to "talk" to each other, but to actively collaborate in joint initiatives, by means of the creation of public policies that encourage such collaboration.

Enablers

They provide resources in order to support the generation and development of new high impact and innovative projects, either within the ecosystem itself or outside it.
Enablers are all those who provide all kinds of tools and monetary or in-kind resources, such as training, talent, consulting, financial resources, infrastructure, and coworking spaces, among others. These allow the ecosystem to increase the level of resources available so that both actors and entrepreneurs can reduce the natural entry-barriers to the ecosystem or market. Regardless of monetary investments, enablers provide resources as strategic as the funds themselves.

Linkers

They connect entrepreneurs, companies, and actors within the ecosystem in order to create new relationships.
These relationships foster collaboration and the sharing of knowledge on best practices and market-information, while allowing institutions to face opportunities and problems together, strengthening their mutual position.
The linkers are usually public or private organizations that focus on connecting institutions with similar interests to strengthen their position by the establishment of common objectives, such as chambers of commerce, business or industrial councils, second-floor foundations, and organizational networks among others.

COMMON PURPOSE

Communities
Articulators
Promoters
Entrepreneur
Enablers
Knowledge Genrerators
Linkers

VALUE

COMMON PURPOSE

ABOUT THE AUTHORS

Marcelo Tedesco is an Affiliate Research at MIT D-Lab, part of the Local Innovation Group. He is a philosopher, sociologist, and expert in business and social transformation. He is the founder and Executive Director of Global Ecosystem Dynamics Initiative, an international research initiative and a non-profit organization affiliated to MIT D-Lab. He specializes in the development of economic ecosystems, mainly innovation-based entrepreneurial, in emerging countries. Recognized as one of the 10 most influential leaders of the entrepreneurial ecosystem in Mexico, he has received numerous awards and recognitions, including the Adolf Horn Award for leadership in the entrepreneurial ecosystem in Mexico. Among other executive positions, Marcelo was also Executive Director of the MIT Enterprise Forum in Mexico and Director of Strategy for TOSHIBA Latin America. He is the author of two books on strategy, leadership, and cultural patterns in Latin America. He has been a consultant of strategy and culture for several of the 100 most important companies in the world as well as for different governments and multilateral organizations.

Tania Serrano is an experienced professional in market strategy. For several years she was responsible for Business Intelligence of one of the largest companies in Mexico. Her passion for high-impact social entrepreneurship has led her to mentor different projects focused on the development of Mexico, from biomedicine to farming. Tania is Deputy General Director of Strategic Initiatives at MIT Enterprise Forum Mexico, being responsible for all strategic programs of the organization as well as the relationship with the organizations that make up the ecosystem of high-impact entrepreneurship in Mexico.

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