INTERNATIONAL WORKSHOP
BBVA Foundation – Ivie

KNOWLEDGE, INNOVATION AND REGIONAL DEVELOPMENT: NEW EVIDENCE

18 October 2019 - Faculty of Economics

Fundación BBVA

Ivie

In collaboration with:

Universitat de València

Facultat d'Economia

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Her research interests are in the field of economics of education, with a specific focus on higher education institutions (e.g. efficiency, productivity, quality assurance, university-business cooperation, academic entrepreneurship, technology transfer). She is in the editorial board of different academic journals including the Journal of Business Research, Management Decision, Journal of Innovation and Knowledge, and Intangible Capital.

Among other academic roles, since 2016 she is the director of the double degree in Business+Engineering in collaboration with Politecnico de Torino and the director of the Master's Programme in Business Administration and Production Systems, both at UIC. In these programmes she teaches the courses on Quality Management, Operations Management and Project Management.

Assessing universities' performance and their role in fostering regional economies

Jasmina Berbegal Mirabent

Knowledge, innovation and regional development: New evidence

Valencia, 18 October 2019

Universities and the consolidation of knowledge-based sectors

Krisztina Horváth
University of Pécs

Cross-country analysis of higher education institutions' efficiency: The role of strategic positioning

Tommaso Agasisti
Politecnico di Milano

Triple Helix and the evolution of ecosystems of innovation

Josep M. Piqué
la Salle - Universitat Ramon Llull

Henry Etzkowitz
Stanford University

Universities and the consolidation of knowledge-based sectors:

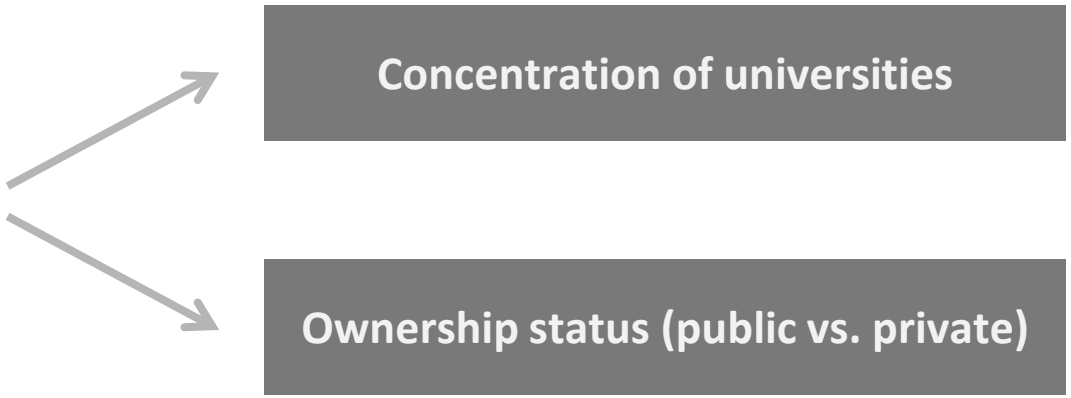
An application of the knowledge spillover theory on KIBS formation in Spanish regions

Krisztina Horváth
University of Pécs

Context

- A **priority** in **public policy**: knowledge-based economies
- Increasing expectations from **universities** to **facilitate knowledge-based** processes (European Commission, 2015)
- Knowledge-intensive business services (**KIBS**) firms as key engines: both sources and recipients of **knowledge** (European Commission, 2007, 2012)… e.g., *interconnectedness with manufacturing*

To what extent do **universities contribute** to **KIBS** formation in the same territory?



Hypotheses

H1: Higher concentration of universities contributes to higher KIBS formation in the same region

- **Knowledge spillover processes** between **HEIs** & **businesses** (Fernandes & Ferreira, 2013; Varga & Sebestyén, 2017)
- **Businesses' choice** to **locate** close to HEIs might be conditioned by their differing need for their knowledge output
    - *Type of firm* (Harhoff, 2000; Fischer et al., 2018)
    - *Accessibility (codified vs. tacit nature) of knowledge* (Acosta et al., 2011; Calcagnini et al., 2016)
    - *Quality of knowledge: impact of competition on university performance* (Agasisti et al., 2019)

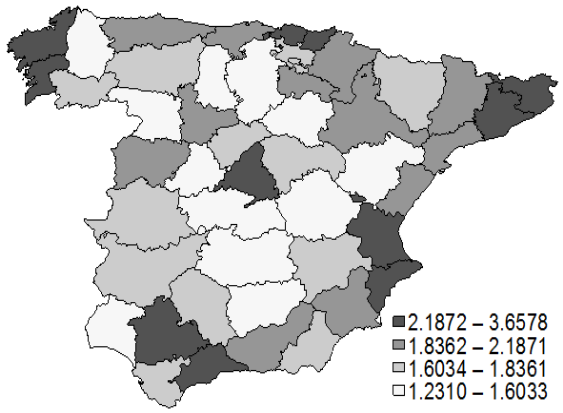
H2: Higher rate of public universities contributes to higher KIBS formation in the same region

- The **meaning** of '**public**' in universities (i.e. the case of Spain)
- Characteristics of **public vs. private** universities. On average, **public universities** have:
    - *…higher number of R&D contracts* (Caldera and Debande, 2010)
    - *… higher research productivity* (Casani et al., 2014)
    - *… substitutes of KIBS in less developed territories* (Pinto et al., 2015)

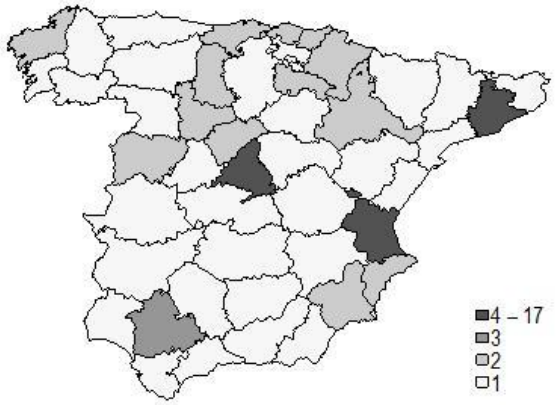
Data and variables

- **Data sources**: EUROSTAT, ETER, INE
- **Level of analysis**: 47 **NUTS-3** level Spanish regions
- **Period**: **2009-2013**

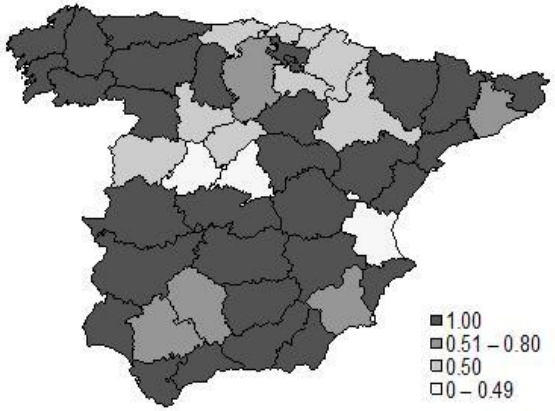
- **Dependent variable**: KIBS formation rate
- **Independent variables**: number of universities, proportion of public universities
- **Control variables**: proportion of industrial businesses, GDP per capita, population density



Number of new KIBS firms per 1000 workers



Number of universities



Proportion of public universities

Method

Spatial Durbin panel models

- **Base model** (1)

$$\text{KIBS fr}_{rt} = \rho W \text{ KIBS fr}_{rt} + \beta_1 \text{Number\_univ}_{rt} + \beta_2 \text{Prop\_public}_{rt} + \beta_3 \text{Controls} + \theta_1 W \text{ Number\_univ}_{rt} + \theta_2 W \text{ Prop\_public}_{rt} + \theta_3 W \text{ Controls} + \mu_r + \lambda_t + \varepsilon_{rt}$$

- **Full model** (2): Interaction with the proportion of industrial businesses

$$\text{KIBS fr}_{rt} = \rho W \text{ KIBS fr}_{rt} + \beta_1 \text{NumberUniv}_{rt} + \beta_2 \text{PropPublic}_{rt} + \beta_{31} \text{NumberUniv}_{rt} \times \text{PropInd}_{rt} + \beta_{32} \text{PropPublic}_{rt} \times \text{PropInd}_{rt} + \beta_4 \text{Controls} + \theta_1 W \text{ NumberUniv}_{rt} + \theta_2 W \text{ PropPublic}_{rt} + \theta_{31} W \text{ NumberUniv}_{rt} \times \text{PropInd}_{rt} + \theta_{32} W \text{ PropPublic}_{rt} \times \text{PropInd}_{rt} + \theta_4 W \text{ Controls} + \mu_r + \lambda_t + \varepsilon_{rt}$$

Results

	Model 1: Baseline model				Model 2: Full model			
Dependent variable: KIBS formation rate	**Coefficient (Std. error)**	**Direct effect**	**Indirect Effect**	**Total effect**	**Coefficient (Std. error)**	**Direct effect**	**Indirect effect**	**Total effect**
Number of HEIs (ln)	0.8865** (0.3858)	**1.0912** (0.4360)**	3.1916 (2.2572)	4.2829* (2.5098)	1.4450*** (0.4951)	**1.5799*** (0.5117)**	3.4166 (2.2975)	4.9966** (2.5080)
Proportion of public HEIs	1.2507** (0.5230)	**1.5815*** (0.5902)**	5.1155 (3.2033)	6.6970* (3.5495)	3.0407*** (0.9237)	**3.3780*** (0.9207)**	9.0966* (4.7185)	12.4746** (5.0833)
Proportion of industrial businesses	0.0104 (0.0568)	0.0203 (0.0557)	0.1326 (0.1093)	0.1529 (0.1145)	0.2328*** (0.0701)	0.2419*** (0.0799)	0.3102 (0.3919)	0.5521 (0.4507)
Number of HEIs (ln) X Proportion of industrial businesses					–0.0843** (0.0389)	**–0.0712* (0.0387)**	0.1916 (0.1983)	0.1204 (0.2411)
Proportion of public HEIs X Proportion of industrial businesses					–0.2280*** (0.0650)	**–0.2232*** (0.0729)**	–0.1525 (0.3367)	–0.3757 (0.3879)

H1

H2

H1

H2

Note: Time dummies are included in the model specification (2013 is the omitted time category). Robust standard errors adjusted by heteroskedasticity are presented in brackets. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. Spatially lagged and control variables are included.

Results

- Universities have a **heterogeneous impact** on **regional economic development**
- In **Spain**, increased presence of universities and **public universities** in general have a **positive effect** on regional KIBS formation… **BUT** these positive effects may be conditioned by **other regional characteristics**! (e.g. *industrial specialization of regions*)
- Policy **recommendations**:
    - ***Leading regions*** *with more universities: importance of adapting to EU standards*
    - ***Less developed regions*** *with more public universities: university-industry interactions should be supported to increase knowledge exploitation and business development*

Cross-country analysis of higher education institutions' efficiency:

The role of strategic positioning

Tommaso Agasisti

Politecnico di Milano

Setting

- **Academic institutions** are asked to **improve** their **efficiency** (European Commission, 2017).
- **Universities** have very **different traditions**. Using their operational and strategic **autonomy** have developed their activities in an **heterogeneous** way (Fumasoli et al., 2014) → **Different strategies** (T, R, 3rd mission).
- The **exposure** to a **growing internationalization** (Altbach & Knight, 2007) is affecting universities' strategic choices.
- Universities have to decide whether they want to **compete** in the **international market** – becoming "world-class" institutions (Deem et al., 2008), or in the **national market** as flagship universities (Douglass, 2016) or to be more oriented to **regional/local market**.
- "**Strategic profiles**" (Warning, 2007) → The evaluation of HEIs' performance cannot assume that each institution is pursuing the same objectives.

Research question

Investigate the extent to which **strategic choices** regarding **international positioning** and **scope** determine how **efficient** universities are in the **allocation** of their internal resources for the production of a given set of outputs.

Are there any differences in performance (efficiency) across groups?

Original contribution

1. Universities are **heterogeneous** and that this diversity needs to be considered when analysing their performance
   - *Heterogeneity comes from the strategy and the positioning > We study efficiency but we interpret the results by grouping universities that share a similar strategy.*

2. Prior studies examining universities' efficiency have mainly concentrated in **teaching** and **research** outputs.
   - *We model universities' objective function using indicators for T, R, and 3rd mission outputs.*

3. Literature examining cost/technical efficiency of universities has mainly adopted a **country-specific** approach.
   - *Our study look across several European countries.*

4. Previous studies have mainly restricted their analysis to **public** and **governmental universities**.
   - *This study confronts patterns of efficiency based on the legal status.*

Data

- European Tertiary Education Register (**ETER**) → 2,764 HEIs in 36 countries
- European Patent Office's Worldwide Patent Statistical Database (**PATSTAT**) → > 100 patent offices
- **Period**: **2011-2013**
- **Final sample**: **761 observations** from 307 universities located in **8 countries**

Country	# HEIs	Legal status		Average age	Academic diversity
		Public	Private		
Belgium (BE)	5	3	2	178.11	0.2489
Switzerland (CH)	10	10	0	164.96	0.3111
Germany (DE)	68	66	2	211.20	0.2350
Italy (IT)	57	52	5	218.45	0.2586
Lithuania (LT)	10	10	0	104.30	0.3990
Portugal (PT)	10	10	0	114.70	0.2170
Sweden (SE)	28	25	3	82.000	0.3120
United Kingdom (UK)	119	0	119	135.23	0.2160
Total	307	176	131	163.52	0.2403

Method

Step 1: Cluster analysis

- **Objective**: Characterise European universities
- **Based on**: level of internationalisation (share of foreign students, share of international academic staff), third-party funding
- **How?**
  - For each year and indicator, compute the median
  - Group universities according to whether they are above or below these values

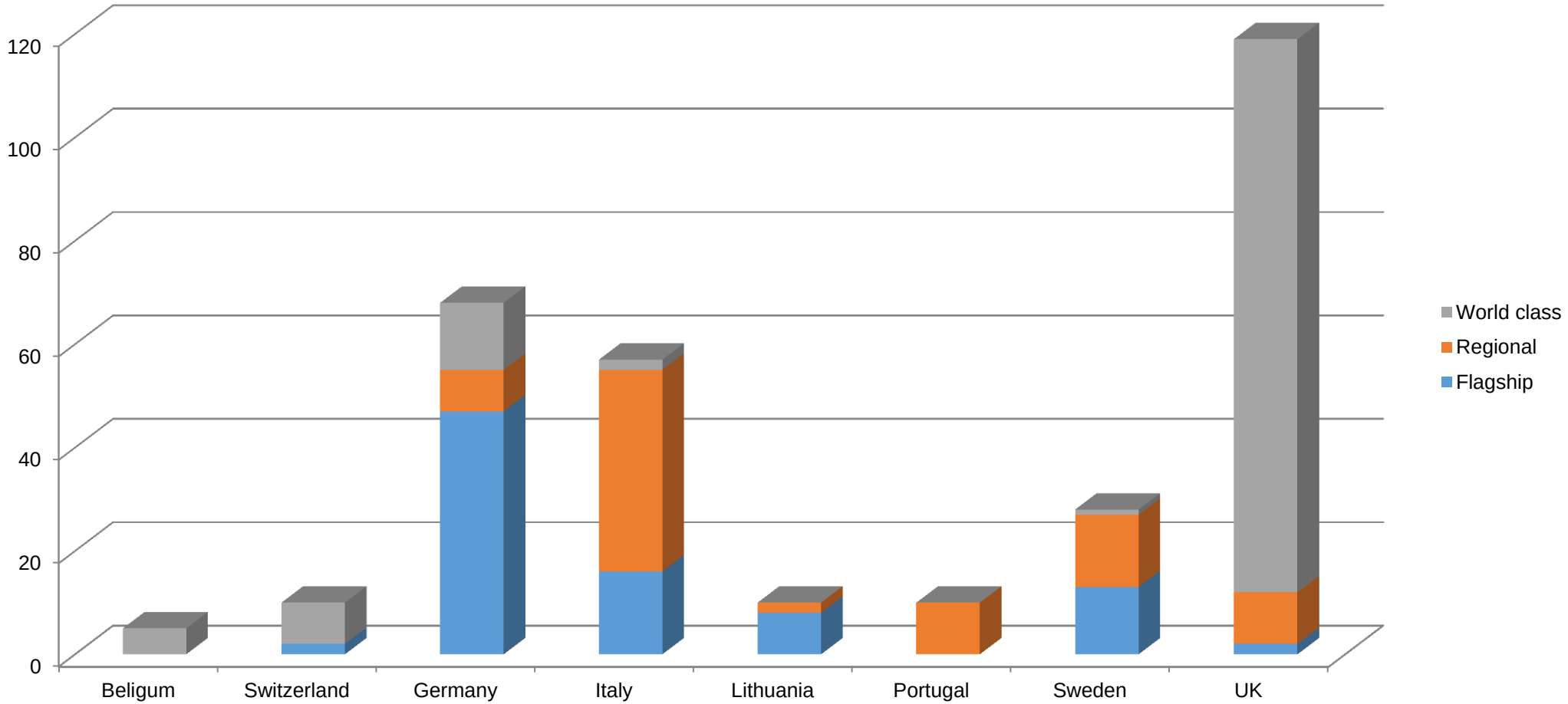
Step 2: Meta-frontier analysis

- **Objective**: Compare universities with adequate peers.
- **How?**
  - DEA (bootstrapped scores), output oriented, VRS
  - Procedure described by O'Donnell et al. (2008)
  - Input: Budget
  - Outputs: ISCED 6, ISCED 7, papers (JCR), patents, third party

Step 3: Regression model

- **Objective**: Effect of exogenous variables on efficiency scores.
- **How?**
  - Truncated regression model (DEA scores from step 2)
  - Independent variables: academic spread, age, academic/non-academic staff, hospital, legal status, multicampus, time & country effects

Results: Step 1



Results: Step 2

- **Without** accounting for **heterogeneity** (**DEA-MF**)
  - Average efficiency 0.5708
  - ↑ UK, Belgium and Sweden
  - ↓ Switzerland, Portugal and Germany

- Comparing universities with **appropriate peers** (**DEA-K**)
  - DEA-K is higher than DEA-MF (statistically different, also by groups)
  - **Regional** universities produce outputs under conditions that are more restrictive compared to **world-class** and **flagship** universities, yet, within the own group universities are performing reasonably well
  - The average DEA-MTR for **world-class** universities is the highest (0.9483) → the group frontier for these universities is the closest to the meta-frontier
  - **Flagship** universities exhibit an intermediate value (0.7774)
  - **Performance**: World class > Flagship > Regional

Results: Step 3

- Inefficiency is related to high academic diversity (**G, WC, R**) → **specialisation**
- **Public** universities tend to be less efficient than private ones (**G, F, R**)
- The **age** of the university is relevant (**G**)
- Proportion of **academic staff relative to non-academic staff**
  - Large pool of academic staff + qualified non-academic staff (**G, WC, F**)
  - Balanced workforce (**R**)
- Inefficiency is **not explained** by **country-specific** unobservable factors. Exceptions:
  - Belgium (WC), Switzerland (G, WC, F) and Denmark (R) → less efficient
- Universities become less efficient **over time** (**G, WC, R**), but short panel data

Triple Helix and the evolution of ecosystems of innovation:

The case of Silicon Valley

Josep M. Piqué

la Salle - Universitat Ramon Llull | IASP

Henry Etzkowitz

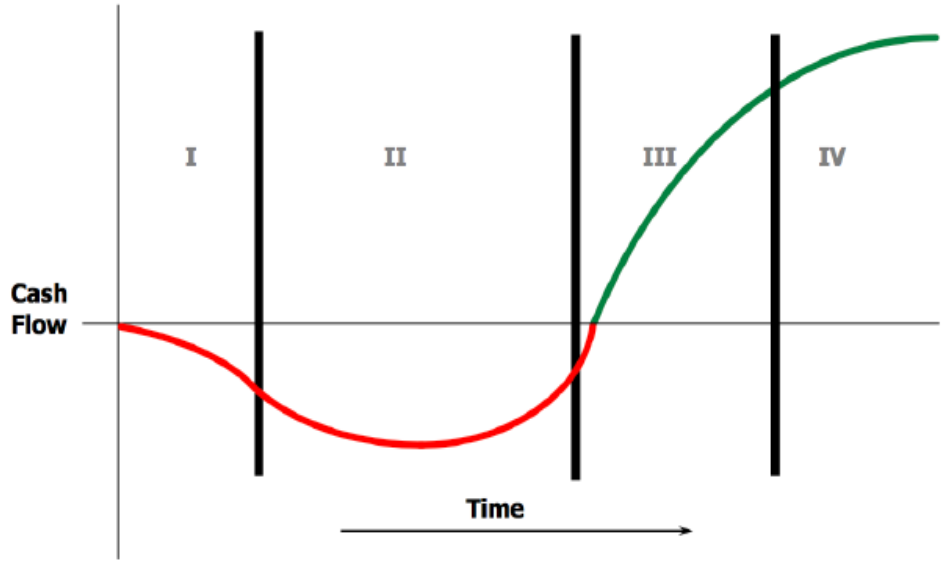
Stanford University | Triple Helix Association

Setting

- Silicon Valley as the **archetype of innovation ecosystems** → widely discussed in the academic literature and policy debate (Cheyre et al., 2015; Engel, 2015; Katz, 2015).
- While weak-entrepreneurial ecosystems evolve—mainly in response to government incentives, regulations or funds—the **evolution of strong-entrepreneurial ecosystems**, where government also plays a significant role, and the effects in the startup development process remains underexplored (Etzkowitz & Klöfsten, 2005).
- Different **waves** affecting Silicon Valley → Which are the **drivers**?

Research design

- To understand **how** and **why** and entrepreneurial ecosystem (Silicon Valley) evolves by identifying changes on the role played by the **Triple Helix Agents**.
- To identify if **changes** in one of the agents **trigger evolution of the others**.
- **Approach**:
  - *The **startup** as the unit of analysis*
  - *Multiple case-study*
  - *Cases are analyzed on the bases of the Triple Helix Model*
  - *Cases are interpreted in the light of the periods of development of an entrepreneurial venture.*
- **Data**: IT sector. 6 start-ups (2008 and 2017)
- **Interviews:** university, public administration

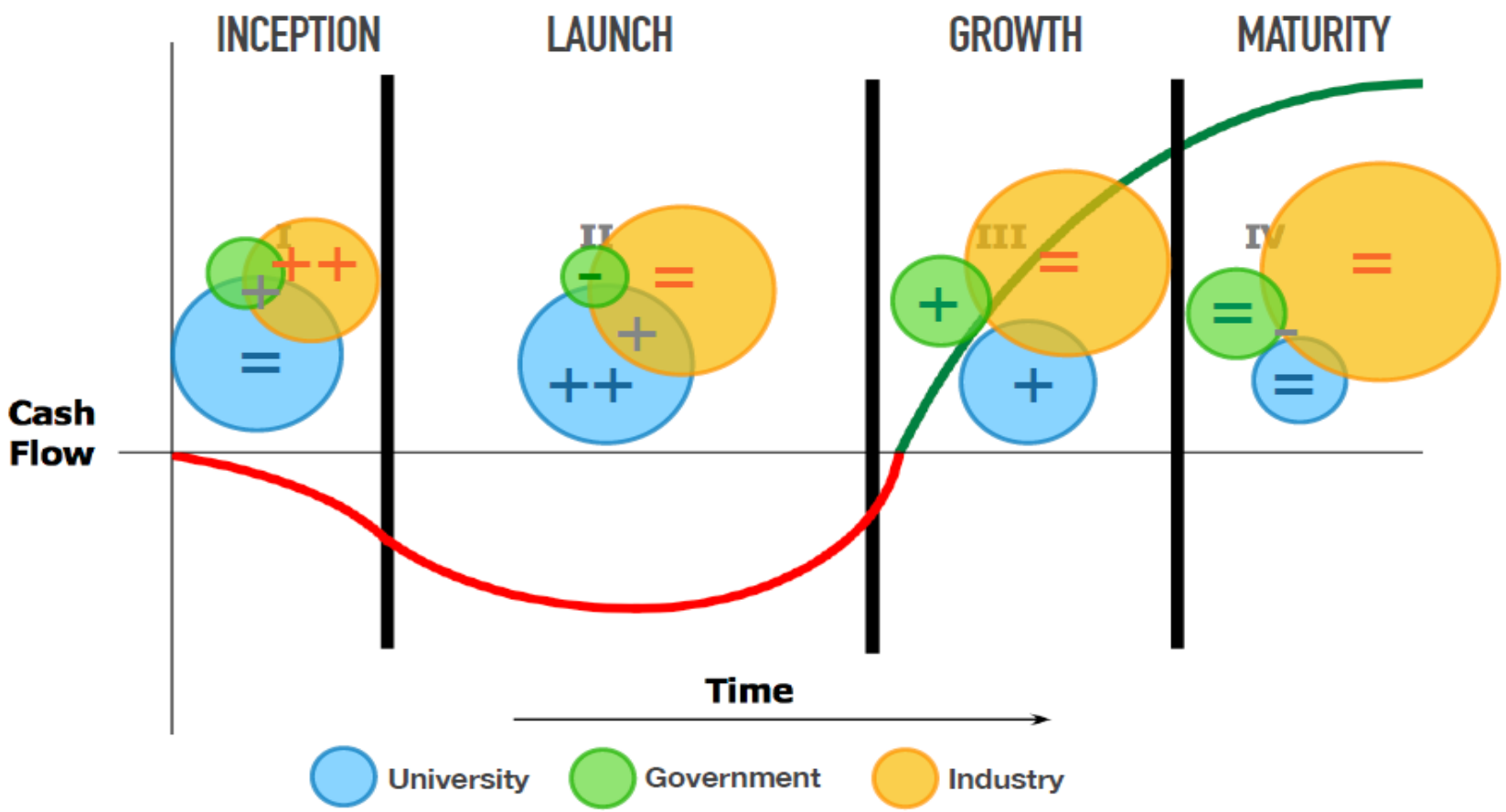


Research design

Name of the company:				
General information				
Name		Founding date		
Position		Headquarters		
Num. of founders		Sector		
Nationalities		Team		
Board of advisors		Accelerator (yes/no)		
Product/Service				
Stage of development and role of the TH agents				
	Early	Launch	Growth	Maturity
Government				
University				
Industry				

Name of the company:					
		Early	Launch	Growth	Maturity
Team	Number & source				
	Background (professional & education)				
	Nationality				
	Founders still at the company				
	Ownership (% shares)				
Technology	IP or knowledge source				
	Type of client				
Location	Headquarters				
	Subsidiaries				
	Infrastructure				
Go-to-market	Business model				
	# of clients/users				
	Markets				
	Partnerships				
Financing	Programs				
	Source				
	Round – Amount				
	Year (related to company)				
	Acquisitions				
Milestones					
Other information					

Results


INCEPTION
LAUNCH
GROWTH
MATURITY
I
II
III
IV
Cash Flow
Time
University
Government
Industry

Results

- **Inception**: **Universities** keep their important role. Creation of a new industry agent (**accelerators**). **Business angels** are also increasing the role of industry at this early stage. **Government** is trying to get closer to both universities and industry enlarging the collaboration area.

- **Launching**: **Universities** and **industry** are strengthening their ties, while **government** adopts a secondary role.

- **Growing: Government** has a slightly bigger influence, allowing companies to showcase their solutions through policy regulations. On the contrary, **universities** seem to lose part of their influence, although they can keep their ties with their startups for a longer period through their VC funds.

- **Maturity**: **Industry** remains the most important agent at this stage. **Administration** keeps its role as a regulator. **Universities** continue to supply human capital and new ideas (their relevance might have slightly declined with firm growth and the revival of corporate research labs). Less interaction is observed between the three agents compared to 10 years ago.

Next steps:

Directions for future research

Patterns of resource consumption in technology transfer activities using QCA

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Universidad Autónoma de Madrid

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The role of universities in shaping the evolution of ecosystem of innovation

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