University–industry collaborations: an industry perspective

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Abstract

Purpose – The engagement with industry actors is a key element in the transition towards an entrepreneurial university model. The purpose of this paper is to explore the university–industry collaboration (UIC) drivers from the industry side. It analyses how, and to what extent, policy interventions could increase the engagement of industry actors in UICs.

Design/methodology/approach – An experimental research design has been used involving a feasibility and pilot study (January to June 2018) with 36 firms, in a non-urban region context, with a satellite university campus. The pilot study explores a randomised control trial (RCT) design, with a training intervention to a randomized group of participants in the pilot study.

Findings – Firms involved in universities’ students (academic forms of UICs) might not necessarily consider the university as a research partner, even in a geographic proximity setting. In addition, there is a potential “dark-side” to proximity, when industry participants build their perceptions using second-hand experiences or indirect information. A training intervention facilitates to overcome pre-existing biases but does not trigger a substantial change in the UIC’s behaviour of the firms in the short-term.

Research limitations/implications – The pilot study provides valuable insights for researchers interested in a larger RCT. It also provides insights for university managers who want to understand the motivations of industry participants in UICs.

Originality/value – The experimental approach of the research generates evidence on the feasibility to intervene in the activation of UICs from an industry perspective, a central aspect in transition towards an entrepreneurial university model.

Keywords University–industry, Collaboration, Pilot study, Randomized-control trial, Entrepreneurial university

Paper type Research paper

Introduction

The call for universities to embrace the entrepreneurial university model is strong and urgent (Klofsten et al., 2019). Governments see the opportunity to activate universities as part of their regional growth strategy (Delgado et al., 2014; Guerrero et al., 2016; Sánchez-Barrioluengo and Benneworth, 2019), advancing towards a more dynamic capitalism that relies on the contribution of a broad range of entrepreneurial activities (Thurik et al., 2013). The entrepreneurial university adopts an entrepreneurial management style, in their internal activities and organisation, but also with the outside environment (Guerrero et al., 2016). It pushes universities beyond the research and teaching mission dichotomy, embracing the entrepreneurial contribution as their third mission (Guerrero and Urbano, 2012).

As a result, industry players are not only at the receiving end of the university’s knowledge and technology, but also active actors in the generation of this new type of contributions. Consequently, university–industry collaboration (UIC) has been heralded as a practice that accelerates innovation, effectively fostering universities’ knowledge diffusion to society. Prior research has explored the antecedents that make researchers more likely to engage in UICs (Perkmann et al., 2013); and the consequences for both researchers’ academic performance and industry participants’ innovativeness and growth. Nevertheless, less is known on industry participants’ antecedents, and what motivates them to engage in such collaborations. In particular, when the participants are SMEs or organisations with limited experience in collaborative innovations projects.

Such research gap is particularly relevant for universities that want to transition towards the entrepreneurial university model, but that start with unfavourable conditions such as weak connections to the regional innovation ecosystem, or limited relatedness.
between the regional industry activities and the university research fields, despite being geographically close (Etzkowitz et al., 2019).

This research follows an experimental approach to address this gap. First, a feasibility study informs on potential interventions, based on prior research that could have an effect on the intentions of SMEs to collaborate with universities. Second, a pilot study for a randomised control trial (RCT) with 36 industry participants (with an overrepresentation of SMEs) is completed. A training intervention is used to explore the changes on SME’s intentions and engagement in university collaborations. The pilot setting is in a Nordic non-urban region with a satellite campus of a university, with few but large industrial players and a substantial number of SMEs.

The results of the pilot study suggest positive effects of the proposed intervention, but also point to a substantial warning on how industrial participants might perceive UICs, even in close geographical proximity. The findings point towards a diversity of perceptions among industry actors regarding UIC. The consideration of UIC as an attractive activity might not correlate with an active engagement with the regional university or research centre. The study results have implications for university managers driving the transition towards an entrepreneurial university model, as well as for innovation policy makers looking for evidence-based approaches to trigger UIC activity in their region.

The paper starts with a review of the UICs research and the existing barriers; it continues with a presentation of the research design and the specifics of the pilot study; and it ends with a description of the results and a discussion of the findings and implications of the study.

**Background**

Despite the visibility of the entrepreneurial university concept, there is not, however, a clear model of entrepreneurial university. Instead, there is a multitude of models and transition paths that stress the necessity to develop further linkages with industry and society in general (Riviezzo et al., 2019). Establishing relationships with industry, collaboration networks and alliances are seen as stepping stones towards the entrepreneurial university (Guerrero et al., 2014). While much of the prior work has focused on describing the internal aspects of the university and their activities, less is known on the contextual factors that influence on the transition towards an entrepreneurial university (Guerrero et al., 2016; Riviezzo et al., 2019).

Universities find themselves in this transition process with multiple open fronts. Their teaching activities content and methods are changing, their governance and strategies are subject to reductions in public funding for education and research, and they see an increased, globalised, competition. Still, balancing the three missions (teaching, research and entrepreneurial) is possible, as long as there is an alignment with the needs of the region and other external demands (Guerrero et al., 2015). Hence, there is an opportunity to navigate (and survive) the transition to the entrepreneurial university model while generating a positive impact in the region’s social and economic development.

As previously mentioned, the UICs have a central role in the activation of innovation and entrepreneurship activities in the university (Elia et al., 2017; Guerrero and Urbano, 2012; Schmitz et al., 2017). UICs promise to combine specialized knowledge and technology transfer activities from universities, with production and market knowledge from industrial actors in the region (Rajalo and Vadi, 2017). They can be formalized in several different types of activities, including: creation of joint research facilities, research contracts, shared publications, consultancy agreements and training or industry secondments for students (D’Este and Patel, 2007). Universities can also approach these activities from different strategic perspectives, in some cases, the priority might be to monetize their knowledge contributions (using for example licensing or research contracts), in other cases, the goal is...
an entrepreneurial contribution, for instance to generate new firms, stimulate the regional
innovation capabilities, or the creation of local jobs (Giuri et al., 2019). Thus, the nature of
UICs can be rather complex, suggesting the appropriateness to review the elements that
define them.

**Engaging with industry to transfer university knowledge**

Universities’ technology transfer offices (TTOs) have been introduced with the ambition to
facilitate the knowledge transfer from university to society (Brescia et al., 2016; Fitzgerald
and Cunningham, 2016). The technology transfer paradigm assumes that universities
generate new knowledge (including new promising breakthrough technologies), that can be
patented and licensed. Thus, the more the ability of a university or research centre to
generate patents, the more the possibilities to generate revenues and a positive
socio-economic impact in terms of innovation (Kolympiris and Klein, 2017). This
paradigm, strongly influenced by few star cases from US universities and research centres,
has rarely been replicated in Europe (Mustar et al., 2008). Furthermore, recent research
findings on the economic impact of universities’ innovation initiatives in Europe suggest the
need to reassess the underlying dynamics of the phenomenon (Fini et al., 2017, 2018;
Steinmo and Rasmussen, 2018).

Most of the prior research on university knowledge and technology transfer has had as
a focal actor the motivations and incentives of the academic researcher (Azagra-Caro and
Llopis, 2018; Bozeman et al., 2013). It is of particular interest the figure of the principal
investigator (PI) as an individual who combines science innovation and entrepreneurial
activities (Casati and Genet, 2014; Mangematin et al., 2014). PIs have to respond to the
demand of producing science, build legitimacy in and outside their science field, while at
the same time interacting with a broad community of actors (Casati and Genet, 2014). As a
result, they experience tensions between supporting technology transfer activities
(generating IP) and sustaining their scientific production (Cunningham et al., 2014).
Interestingly, the more time PIs allocate for their research, the more they engage in
direct consultation with the industry, their TTO and a larger number of industry partners
in their projects (Cunningham et al., 2016). This finding resonates with the observation
that industry engagement can coexist with academic’s research performance (Perkmann
et al., 2013).

However, the motivations of PIs, or researchers in general, to engage with the industry
can be very distinct. Academics follow different approaches depending on whether they
see the industry engagement activities as valuable for their research, or if instead, they are
perceived as an activity to monetise or commercialise their knowledge (D’Este and
Perkmann, 2011). In addition, Perkmann et al. (2013) identify that not all commercialisation
activities have the same effect, getting involved in commercialisation, via academic spin-offs
or licensing, might have positive effects on research productivity. However, generic
academic services (consulting or collaborative research) have no clear effects on researchers’
productivity. On the positive side, there is extensive evidence supporting the idea that
academic engagement in general (even informal interactions) precedes more formal UIC
activities such as academic research commercialisation (Perkmann et al., 2013).

Less is known on the perspective of the industry on the technology and knowledge
capabilities of universities, in particular regarding the factors that affect firms’ expectations
towards UICs (Azagra-Caro et al., 2014). For instance, firms often involve universities in
research projects that are difficult and have additional risk or complexity (Hall et al., 2003)
and are likely to find public research more useful if the firm has developed technology
innovation capabilities in their organisation (Azagra-Caro et al., 2014). This opens the
discussion on whether there are barriers or enablers that could explain the different
responses of academics and firms in relation to UICs.
Barriers and enablers for university–industry collaborations

There are substantial differences in how academics and industry operate, in particular when it comes to manage the knowledge they generate or acquire (Tartari et al., 2012). Therefore, it does not come as a surprise that there are conflicts that create collaboration barriers. However, there are also enablers that help to smoothen or overcome such barriers. The conflicts are often a scaled-up representation of the underlying tensions at individual level. While the PI or academic researcher builds an academic career based on publications and research outputs reputation, the industrial counterpart benefits from transforming knowledge and intellectual property into competitive advantages for their firm (Perkmann et al., 2013). Furthermore, there are institutional setting differences that introduce additional barriers, not necessarily related to individual-level tensions. For instance, overzealous TTOs valuations of the researchers’ intellectual property or competitive pressure for a quick market-ready solution in the firm context.

In an attempt to identify and classify the different elements that might deter the generation of UICs, Bruneel et al. (2010) proposed to classify them in two overarching categories: orientation and transaction barriers. Orientation barriers capture the aspects related to the different vision that academics and industry. They include aspects such as the distance between pure and applied scientific research, the conflicts between businesses’ short-term orientation and the long-term perspective of academic researchers and the distinct working practices and expectations in each context. For instance, it might be difficult to convince a researcher to give up on their autonomy to set the project’s research agenda, similarly it is not plausible for industry partners to allocate resources to long-term research projects without a business case (Tartari et al., 2012). Transactions barriers capture how the distance between academics and industry partners translates into additional transactions costs. They include the often unrealistic or unclear impact of universities’ research vs the need for specific deliverables in the industry context, the conflicts regarding IP or confidentiality arrangements, the incompatible rules and regulation, and the limited capabilities of universities (industry liaison offices) to engage in business with firms (Bruneel et al., 2010).

Nevertheless, there are also enablers that contribute to overcome such barriers. The enablers combine elements at individual and institutional level. At the individual level, trust between the parties involved facilitates exchanging information, knowledge, and materials that could be sensitive or that should not be released publicly. Such exchanges inform on the other side needs and the specifics of a useful collaboration (Santoro and Saparito, 2003). Also at an individual level, the prior experience in UICs facilitates the preparation and organisation of such activities, being able, both sides, to better estimate the costs and resources needed (Tartari et al., 2012).

At an institutional level, the variety of channels of collaboration can be an enabler. While having a narrow collaboration focus can foster efficiency, a broader scope of collaborations facilitates the identification of new opportunities and the convergence between the involved parties (Bruneel et al., 2010). Finally, the geographical proximity between the parties facilitates interactions (Boschma, 2005), even when there is institutional distance between them (Crescenzi et al., 2017). Geographical proximity and university’s research quality have a positive effect on the interaction likelihood and also on the firm’s innovative outcomes (Bishop et al., 2011). Even in cases where there is a distance between the university and industrial partner, there are options to introduce intermediary organisations (e.g. TTOs or joint research centres) that play a bridging function, increasing the proximity, accumulating knowledge and generating trust (Clayton et al., 2018; Villani et al., 2017).

Regardless of the barriers and enablers, there is a need for a starting point where both sides have a minimum willingness to engage in joint projects, without a minimal relational trust or pre-existent ties, it becomes very unlikely to see fruitful UICs (Al-Tabbaa and Ankrah, 2016).
Overcoming barriers with policy interventions

Given the significance of UICs for innovation and regional growth, there is a substantial interest in the identification of potential policy interventions that could trigger further interactions (Cunningham and Link, 2014). Such policy initiatives should be seen as part of the public entrepreneurship activities, where public institutions establish rules, new organisations or alternative management approaches of public resources, with the goal to better serve public interests (Klein et al., 2010).

Nevertheless, the scant systematisation of public policy evaluation regarding technology transfer or UICs makes it difficult to unequivocally identify the right intervention for each policy challenge (Kochenkova et al., 2016). The absence of a comparable evaluation leaves it to policy makers to estimate the policies’ effects, and the mechanisms to mitigate existing concerns on the effectiveness and efficiency of academic innovation and entrepreneurship promotion policies (Sandström et al., 2018). This problem is particularly prevalent when the objects of the policy or the desired outcomes are not well defined.

In order to avoid such shortcomings, policy interventions for UIC should consider prior research results and aimed to address the orientation and transaction barriers towards UIC. The selection of potential interventions is intrinsically related to the assumption on what is causing the observed market failure (either from the supply or demand-side). In the context of UIC the assumptions are that resources, capabilities and perceptions towards the behaviour are the underlying factors that make the barriers difficult to overcome (Cunningham and Gök, 2012). These justify the identification of three of the possible interventions from the instruments analysed in recent reviews (see Kochenkova et al., 2016): grants to reduce resource limitations, vouchers to facilitate access to capabilities or training to modify perceptions and motivations.

The introduction of grants for innovation activities, R&D projects or intermediaries that can help to put together projects with a firm/s and university researchers is based on the assumption that financial resources (lack of) are an obstacle for UIC innovation (D’Este et al., 2012). Therefore, financial aid (in the form of grants) would be the missing element that would trigger the acquisition of knowledge resources to start innovation projects (Kochenkova et al., 2016). Innovation vouchers interventions assume that firms have projects and defined needs, but that they lack the specialized capabilities to activate them and also are not able to identify the right partner to get them started. The use of innovation or growth vouchers has been an innovation policy tool in use in different contexts in the last decade (Roper, 2018). Finally, training interventions assume that the barriers to innovation are related to the resistance to adjust to a new behaviour (locked-in) and/or resistance to engage in new practices that could destabilise core competences (D’Este et al., 2012). Therefore, training activities could provide the necessary stimuli to modify the attitudes and perceptions of the individuals in relation to the behaviour of collaborating with universities to explore innovation projects. Prior research on training and education effects on the behaviour of individuals in similar working contexts suggests that this intervention could have a sizeable effect (D’Este and Patel, 2007; Frese et al., 2016; Gielnik et al., 2017).

Summarizing, the activation of purposeful UICs has a central position in the transition towards an entrepreneurial university model (Guerrero et al., 2014). The ambition of UICs goes beyond the transfer of technological knowledge from universities to the industry, it is an activity that generates knowledge exchanges in both directions, shaping the future innovation trajectories of private players and public actors. The antecedents and consequences of academics’ involvement in UIC has been a subject of extant research, nevertheless, there is a paucity of research from the industry partner’s perspective. A recent review of 36 articles on UICs research identifies only two articles with industry participants data (Perkmann et al., 2013); in the Bekkers and Bodas Freitas (2008) that involved university and industry researchers in their research, and in the Van Dierdonck et al. (1990)
where companies in the university science parks were included in their study of attitudes towards university–industry technology transfer. Significant exceptions would be the work by Bishop et al. (2011) on the effects on UICs on firm’s absorptive capacity and innovativeness, Hall’s et al. (2003) work on the characteristics of industry projects with the university as a research partner, or Azagra-Caro et al. (2014) study on how manufacturing firms would perceive public research.

Considering the significance of UICs in the further development of entrepreneurial universities, the prior research findings on barriers towards UICs, and the significant gap on industry perspectives on this topic; this research proposes to explore how and to what extent could a policy intervention facilitate the activation of industry participants in UICs.

**Research design**

This research follows an experimental research design. The use of experimental methods, RCTs is often considered to be the reference method to generate “reliable and action-oriented knowledge” (Williams et al., 2019, p. 3). It is particularly useful when researchers aim to clarify correlational vs causal relationships (Williams et al., 2019). For instance, to elucidate whether knowing about the university is enough to activate university-industry collaborations. Other approaches such as case studies would not have offered the possibility to isolate the effects of the knowledge acquisition and the subsequent behaviour.

While this methodological approach combines randomisation (in the allocation of participants into the treatment and control group) and realism (it replicates and is conducted in a real life context), it also introduces limitations regarding generalising the findings to a large population group, the subjects (industrial participants) who take part in the experiment might be the ones that expect the benefit the most from the programme, leaving a question mark on the effect on the potential participants that do not volunteer to participate (List, 2011).

**Intervention assessment**

To assess the most suitable of the alternative interventions, an assessment framework is introduced following the common practice in this type of research (Bowen et al., 2009). The framework includes five different intervention criteria: acceptability, demand, implementation feasibility, implementation practicality, and further adaptation or expansion of the intervention. The objective of this feasibility study is to identify the most suitable intervention given the research question and the research setting of the study.

The Table I summarises the assessment of each of the criteria for the proposed interventions. While grants and innovation vouchers are still popular in innovation policy interventions, the training intervention is expected to be a better fit to modify the attitudes and perceptions towards UICs. The underlying assumption is that monetary incentives might trigger a short-term response, but would not be conducive of changes in the behaviour perceptions and motivations in industry participants (Dalziel, 2018). This would effectively aim to mimic (at a reduced scale) the innovation and entrepreneurship training activities for researchers (Klofsten et al., 2019), focusing instead on the industry participant side. As a result, the remaining part of the research design is built taking into consideration that the type of intervention selected is a training session for private firms.

**Intervention specifics**

A central aspect of the transition towards an entrepreneurial university is the generation of collaborative interactions between academics, industry and other institutions. It is often these informal, individual, interactions that generate the dynamics that will then end in
more formal and institutionalized innovation and entrepreneurial activities (D’Este and Perkmann, 2011). This is two-side dynamics, where academics and industry participants have common interests and motivations to engage in these informal interactions. It is established that a supportive institutional environment (including university support mechanisms and established industrial partners) facilitates commercialisation of research and technology transfer (Guerrero et al., 2016). But less is known on how the institutional context can be modified in order to facilitate the transition towards becoming an entrepreneurial university. This is particularly relevant in regional contexts where the supportive innovation ecosystem is missing or is still underdeveloped.

In this setting, the intervention aims to assess the potential benefits of a training programme to build-up or modify the environment where the entrepreneurial university transition occurs. The training intervention is conceived as a half-day workshop delivered by an external facilitator, it is delivered in the innovation lab of the university. The short and intense design aims to reduce the participation barriers for industry participants (with limited time availability). The content of the workshop is defined with the assumption that the training can modify behavioural aspects of the participants.

The theory of change behind the intervention is the Theory of Planned Behaviour (Ajzen, 1991), well tested in short- or long-duration training programmes (see Sánchez, 2011; Frese et al., 2016; Nabi et al., 2017), that have shown that individual motivations and perceptions

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Acceptability</th>
<th>Demand</th>
<th>Feasibility (implementation and practicality)</th>
<th>Adaptation and expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grants or direct funding for UIC activities and projects</td>
<td>High: participants are used to public funding instruments for joint R&amp;D projects with universities and research centres</td>
<td>Medium-Low: already common instrument, granting institutions, often struggle to receive qualified applications, tends to attract the same group of participants, requires expertise</td>
<td>Very low: the programme managers of grants are rather unlikely to accept randomisation of grant assignment, it would require additional resources and a specific new programme</td>
<td>High: it can be replicated with additional budget but there are learning effects and possible spill overs from participants in the programmes</td>
</tr>
<tr>
<td>Innovation vouchers</td>
<td>Medium-Low: the concept of voucher is known, but not used commonly in business support programmes in the region of the study</td>
<td>Medium: can be attractive to address small or early-stage innovation projects or specific services, but not likely to connect distant institutions (like university–industry)</td>
<td>High: existing pool of innovation services suppliers, but rather limited experience in the university (at least in the region of study) as a service partner for innovation projects</td>
<td>Medium-High: would require for similar settings and pools of actors in the demand and supply side to replicate the intervention. Additional budget can facilitate the extension of the programme</td>
</tr>
<tr>
<td>Training seminars</td>
<td>Medium-High: common form of developing knowledge and capabilities in firms, but limited experience of the university in supply of in-company training</td>
<td>Medium: interest in companies in the region in getting more out of the university campus, low cost effort to assess future potential collaborations</td>
<td>High can be replicated if content and dynamics structured are defined, can be carried out with limited additional resources, it requires a training space</td>
<td>High: training content and delivery methods can be adapted, expansion of the training is feasible with additional programme delivery support and basic resources</td>
</tr>
</tbody>
</table>

Table I. Validation of the interventions using the assessment framework
can be modified through training. The objective of each part of the training session (see Table II) is to influence on the participants’ perception on the UIC behaviour, in particular, their awareness and attitudes, the social norm and their perceived behavioural control or self-efficacy towards the behaviour (Gielnik et al., 2017).

The workshop’s session includes content related to models for collaboration with university (international and local success stories), practical aspects on how to make the first steps, and identification of potential topics for a first collaboration, see Table II for details on the training structure.

The group that does not receive the intervention (control group – business as usual), receives a short guide (electronic support) on how to get started with UIC based on a review of literature on the topic and suggestions for first steps. This guide is also shared with the intervention group.

**Pilot study design**
The structure of the pilot study is described in Figure 1. It includes a baseline measurement, a randomisation, a treatment and control group and a follow-up measurement. The target population to reach are the 150–180 firms in the proximity region of the university. The randomisation of the baseline participants into treatment or control group is done with a computer in the researcher’s office, ensuring that the treatment group includes participants with different degrees of prior experience in UIC.

**Context and sample**
The context of the pilot study is a significant aspect. It is in a non-urban region, yet with presence of large industrial players and manufacturing SMEs. In the region there is a university campus that is a satellite of a larger university in the same country. The university covers almost all the disciplines, but the regional campus has a strong focus on

<table>
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<tr>
<th>Activity</th>
<th>Method/time*</th>
<th>Objective</th>
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</thead>
<tbody>
<tr>
<td>1. Introduction and explain workshop dynamics</td>
<td>Lecture (15 min)</td>
<td>Set the expectations for the workshop</td>
</tr>
<tr>
<td>2. Identification of general challenges across participants</td>
<td>Brainstorming (15 min)</td>
<td>Build a shared understanding and empathise with the industry challenges, set a departure point</td>
</tr>
<tr>
<td>3. What are university–industry collaborations? Examples and results</td>
<td>Lecture (15 min) Case studies discussion (15 min)</td>
<td>Raise awareness on UICs Introduce role models, activate attitude towards UIC behaviour Explore the social perception of the behaviour (related to social norm)</td>
</tr>
<tr>
<td>4. How can a UIC collaboration help your organisation challenges?</td>
<td>Individual work (10 min) Group work (20 min)</td>
<td>Make a desirable match between challenge and UIC collaboration Foster perceived behavioural control/self-efficacy on engaging in the UIC behaviour</td>
</tr>
<tr>
<td>5. What barriers do you see to get this UIC collaboration started?</td>
<td>Individual work (10 min) Group discussion (20 min)</td>
<td>Explore the barriers and triggers from intention to behaviour Increase likelihood of short-term action on the challenge at hand</td>
</tr>
<tr>
<td>What would make it possible?</td>
<td></td>
<td>Rise commitment towards the behaviour Use goal-setting as driver of action</td>
</tr>
<tr>
<td>6. Building an action plan with an UIC collaboration</td>
<td>Individual work (10 min) Individual presentation and discussion (20 min)</td>
<td>Assess the expectations achievement Collect improvement ideas and suggestions</td>
</tr>
<tr>
<td>7. Summarizing and takeaways</td>
<td>Lecture (10 min) Round discussion (5 min)</td>
<td></td>
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**Note:** *For a group of 5–8 participants, breaks between activities not included (up to 3, 10 min break were used)*
engineering education, and it is the most international (in staff and students) of the different campuses of the university across the country. The university has recently had its 50th anniversary, but the regional campus in its present location was established 10 years ago. It is a university in a transition towards an entrepreneurial university model, trying to find the right equilibrium between being locally driven, responding to the regional demands, but also generating research that is excellent at a global scale (Benneworth et al., 2017).

The entrepreneurial university transition is activated as a response to the continuous reductions in public education budget, targeting commercialisation activities as a revenue and regional legitimacy source. These changes are being materialized with the introduction of a cross-disciplinary unit to support the innovation and entrepreneurial activities, as well as strategic support (including financial resources) for large regional initiatives in collaboration with industrial partners. The engineering focus of the satellite campus and the dynamic industrial manufacturing firms in the region make the university configuration particularly open to change and adaptation (Sánchez-Barrioluengo and Benneworth, 2019).

The target population were companies in the region (in an area of 30 km) of the university campus. The invitation to participate was done with a survey shared with the local business agency and the university’s innovation office (that does the function of the TTO). In addition, companies that attended a job fair in the university were directly invited to participate either using the online baseline survey or a printed copy delivery by hand. From over 165 requests for participation (January–February 2018), 36 confirmations were received (that completed also the baseline survey), a 22 per cent participation rate. That included micro companies or start-ups (25 per cent), small companies (19 per cent), medium-size companies (17 per cent) and large companies (39 per cent).

From the 36 baseline participants, 20 were randomly selected and invited to join the control group (with an invitation to an intervention). Finally, 8 participants from 6 different companies accepted to participate in the intervention workshop (May 2018). The follow-up measurement was completed by 10 participants (6 from the treatment group – had taken the intervention – and 4 from the control group).

**Measures and other data**

General data is collected to identify the participants and to contact them for the further interactions during the project duration. Information on the firm size (number of employees), location and types (research or academic) prior experience in UICs (prior res. UIC, prior ac. UIC) and degree of satisfaction (prior exp. UIC) is also collected.
Regarding the variables of the study (see Table III), it is important to highlight that there are two measurement points, the baseline and the follow-up. The baseline measures also provide the indicator (prior exp. UIC) to stratify the randomisation (satisfaction with their prior experience with UIC). The baseline measurement includes time invariant aspects such as the degree of firm innovativeness (Calantone et al., 2002) with the variable firm innovativeness or their perceptions of the barriers towards UICs (Bruneel et al., 2010) recorded as orient. barrier (orientation barriers) and transact. barr (transaction barriers). In both, baseline and follow-up, the elements of the TPB: attitudes, social norm, perceived behavioural control and intention of the UIC behaviour are measured; for the baseline these are recorded as: UIC attitude, UIC SocialNorm, UIC P.Beh.Cont and UIC Intention; for the follow-up a shorter coded format is used: fuatt_uic, fusn_uic, fupbc_uic and fuint_uic.

Besides the data coming from the two survey measuring points, the researchers collected observational data during the delivery of the training session’s interventions (that were also recorded). The additional follow-up with the firms also generated data on the behaviour of the firms beyond the initial time scope of the pilot study.

Outcomes and proposed statistical analysis
The primary outcome of the pilot study is the intention to engage in UIC projects. The change, if any, on the intention of participants from the baseline to the follow-up measure would determine whether there has been a treatment effect or not. The statistical analysis is based on a group t-test to identify whether there is a significant difference between those that were in the treatment or control group. In addition, there are other outcomes that are of interest such as the actual behaviour of the firms participating in the study, in particular those that had been enrolled in the treatment group.

Results
This section covers the results from the baseline and follow-up measurements, as well as the overall data collected to assess the proposed pilot study.

Baseline
The descriptive and variable correlations are presented in Table IV. The baseline participants had an overall positive prior experience with UIC (5.2 in a 1–7 scale); while only half of the firms had done some research collaboration, 71 per cent of them had had a student-based relationship (internships or student projects). This results suggest that in the sample there is presence of some of the enablers identified in the prior literature in the topic

<table>
<thead>
<tr>
<th>Measure</th>
<th>Reference</th>
<th>Baseline</th>
<th>Follow-up</th>
</tr>
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<tbody>
<tr>
<td>Firm innovativeness, linear scale (1–7)</td>
<td>Firm innovativeness measure (Calantone et al., 2002)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Prior type of university–industry collaboration, multiple choice</td>
<td>Types of UIC: research contracts, joint projects, academic spin-offs, industry training, joint publications, patenting, licensing (Perkmann et al., 2013)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Overall satisfaction with prior UIC, Likert scale (1–7)</td>
<td>Types of orientation and transaction barriers (Bruneel et al., 2010; Tartari et al., 2012)</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Orientation and Transaction barriers, multi-item question, Likert scale</td>
<td>Adaptation of TPB to the UIC context, based on the EIQ scale (Liñán and Chen, 2009)</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Table III.
Pilot study measures
<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. UIC Intention</td>
<td>34</td>
<td>4</td>
<td>2.174229</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2. UIC Attitude</td>
<td>34</td>
<td>6.058824</td>
<td>0.7859052</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>3. UIC SocialNorm</td>
<td>36</td>
<td>5.75</td>
<td>1.105183</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4. UIC P.Beh.Cont</td>
<td>34</td>
<td>4.779412</td>
<td>1.207246</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>5. Firm Innovtiv.</td>
<td>34</td>
<td>5.588235</td>
<td>0.9028903</td>
<td>3.666667</td>
<td>7</td>
</tr>
<tr>
<td>7. Transact.Barr.</td>
<td>32</td>
<td>4.257813</td>
<td>0.9598479</td>
<td>2.25</td>
<td>6.5</td>
</tr>
<tr>
<td>8. Prior Exp.UIC</td>
<td>36</td>
<td>5.305556</td>
<td>1.00726</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>9. Prior Res.UIC</td>
<td>35</td>
<td>0.7714286</td>
<td>0.429043</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>10. Prior Ac.UIC</td>
<td>35</td>
<td>5.294444</td>
<td>1.237958</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

| 1. UIC Intention       | 1.0000 |
| 2. UIC Attitude        | 0.3613  | 1.0000 |
| 3. UIC SocialNorm      | 0.4405  | 0.5289  | 1.0000 |
| 4. UIC P.Beh.Cont      | 0.7345  | 0.3641  | 0.4958  | 1.0000 |
| 5. Firm Innovtiv.      | 0.2736  | 0.2645  | 0.4788  | 0.4788  | 1.0000 |
| 6. Orient.Barrier      | 0.1886  | 0.0037  | 0.0290  | -0.0189 | 0.0821  | 1.0000 |
| 7. Transact.Barr.      | 0.2500  | 0.0734  | 0.1447  | -0.0003 | -0.1249 | 0.4316  | 1.0000 |
| 8. Prior Exp.UIC       | 0.1312  | 0.4571  | 0.4717  | 0.4047  | 0.3171  | -0.2413 | -0.1102 | 1.0000 |
| 9. Prior Res.UIC       | 0.1963  | 0.0221  | -0.0663 | 0.1375  | 0.0511  | 0.1450  | -0.1590 | -0.2080 | 1.0000 |
| 10. Prior Ac.UIC       | 0.1355  | 0.1329  | 0.5682  | 0.2948  | 0.3232  | 0.0318  | 0.0314  | 0.4824  | -0.1581 | 1.0000 |
| 11. Firm Size          | -0.0222 | -0.0787 | -0.0343 | 0.0137  | -0.1064 | 0.1075  | 0.3236  | -0.0522 | 0.3761  | -0.0911 | 1.0000 |

Table IV. Variable descriptive and correlation table
(Bruneel et al., 2010; Tartari et al., 2012), such as having prior experience in UICs, or engage through multiple channels of interaction (student and research collaborations). Yet, it also shows that about a third of the participants had no prior collaborations with universities.

The correlation table shows a high relationship between the perceived behavioural control (UIC P. Beh. Cont.) and the intention to engage in UIC in a near future, but no particularly strong relationship between the prior experience (as a potential enabler) and any of the perceptions or intention measures.

The distribution of the intention to engage in UIC and the measure of firm innovativeness (firm innovativ.), see Figure 2, is distributed across the different firm sizes (in employees). Interestingly, for medium-sized firms there appears to be more distance between the two measures.

In a similar manner, and being aware of the limited number of observations, for some of the participant’s firm size groups the orientation barriers are perceived to be higher than the transaction barriers. Figure 3 shows the distribution of their responses by firm size category.

Finally, as part of the exploration of the data of the baseline and to make sense of the effects of the different variables that were being measured, a simple regression model clarifies the influence and weight of the antecedents of the intentions towards UIC. It can be noticed that there are some indications towards the potential positive effect of having had prior experiences on research-based UIC towards future engagement with the university as a collaboration partner. Such results would actually support the theory on prior experience as a valuable enabler to overcome the barriers towards this behaviour (Tartari et al., 2012).

Also, there seems to be a positive relationship between a higher perceived behavioural control on the UIC behaviour (UIC P. Behav. Cont.), and the intention to engage in the behaviour (UIC Intention) can also be observed as part of the overall model coefficients (see Table V).

**Follow-up (post intervention measurement)**

Regardless of the small number of participants, and going beyond the objectives of a pilot study, the results from the follow-up measurement were used to get a preview on a potential full trial experiment with a similar design. The results are presented in Figure 4, the
responses from the baseline (UIC attitude (att_uic), UIC Social Norm (sn_uic), UIC P. Beh. Cont. (pbc_uic) and UIC Intention (int_uic)) are compared next (with same colour) as the follow-up responses (fuatt_uic, fusn_uic, fupbc_uic and fuint_uic); the two group responses, control = 0 and treatment = 1, are reported for data presentation purposes.

The reduced number of observation (n = 10) in the follow-up measurement does not support the generation of statistical insights or other quantitative conclusions. Nevertheless, the data collected does not show an overwhelming change of perceptions on the intentions in either group.

<table>
<thead>
<tr>
<th>UIC Intention</th>
<th>$b$</th>
<th>$se$</th>
<th>$t$</th>
<th>$p$-value</th>
<th>Lower limit</th>
<th>Upper limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIC Attitude</td>
<td>$-0.03$</td>
<td>0.433</td>
<td>$-0.07$</td>
<td>0.9477</td>
<td>$-0.9474$</td>
<td>0.8896</td>
</tr>
<tr>
<td>UIC Social Norm</td>
<td>0.37</td>
<td>0.427</td>
<td>0.86</td>
<td>0.4037</td>
<td>$-0.5393$</td>
<td>1.2722</td>
</tr>
<tr>
<td>UIC P. Beh. Cont.</td>
<td>1.24</td>
<td>0.298</td>
<td>4.15</td>
<td>0.0007</td>
<td>0.6074</td>
<td>1.8729</td>
</tr>
<tr>
<td>Firm Innovativ.</td>
<td>$-0.33$</td>
<td>0.387</td>
<td>$-0.86$</td>
<td>0.4007</td>
<td>$-1.1531$</td>
<td>0.4857</td>
</tr>
<tr>
<td>Orientation barr.</td>
<td>0.21</td>
<td>0.319</td>
<td>0.65</td>
<td>0.5274</td>
<td>$-0.4695$</td>
<td>0.8812</td>
</tr>
<tr>
<td>Transaction barr.</td>
<td>0.63</td>
<td>0.419</td>
<td>1.51</td>
<td>0.1512</td>
<td>$-0.2569$</td>
<td>1.5209</td>
</tr>
</tbody>
</table>

Prior research UIC
1. research_uic
1.05  | 0.732 | 1.43  | 0.1718 | $-0.5043$ | 2.5979      

Prior Academic UIC
1. academic_uic
$-0.57$ | 0.800 | $-0.71$ | 0.4872 | $-2.2661$ | 1.1275      

Firm size (empl.)
Small
$-0.77$ | 1.008 | $-0.76$ | 0.4559 | $-2.9085$ | 1.3673      
Medium
$-0.44$ | 0.928 | $-0.47$ | 0.6430 | $-2.4061$ | 1.5291      
Large
$-1.33$ | 0.895 | $-1.48$ | 0.1576 | $-3.2235$ | 0.5701      
_cons
$-5.28$ | 2.972 | $-1.78$ | 0.0949 | $-11.5756$ | 1.0249      

Table V. UIC intention regression coefficients for the variables of the study

$n = 28$

$R^2 = 0.6973$
Pilot study and continued follow-up

The pilot study results are particularly informative to assess the necessary adjustments for a full-scale RCT. Beyond the limited data insights from the pilot study measurements, it helped to identify the unexpected difficulties to recruit participants from the baseline to be part of the treatment group. The intervention of the treatment group required the participants to join a half-day workshop in the university premises; although multiple dates were offered (and two identical workshops were finally celebrated), there was a low conversion rate from participants being invited (20) to the final 8 (6+2) participants (6 participants from different companies and 2 participants that joined a company colleague).

On the positive side, an additional follow-up (three months after the follow-up measurement) showed how the participants that remained engaged in the project till the end (10 out of the 36) had overall an increase in their activity in UIC. In some cases, it is an increase in the depth and breadth of their activities, in others it is a first-time collaboration. The details of each of the firm’s participant are described in Table VI.

Discussion

The transition towards an entrepreneurial university model requires the implementation of active strategies to engage with industry players. Such collaborations should not only be regarded as knowledge transfer activities, but as actual bidirectional exchanges. They contribute to the research and innovation of the industry players, but also to the academic’s research performance. Successful entrepreneurial university models suggest that a supportive context (an active innovation ecosystem) facilitates the development of the entrepreneurial mindset and activities in the university. Most of the attention in the transition towards such models has had the individual researcher, or scientist, as a focal point (Perkmann et al., 2013). However, much less is known on how to trigger the activation of the industry side. This research gap is relevant as a broad scope of universities explore the transition path towards being an entrepreneurial university, with or without a rich innovation ecosystem.

The study followed an experimental approach to explore whether a training session could be a suitable policy intervention to influence on the intentions and future behaviour of
industry players in a non-urban region with a satellite university campus. Prior research on UICs identified that the different visions of the university and the industry on the applicability of scientific research, on their time orientation and on their working practices (including IP management) could hinder such type of collaborations (Bruneel et al., 2010).

Still, the pilot data suggest that the perception of such barriers does not necessarily eliminate the intentions of industry partners to engage in UIC activities, even though such barriers are likely to be a source of future conflicts in such collaborations. In regard to factors identified as enablers in prior literature, the pilot data conform with the expectation that the diversity of interaction channels facilitates to sustain UIC activities. Yet, challenges the expected enabling function of social embeddedness and geographical proximity between university and industry participants.

The results of the study suggest that there is a heterogeneity of industry behaviours regarding UIC, that the geographical proximity limits the potential of UIC and that there are positive engagement effects of the training intervention.

First, industry participants experience in UIC can be categorised as purely based on academic talent recruitment (students’ internships and student projects), research-focused (joint research projects, joint patenting or licensing) or a combination of both. Interestingly, firms that have had most of their prior experience on the student recruitment category are less likely to consider other forms of UIC participation. Similarly to what D’Este and Perkmann (2011) identified with academics that either focus on commercialising their technology (licensing or academic spin-offs) or in general academic engagement (consulting or training with companies), a parallel pattern might be occurring with industry players. Industry participants might either see the regional university as a source of talented students or as a research partner but not necessarily both at the same time. Therefore, as exposed in Bruneel et al. (2010), UIC activities such as student secondments or company projects generate interactions between industry and university, but the university participants in such interactions might not be connected (or interact) with the university’s research services or scientists that could be interested in activating research collaborations or other knowledge exchanges.
Second, geographical proximity is an enabler of informal and formal interactions between the university and industry in a region. In fact, the short distance between the university and industry partners translates into geographic and cognitive proximity (Roper and Hewitt-Dundas, 2013). Nevertheless, the relative novelty of the university campus in the region (not more than a decade in its current form), and its strong international profile results in an uneven network of connections and relationships between the university’s staff and the firms in the region. Such peculiar configuration favours non-interactive learning from both sides (Roper and Love, 2018), potentially weakening the expected positive effects of proximity on UIC interactions.

This is what could be described as a “dark side” of proximity, where geographical and cognitive closeness – but without a personal linkage – makes non-interactive learning dominant. The perceptions of the capabilities of the counterpart (the university) are built on public information or second-hand experiences. For instance, prior negative experiences with “the” university in the region, might make it less likely for other firms to consider it as a source of ideas or as a partner for innovation projects. Despite being geographically close, without interactive learning the perceptions might become biased or just distorted (Roper and Love, 2018).

Third, despite the attrition rate from the baseline to the follow-up, the post-study observation of an increased UICs activity level is an encouraging finding. The activation of UICs could require a threshold interest towards collaborative innovation activities and knowledge exchange activities. The intervention might actually be working as a “myth-buster”, removing biases built through non-interactive learning and offering a possibility to get a first-hand experience on what can be achieved in such types of collaborations. This finding opens the discussion on whether not only researchers should be receiving training on how to become more entrepreneurial (Klofsten et al., 2019), but to also include industry players in such training programs. University activities that could favour the initial informal interactions between researchers and industry actors (Perkmann et al., 2013), might render stronger results than an exclusive focus on the academic researcher as driver of UIC collaborations.

Finally, the adoption of an experimental approach offers the possibility to discuss the results also from a methodology perspective. The design and execution of a pilot study has proven to generate valuable insights on the participants’ recruitment strategy and needs, the delivery and participation in the intervention and on the overall dynamics of the trial. The results suggest the importance of defining whether the intervention should aim to generate awareness of the UIC practice or actually change the actual behaviour of the industry participants. The short intervention worked to raise awareness. The use of cases that were related to the profile of the participants and the identification of initial (relatively easy) steps to take action might have helped to reduce the perception of UIC’s barriers. However, such type of intervention is less likely to generate deep changes in the behaviour, thus multi-session programme would be a better approach if this is the objective.

Similarly, the content of the intervention (training session) was built mostly on a behavioural learning pedagogy (discussing how UIC work using examples and models), a social or existential learning (Robinson et al., 2016) design would be more conducive of deeper changes in the participants perceptions, attitudes and future behaviour. Therefore, the results of larger trial based on the pilot’s training session might differ if the learning approach is revised to incorporate additional constructivist learning activities.

Such challenges, are however to be expected in pilot studies, surprises and unexpected behaviours from the participants are part of the key learnings to take into account in future research designs (Abbott, 2014). This pilot study is also a step towards the call for more frequent use of experimental research designs in technology transfer or related research fields (Cunningham and O’Reilly, 2018; Williams et al., 2019).
Implications for policy and practitioners

From a policy and practice perspective, the study contributes to the call for more transparent and evidence-based decision making in innovation policy (Cunningham and Gök, 2012). In the context of public policy for university’s knowledge transfer this has been a concern shared by both policy makers and scholars (Kochenkova et al., 2016). As a result, despite the critiques on the viability to run RCTs to study business support programs (Dalziel, 2018), the experimental approaches should help policy makers to make better decisions.

The results of the study suggest that an in-depth understanding of the context and underlying dynamics between the university and industrial actors is necessary before introducing interventions. The pilot study has helped to identify that the effect of a policy intervention to activate further UICs might be concealed by existing pre-conceptions and biases. Those need to be addressed before engaging further in the delivery of training or other types of interventions directed to increase the participation of academic and industrial actors in innovation and entrepreneurial.

For university managers engaged in the transition towards an entrepreneurial university model, the findings of the research make explicit the challenges that young or loosely embedded (in their innovation ecosystem) universities might experience. It is relevant that such managers do not only focus on the university’s internal factors, but also on how they can contribute to generate a more supportive context for the entrepreneurial university. Otherwise, the alignment of the teaching, research and entrepreneurial missions with the regional demands might become a rather difficult task.

Limitations and suggestions for further research

This research reports a pilot study, as such, it has several limitations that hopefully motivate further research on the topic.

First, the assumptions behind the recruitment strategy of the participants and their response rate were too optimistic. The proximity of the university campus to some of the invited participants did not result in an automatic enrolment in the programme. Therefore, a much broader and intense recruitment strategy should be considered for a full-scale RCT. Additionally, the communication strategy regarding the programme should be tested before starting the recruitment period, considering, for example, hosting an official launch event or other more formal activities in relation to the initiation of the programme. Likewise, the low response in the e-mail communications suggests that other mechanisms – visits or phone calls – should have been in place to follow-up the participants. Ideally being able in such redesign to reduce the potential self-selection bias in the sample. Participants with an already high interest with developing UICs were more likely to respond and engage in the project than those with a low interest. Leaving open the question of whether these could actually, be the ones that benefit more from such type of intervention.

Second, the training session proved to be an effective intervention, but did not generate substantial different results (in the intention related measures) among the participants that completed the programme. However, the duration and intensity of the programme should be reconsidered if researchers aim to explore the effects to a broader target population. In such situations, interventions that could span over several days, or in different points in time, might have a stronger effect in behaviour changes. The redesign of the intervention and the overall programme should also then include a revision of the participation incentives. Additional mechanisms that facilitate to deliver the training intervention minimising the time and location constrains (i.e. hosting the seminar nearer to where the participants are based) or offering additional short-term incentives could be potential interesting tweaks.

Finally, this research mostly used data coming from surveys and observations on a reduced sample of participants. Future research could consider other sources of data (direct or indirect) that can better capture actual changes in the behaviour of the participants.
from a longitudinal perspective. This can be easier to achieve if instead of inviting several firms in the region, the experiment involves only employees from a specific organisation (Rigtering et al., 2019).

**Conclusions**
The transition towards an entrepreneurial university model can follow many different paths. A common element across these different paths is an active engagement with the industry actors in the university’s region. While prior research has substantially contributed to understand the barriers and enablers that facilitate the academic engagement with the industry, less is known on how to nurture and activate industry interest in engaging in UICs.

As the entrepreneurial university model is reinterpreted in different contexts, it is also necessary to consider the additional transitional challenges that might appear. In particular for universities that need to create or rebuild linkages and relationships with the innovation ecosystem that surrounds them. This study contributes to identify and explore the industry perspective on UICs. It takes advantage of the experimental approach to generate insights on the challenges and possible remedies for policy makers and university managers interested in activating UICs.

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**References**


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