

# PROMOTING ENTREPRENEURIAL CULTURE IN THE UNIVERSITY: THE INSTITUTIONAL COLLABORATIVE MODEL AT THE UNIVERSIDAD AUTÓNOMA DE MADRID

**Subtheme:** S3 Triple Helix in action: unlocking economic and social crises.

**Keywords:** human sciences and social entrepreneurship, regional development, spin-off companies, university entrepreneurship, CIADE, Madrid, social innovation, Triple Helix.

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## ABSTRACT

This paper presents a clear case of collaboration among different types of Public Services and the Private Sector for the promotion of Entrepreneurial Culture by means of a program developed by one of the main universities in the Comunidad de Madrid (Spain).

The instrument to accomplish this task is the Center for Entrepreneurial Initiatives (CIADE) of the Universidad Autónoma de Madrid (UAM), set up twelve years ago for the promotion of entrepreneurial values and the creation of enterprises in the University.

Since its creation, CIADE, due to the lack of University-allocated financial resources, has been using a collaborative model with a wide range of entities. In this model, named “Triple Helix Model”, by Etzkowitz & Leydesdorff, the University (UAM) is supported by the following organizations: three levels of the Public Administration, national, regional and local (Ministry of Science and Innovation, the Regional Employment Service of the Comunidad de Madrid, and the Local Development Office of Madrid municipality, respectively), several private entities, with special attention to a financial institution (Caja Madrid Foundation) and different corporate civic entities (ACS Foundation, and 3M Foundation, among others).

The Triple Helix model is nowadays one of CIADE’s trademarks, both in its global design and in the operation of its different areas.

CIADE’s main distinctive elements from the Triple Helix model’s perspective are collaboration, self-financing, project management, and a horizontal hierarchical structure, which allows fast adaptation to the changing circumstances of the environment.

## INTRODUCTION:

Madrid is one of the most innovative poles in Spain, and it is among the regions with the greatest economic growth in Europe. It is considered a dynamic, multicultural and entrepreneurial region characterized by the convergence of public administration with a high concentration of universities (currently there are fourteen universities, seven of which are public, including the UAM, while the other seven are private). This social and economically complex environment has proved to be a very competitive setting for conventional entrepreneurial activity. Nevertheless, it is the right place to establish collaborative models.

According to the latest data by *Global Entrepreneurship Monitor* (GEM report, 2009), the rate of entrepreneurial activity (TEA) in Spain is 5.1%. If we focus only on entrepreneurs who are university educated, the rate is 17% of that initial figure, which means that less than 1% of Spaniards are university-educated entrepreneurs. This figure is quite low considering that 23.08% of the Spanish population has university degrees (according to data from the National Institute of Statistics/Instituto Nacional de Estadística)

This paper will analyze a typical case of collaboration between the public and private sectors in fostering the promotion of an entrepreneurial attitude via a program chartered by one of the most active Universities in Madrid, in collaboration with a financial institution's Foundation and three Public Administration bodies. Collaborative models have been studied by several researchers as in the case of the Triple Helix theory.

The organization to be highlighted is the *Center for Entrepreneurial Initiatives* (in Spanish *Centro de Iniciativas Emprendedoras* – CIADE, [www.ciade.org](http://www.ciade.org)) of the *Universidad Autónoma de Madrid* (UAM, [www.uam.es](http://www.uam.es)), which has been working for twelve years to foster entrepreneurial values and to support the creation of spin-offs and start-ups within the University.

In order to achieve this mission, comprehensive support is offered during all phases of the entrepreneurial process, from the birth of the business idea up to the firming up of the project. Table 1 lists the main services that are offered:

**Table 1. Main services offered to entrepreneurs by CIADE**

- |  |
|--|
| <ul style="list-style-type: none"><li>✓ Analysis of an idea's viability</li><li>✓ Training</li><li>✓ Business plan mentoring</li><li>✓ Financial guidance and seeking</li><li>✓ Guidance concerning Industrial and Intellectual Protection</li><li>✓ Assistance in seeking a location</li><li>✓ Assistance throughout the creation phase</li><li>✓ Acceleration in the consolidation and globalization phase</li></ul> |
|--|

Source: CIADE

The CIADE method is based on four fundamental principles: raising awareness, training, assistance and consolidation, directed toward anyone with entrepreneurial initiative, whether originating in the university (e.g. students, researchers and faculty) or the general public.

#### **The Organizational model of CIADE**

The CIADE model, since its inception, has been based on project management principles, which allows it to adapt itself and respond quickly to environmental changes.

Since the beginning, each one of its projects has followed a collaborative model working with various agents in order to achieve its objectives, in particular:

- The structural financing that since its inception has been provided by the Fundación Caja Madrid.
- The introduction in 2000 of the University Entrepreneur Award (Premio al Emprendedor Universitario) which recognizes collaboration with various financial entities (mainly enterprises and foundations of large corporations).
- The debut in 2004 and 2007 of two programs with two Public Administration bodies: the Ministry of Science and Innovation and the Regional Employment Service of the Comunidad de Madrid, respectively. The objective of the first is to promote the number of technology-based enterprises originating in the University, and the second to spread the entrepreneurial spirit among university students, as well as serving as an information point for entrepreneurs in the Comunidad de Madrid.

Since 2009, CIADE has been restructured into three areas:

- Science and Technology
- Humanities, Social Sciences and Law
- Entrepreneurship in the Third Sector

The reason for this division is due to the fact that each one of the entrepreneurial groups, as classified above, has unique characteristics and calls for a series of specific services, prompting CIADE to specialize its services that prior to 2009 were more generalist.

This new structure sets out to further the collaborative model in such a way that currently each area behaves independently of the others, following its own Triple Helix model in order to maintain agreements with various organizations that allow specific projects to be carried out and self-financed. Table 2 shows examples of this model in each area:

**Table 2. Example of the Triple Helix model for each one of CIADE's activity areas**

<b>Area</b>	<b>Project</b>	<b>Description</b>	<b>Parties Involved (collaborators y financiers)</b>
<b>Science and Technology</b>	Project for the creation and acceleration of technology-based enterprises	Enables the creation and the firming up of technology enterprises via specific consulting, training and coaching services	Parque Científico de Madrid, Fundación Genoma España, Ministry of Science and Innovation, OTRI-UAM and CIADE-UAM.
<b>Social Entrepreneurship</b>	Insertion Program for the Green Entrepreneur	Training program to specialize businesses in entering into the environmental sector. Enabling self-employment among people at risk for exclusion in this sector	Fundación de la UAM, Obra Social de Caja Madrid, CIADE-UAM and the Federación de Asociaciones de Empresariales de Empresas de Inserción
<b>Humanities and Social Sciences</b>	School of Humanities and Social Sciences	Program designed specifically to support entrepreneurs	In development, with the promised support of the network of incubators of the Madrid City Council (Madrid Emprende) CIADE-UAM and other city councils close to the UAM

Source: CIADE

For all these reasons CIADE has been appointed as Best Practice in the European Commission's report "*Entrepreneurship in Higher Education in Europe*" ([http://ec.europa.eu/enterprise/policies/sme/files/support\\_measures/training\\_education/highedsurvey\\_en.pdf](http://ec.europa.eu/enterprise/policies/sme/files/support_measures/training_education/highedsurvey_en.pdf))

**STATE OF THE ART:**

Since Etzkowitz and Leydesdorff (1995) defined the Triple Helix model, the University-Public Administration-Enterprise relationship has been deeply studied by a broad number of researchers. This coordination is closely related to country competitiveness. There are ample records dealing with the importance of diffusion of entrepreneurial culture and the policies oriented to its promotion (Lumpkin and Dess 1996, Lee and Peterson, 2000).

The relevance of entrepreneurship as the key factor for economic growth as well as to regional development is constantly increasing, thus justifying its promotion. To illustrate this reality it is relevant to mention the recommendations of the OECD's Business and Industry Advisory Committee (BIAC) and the commitments of the UE Lisbon Summit, March, 2000.

The promotion of the entrepreneurial spirit in universities refers to the concept of university entrepreneurship, such as the ability of a university to transfer to Society its own projects, knowledge and technologies through multiple channels, among those the creation of university spin-offs. It is at this second level we find studies about how to generate an entrepreneurial culture in a university (Vickers *et al.*, 2001 and Kirby, 2005), including diverse studies of best practices in university entrepreneur programs. (Kloftsten, M. and Serio, L., 2008)

#### **RESEARCH FOCUS:**

The main objective of our research will be to analyze the role Public Administration and the private sector play in the UAM with respect to the creation of an entrepreneurial university, to understand just how a university openly draws on market opportunities and meets the demands and challenges of Society.

The first aim will be to analyze how students' perception of entrepreneurship and self-employment as a career path has changed, the various programs carried out to stimulate this change in attitude, as well as the main indicators of entrepreneurial activity.

The second aim will be to analyze University support in the entrepreneurial process along with the structures to create enterprises and the number of enterprises that have participated with the UAM.

#### **RESEARCH METHODOLOGY:**

Following the single-case study (Yin, 1989), this analysis will center on five main components:

- A set of research questions. In this study we shall set out to answer the following questions:
  - o **Q1:** Can a university act as a catalyst for making the objectives of programs designed by different administrations and the private sector compatible?
  - o **Q2:** Has the participation of public administration bodies affected in some way the development of an entrepreneurial culture in the University?
  - o **Q3:** What role should the University play in engaging various levels and government authorities in order to create an entrepreneurial culture in the two levels mentioned above?
  
- Some theoretical propositions to contrast with the research results are as follows:
  - o With respect to Q1, the following propositions:
    - P1:** In theory, private companies are more concerned with certain short-term objectives than public entities.
    - P2:** It is easier for a public university, theoretically, to seek financing from Public Administration bodies than from private entities.
  - o With respect to Q2, the following proposition:
    - P3:** We will demonstrate that the presence of programs designed and financed by Public Administration bodies effectively influence the main indicators of entrepreneurial activity in the university..
  - o With respect to Q3, the following propositions:

**P4:** The university should play the role of unifier and coordinator of the various support structures in order to, as expert in its field and sector, achieve the maximum coherence and effectiveness of these programs.

**P5:** The existence of a variety of programs designed by various public and private agents with different objectives can lead to either closed off units or the rise of opposing interests.

- The unit of analysis selected. In this case, is it the UAM and the operation of its Center for Entrepreneurial Initiatives (CIADE - UAM) in the period from 1998-2009.

Regarding the Center's own data, CIADE has been collecting various indicators since its inception, such as the number of entrepreneurs assisted, business plans mentored or businesses created, which have been increasing throughout the years.

- Logical link between the data and the propositions, presenting the criteria for the interpretation of this data. As this is the nucleus of the paper we move on to the *Field Work* section for the presentation of the data collected in order to form a logical connection in the *Findings* section.

## FIELD WORK

In order to analyze the propositions considered for the research questions, the best approach would be to analyze the key results obtained by the CIADE, given that multiple conclusions can be drawn from this data.

The first table, Table 3, shows the start dates and length of continued collaboration of the various public and private entities with CIADE.

**Table 3. Main Entities and Length of Continuation**

<b>Private Entities</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Fundación Caja Madrid												
Fundación ACS												
Fundación Canal de Isabel II												
Fundación Alfonso Martín Escudero												
Fundación Iberdrola												
Fundación 3M												
Fundación AUNO												
PricewaterhouseCoopers												
Fundación de la UAM												
Parque Científico de Madrid												
<b>Public Entities</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Fondo Social Europeo Equal												
Regional Employment Service												
Ministry of Science and Innovation												

Source: CIADE

In the following table, Table 4, the major milestones of the start dates of CIADE collaborations are shown in relation to the structural milestones that they brought about.

**Table 4. Major Milestones in CIADE since its inception**

Year	Collaborative Milestones	Structural milestones
1998	Collaboration agreement with Fundación Caja Madrid	Creation of CIADE
2000	First University Entrepreneur Award	Private entities and foundations join as sponsors (e.g. Fundación ACS)
2002	Institutional legitimacy	Own installations, pavilion C (university campus)
2004	Beginning of Collaboration with the Ministry of Science and Innovation	Program for the creation of technology-based businesses
2005	New sponsors join the University Entrepreneur Award (e.g. Fundación 3M) A new collaborative agent joins, the Fondo Social Europeo via Equal	Annual competition for the University Entrepreneur Award.
2006	-	Start of the School of Social Entrepreneurs (financed by Equal).
2007	Support from the governing bodies of the University of the activities of CIADE	Beginning of elective courses
2007	Beginning of collaboration with regional Public Administration through the Regional Employment Service of the Comunidad de Madrid.	Start of the Campus Program of the Promotion of Entrepreneurial Spirit
2009	-	Creation of the three communities of CIADE

Source: CIADE

Table 5 reflects the key entrepreneurial data:

**Table 5. Entrepreneurial Activity**

Activity Indicators	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total Entrepreneurs Assisted	23	30	66	35	59	35	84	106	82	147	208	303	<b>1178</b>
Female Entrepreneurs	6	11	16	12	23	10	34	28	38	65	74	141	<b>458</b>
% females of total	26%	37%	24%	34%	39%	29%	40%	26%	46%	44%	36%	47%	<b>4,28</b>
Ideas valued	10	17	55	24	29	25	56	72	68	72	85	103	<b>616</b>
Web Consultations	-	-	-	-	-	-	-	-	-	-	190	392	<b>582</b>
Business Plans Initiated	10	17	45	20	29	21	29	38	28	32	39	44	<b>352</b>
Business Plans Finalized	6	5	26	17	27	18	16	22	21	22	30	32	<b>242</b>
Businesses Created	-	8	16	9	9	9	10	14	21	17	18	19	<b>150</b>

Source: CIADE

	Period of collaboration with the Ministry of Science and Innovation
	Period in which collaboration with the Ministry continued and the Regional Employment Service of the Comunidad de Madrid also joined

As of December 2009, CIADE had assisted in the creation of 150 enterprises, which by the very nature of the Center and the groups it aims to assist, operate in very diverse fields. Table 6 shows these 150 enterprises classified by the origin of its developers.

Regarding the classification of the developing team, the division is made based on whether the enterprises were developed by teaching and research staff with the University's participation and social capital (which

would be the termed spin-off), or if they are enterprises developed by the rest of the university community (called start ups), or if there is no tie between the member and the UAM.

**Table 6. Enterprises created with the support of CIADE**

Enterprise creation indicators	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
N° of business incubators	-	-	-	1	1	1	1	1	1	1	1	1	1
Spin-off (UAM participated)	-	-	-	-	1	1	3	1	2	3	2	4	17
Start up (students, and ex UAM)	-	4	11	6	4	6	4	8	11	6	10	10	80
Others (OPIS/Universities/other)	-	4	5	3	4	2	3	5	8	8	6	5	53
<b>Total enterprises</b>	-	<b>8</b>	<b>16</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>10</b>	<b>14</b>	<b>21</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>150</b>

Source: CIADE

	Period of collaboration with the Ministry of Science and Innovation
	Period in which collaboration with the Ministry continued and the n de la Comunidad de Madrid also joined

Another division can be seen in connection to the different knowledge areas in which the enterprises operate, as observed in Table 7. These have been classified according to the existing specialization of CIADE as: Science and Technology businesses, which would develop their professional activity in any of the disciplines related to this area (medicine, chemistry, biotechnology, psychology, computer science and engineering...), Humanities/Social Sciences/Legal businesses (law, psychology, philosophy, linguistics, history...) and Third Sector entities which would be organizations that arise to meet the needs of a specific group or alleviate a specific problem and wouldn't be profit-minded (associations and foundations).

**Table 7. Classification of the enterprises supported by CIADE**

Classification of Created Enterprises	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Developed by Women	-	2	2	1	1	-	3	2	4	3	4	5	27
Science and Technology Enterprises	-	4	6	4	4	7	5	5	5	10	7	9	66
Enterprises: Humanities/S. Sci./ Legal	-	4	9	4	5	2	5	7	10	6	6	7	65
Entrepreneurship in the Third Sector	-	-	1	1	-	-	-	2	6	1	5	3	19

Source: CIADE

	Period of collaboration with the Ministry of Science and Innovation
	Period in which collaboration with the Ministry continued and the Regional Employment Service of the Comunidad de Madrid also joined

## FINDINGS:

### 1. The university as a catalyst of initiatives for various agents

In this topic, we considered the role that the public sector and the private sector would play in the entrepreneurial environment within the University, and to do so we made two propositions:

The first assumption is that businesses will have more specific and short-term objectives related to the UAM than the public sector (P1).

Contrary to this assumption, the results are not so clear cut given that, as shown in Table 3, only four entities have maintained a specific and short-term collaboration, five have continued their collaboration despite the severe crisis that affects Spain, and the rest have ceased collaboration as a result of the current economic crisis.

With respect to the proposition that it is easier for a public university to turn to Public Administration (P2), we can see in Table 3 that the primary support systems, contrary to what was expected, were private (Fundación Caja Madrid, in particular), with public bodies not joining until seven years after the creation of the Center. However, once public support was obtained, it resulted in strength and stability allowing the consolidation of results, as can be seen later in the text.

## **2. Impact of public programs on the entrepreneurial culture of the University**

Concerning the effectiveness of programs designed and financed by Public Administration bodies and the main indicators of entrepreneurial activity in the University (P3), we highlight three main periods: the creation of the Center until 2003, during which it only received financing from one private source, the period 2004-2006, coinciding with the beginning of participation by the Ministry of Science and Innovation and the period 2007-2009, when the Regional Employment Service of the Comunidad de Madrid joined.

Nonetheless, the major leaps coincided with the induction of programs supported by the Public Administration bodies. The average of forty-one entrepreneurs assisted in the period 1998-2003 jumped to ninety in the period 2004-2006 and then to two hundred nineteen in the period 2007-2009. It is also important to note the gradual increase of women assisted, which was almost equal to men in 2009.

Regarding the number of enterprises created by students, Table 6, the rate in the first six years of CIADE was five per year, increasing to more than seven per year in the period 2004-2006 and, in the most recent period studied, to almost nine in 2007-2009.

There is also evidence of a clear positioning toward what would be defined as an Entrepreneurial University. As shown in Table 6, the average number of businesses participated in by the University (spin-offs) in the period 1998-2003 was practically zero. In the second period studied, 2004-2006, that number grew to two per year and in the last period, 2007-2009, it reached three per year. It is also important to note that the University has provided a business incubator on its campus since 2001 (The Scientific Park of Madrid/el Parque Científico de Madrid that currently has two buildings to house businesses on the university campus).

## **3. The generation of entrepreneurial culture in the University: the work of many**

If anything can be attested by the trajectory of CIADE it is that the model for the creation of an entrepreneurial culture in UAM has fourteen entities, as can be seen in Table 3. CIADE has acted as a coordinator and integrator for various public and private agents, each time developing programs in greater numbers and more ambitious. Therefore, this proposition can be confirmed (P4).

In light of the data reflected in Tables 5 and 6, one can respond to the fifth proposition (P5) that considered the question of whether the coexistence of various programs designed by various public and private agents with different aims could give rise to competing interests or compartmentalization. We can affirm that these risks, in our case, have been avoided.

As an example of this, one only has to look at the programs financed by the Ministry of Science and Innovation and the Regional Employment Service. 62% of the science/technology-based businesses and 88% of the spin-offs have been set up since 2004, coinciding with the financial support of the Ministry of Science and Innovation, which co-financed the hiring of staff on behalf of CIADE in order to stimulate the creation of these types of businesses. With regard to the Regional Employment Service program, the objective is to spread the values of entrepreneurship, and 56% of the entrepreneurs assisted in the history of the Center were advised in the period 2007-2009, coinciding with the beginning of this program. Therefore, a clear relationship between these programs and the achieved results can be observed; not only is there no conflict between them but, in fact, there is a synergy. The more the diffusion of the entrepreneurial spirit is emphasized, and the more personal consultations given, the greater the number of enterprises created, including those with a technology base, as shown in the period 2004-2006 when five technology-based enterprises were created a year, and in the period from 2007-2009 when that number grew to eight.



## CONTRIBUTIONS AND IMPLICATIONS:

The Triple Helix model provides a high capacity for social innovation in the design of models oriented towards change, since the agents involved can more easily cooperate in a context of interdependence.

In this area, a University can act as catalyst for national and regional policies in the promotion of entrepreneurship, thus fostering the transformation of the regional productive model.

The distinctive elements (drivers) of the model are collaboration, self-financing, project management, and a horizontal hierarchical structure, allowing flexibility and agility in the presence of opportunities and environmental conditions.

CIADE is a clear example of collaborative management, wherein the University, Enterprise and Public Administration play a fundamental role in the development of entrepreneurship. This is the underlying model of all aspects of the Center's operations, thus the objective is for each area to operate, in turn, under the Triple Helix model in such a way that each area develops its own collaborations and projects, focusing on opportunity and sustainability.

The CIADE model proves that the sum of specific projects, each one viable in its own right, can contribute to the success of a global project. In this manner, the partial contributions of all types of entities and financing formulas can lead to a synergy and sharing of resources that results in a greater diffusion of entrepreneurial spirit, especially among the university community.

## REFERENCES:

"Best Procedure Project: Entrepreneurship in higher education, especially within non-business Studies". Directorate General for Enterprise and Industry. European Commission (2008).

Bueno, Y.; de Pablo, I.; Santos, B. (2006): "Actitudes emprendedoras de los estudiantes de la Universidad Autónoma de Madrid". Grupo de Investigación GENERA, Departamento de Contabilidad y Organización de Empresas. Universidad Autónoma de Madrid.

Etzkowitz, H., Leydesdorff, L. (1995): "The triple helix-university-industry-government relations: a laboratory for knowledge-based economic development. *EASST Review*, 14 (1), pp. 14-19

EU Lisbon Summit [www.euroactiv.com](http://www.euroactiv.com)

de Pablo, I. et al. (2001): "Diagnóstico del perfil emprendedor de los universitarios de la Comunidad de Madrid". Edita Agencia Financiera de Madrid. Madrid.

Indicadores Sociales (2009): Instituto Nacional de Estadística (INE), [www.ine.es](http://www.ine.es)

Informe Ejecutivo Global Entrepreneurship Monitor España (2009). Instituto de Empresa, Madrid. [www.ie.edu/gem](http://www.ie.edu/gem)

Kirby, D.A. (2005). "Creating Entrepreneurial Universities in the UK: Applying entrepreneurship theory to practice". *Journal of Technology Transfer*, Vol. 3 (5), p. 599

Klofsten, M. and Serio, L. (2008). European Entrepreneurship Training programmes: European Best practices. High technology Small Firms Conference 22 and 23 May 2008, Enschede, the Netherlands.

Lee, S. and Peterson, S. (2000): "Culture, entrepreneurial orientation and global competitiveness". *Journal of World Business*, 35 (4), pp 401-416.

Observatorio de Empleo de la UAM (2009): "La inserción laboral de los titulados de la Universidad Autónoma de Madrid del curso 2006/2007". Vicerrectorado de Estudiantes y Extensión Universitaria. Universidad Autónoma de Madrid.

OECD's Business and Industry Advisory Committee [www.biac.org](http://www.biac.org)

Vickers, K. et al, 2001. "Creation of an entrepreneurial university culture, the University of Arkansas as a case study". *Journal of Engineering Education*, 90:4, pp. 617-622.

Yin, R.K., 1989. "Case study research—design and methods". (2nd ed.), *Applied Social Research Methods Series* vol. 5, Sage Publications, Newbury Park (CA)

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