An examination of the attractiveness of university and corporate anchor tenants in the conception of a new cluster

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Abstract

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Abstract

This paper attempts to investigate the attractiveness of public and private anchor tenants in the conception of new technological clusters through the examination of a case study. The University of Bath secured public funding to develop a University Research Institute (URI) i.e. public anchor tenant in the Bristol and Bath Science Park (BBSP). Although anchor tenants play an important role in promoting innovation and network formation in technological clusters by rendering them more attractive to investors, there is not much empirical evidence on their impact before cluster formation. Accordingly, the paper attempts to fill this literature gap and provide relevant policy recommendations.
From a theoretical perspective, the paper investigates the role of public and private anchor tenants in clusters and discusses how both types of anchors can have a complementary role in cluster formation. More specifically, anchors can act as magnets to investors and attract high-quality human capital, they can amplify existing networks in the cluster and act as bridges between the cluster and other (global) clusters. From an empirical perspective, the paper attempts to identify what are firms’ main perceived benefits stemming from public and private anchors which can, in turn, promote firms’ involvement with public anchors. Further, we investigate for which types of firms differentiated by their degree of innovativeness, R&D intensity, financial constraints and involvement in business and knowledge networks, the benefits from a) public anchors and b) public anchors co-located with private anchors in the cluster are the greatest. Finally, the paper investigates whether a private anchor located together with the public anchor in the cluster can amplify the attractiveness of the latter.

Unique survey data was collected for firms in the automotive and aerospace industries in the UK. Firms from these two industries are technologically very similar and the URI is mostly relevant to them. Information on innovation, R&D intensity, involvement in business and knowledge networks, financial constraints, size and age was collected for the purposes of the study. Exploratory factor analysis was employed to identify what are firms’ perceived benefits of: a) a public anchor tenant (URI) located in the cluster on its own and b) a private anchor tenant (OEM) co-located in the cluster with the public anchor tenant (URI). Further, by developing two appropriate constructs we were able to test whether the OEM has amplifying effects on the attractiveness of the URI. Further, by employing Ordinary Least Squares (OLS) estimation we investigate which types of firms by innovativeness, R&D intensity, financial constraints and involvement in business and knowledge networks are most attracted by the anchor tenants. Finally, by using interaction terms in the specification we derived pairwise comparisons between the different types of firms with respect to benefit perception.

We find that firms most likely to benefit from knowledge, facility and other regional benefits stemming from the co-location of the public and private anchor tenant in the emerging cluster are highly innovative firms, firms with high R&D intensity and firms highly involved in business and knowledge networks. However, it is found that financial constraints may inhibit firms from appropriating the aforementioned benefits and would be, thus, less likely to be attracted in the cluster. Finally, we find that the presence of a private anchor can amplify the attractiveness of the public anchor to firms and propose that this can heighten the likelihood of a cluster emerging around the tenants. The implications lead us to provide policy recommendations.
An examination of the attractiveness of university and corporate anchor tenants in the conception of a new cluster

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Abstract

Studies of established regional technological clusters have long documented anchor tenants as significant factors in their growth and success. However, the potential presence of anchor tenants, perceptions about their expected benefits and hence role in the conception of a potential new cluster is unknown. This study focuses on a proposal to develop a new tech-based cluster in the UK. By drawing on a unique survey of UK-based automotive and aerospace firms, we examine the perceived respective roles of, and interplay between, public and private anchor tenants in cluster creation. Furthermore, we identify some characteristics of the firms most likely to observe future potential benefits stemming from a) the presence of the public anchor alone, and b) a public anchor that has a research-based relationship with a co-located private anchor. We find highly innovative, highly R&D intensive firms that are already embedded in knowledge and business networks, are the most likely to perceive benefits from, and therefore be attracted to, the anchor tenants in the potential cluster (although financial constraints may inhibit them from fully exploiting regional synergies with them). We propose the presence of a private anchor can amplify the attractiveness of the public anchor to firms and heighten the likelihood of a cluster emerging around the tenants. The implications lead us to provide policy recommendations.

JEL Codes: R11; R53; R58; O30

Keywords: Anchor Tenants, Clusters, Networks, Innovation
1. Introduction

There is growing policy interest in the role of universities as local economic actors, their potential to stimulate regional economic growth and technological/industrial cluster formation i.e. as anchor tenants (see Benneworth, 2018). Anchor tenants can play a key role in the development of regional clusters (Markusen, 1996) and are defined as organisations heavily engaged in R&D with the absorptive capacity to apply new knowledge and generate knowledge externalities within a particular (regional) technological field (Agrawal and Cockburn 2003; Niosi and Zhegu, 2010). Anchors can facilitate cluster dynamics by connecting actors (such as buyers and suppliers) both within and beyond a cluster. This network building is important for collaboration, knowledge transfer and creating value within the cluster through innovation and, crucially, enabling cluster-based firms to capture this value through exploiting new market opportunities (Bailey et.al, 2018; Adner and Kapoor, 2010). At least two categories of anchor tenants exist: public anchor tenants (research universities and public research organisations) and private anchor tenants (typically Original Equipment Manufacturers (OEMs) and/or multinational firms).

The role of anchor tenants is becoming increasingly important within the context of nascent and emerging clusters because an anchor can act as a magnet for attracting new investment in a cluster, and as critical players themselves in the nurturing of cluster specialisms in new technological fields (Braunenjelm and Feldman, 2006). However, the roles of public and private anchor tenants are different. Universities, for instance, may play a role as a public anchor through their ‘third mission’ (Laredo, 2007; Benneworth, 2018) especially with regard to promoting local growth e.g. by transferring their know-how to local industry and supporting regional knowledge networks (Goddard et.al 2014); something which is of heightened political interest in the UK. Corporate anchor tenants can bring forth opportunities for local firms to access the anchor’s business networks - through their global value chains, for example (Chaminade and Vang, 2008). Yet, we know little about the relationship between the two types of anchor tenants within a single region, even though we know that mutual benefit in terms of innovation and productivity are gained from university researchers working with corporations. By examining established clusters, we tend to impose our ex-post understanding of the importance of anchor tenants onto the emerging stages or conception (pre-birth) of a new cluster (Niosi and Zhegu, 2010). As such, prescient knowledge of the importance of anchor tenants for cluster dynamics exists from a conceptual perspective. However, there is little empirical analysis of the ex-ante perception of their respective roles from firms that stand to benefit from their presence at the early stage of the cluster lifecycle. This makes it difficult for policy-makers to design appropriate policy initiatives in which public and private anchors are key contributors within new cluster formation.

The novel contribution of this paper is three-fold. First, we make a theoretical contribution by exploring the different and complementary roles played by public and

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private anchor tenants in a cluster’s emergence and development stage. In doing so, we highlight their dual roles as both ‘magnets’ for cluster formation/development and crucially as ‘bridges’ between knowledge and business networks so as to propagate value creation and facilitate value capture. Second, and drawing upon our theoretical considerations, we offer a unique exploratory case study of the attractiveness of both a new university research facility and a corporation as anchor tenants in the conception of a new cluster. We do so in the context of what was, at the time of data collection (2015), a detailed proposal for the creation of a new university related automotive research institute (URI) to be located in an already established science park within the same region as the parent university. Drawing upon a unique survey of firms in the UK automotive, and (technologically adjacent) aerospace sectors, we are able to ascertain the range of perceived benefits the URI may offer private firms, and hence the attractiveness of both the proposed facility, and the wider cluster it aspires to create, to firms from across the UK. We also explore whether attractiveness is amplified if the URI could form a direct relationship with a global OEM (acting as a private anchor tenant) in the emerging cluster. Our third contribution is that, through the case study, we offer a framework (or toolkit) for policy-makers (and private investors) to identify and explore the different characteristics of firms that perceive the greatest benefits and are thus more likely to collaborate with a new public anchor and enhance the cluster dynamic. These insights provide important indicators for policy design and implementation not only for the specific URI case, but also more generically in relation to the role of anchor tenants in the genesis of clusters.

The remainder of this paper is set out as follows. Section 2 offers a theoretical exploration of the role of public and private anchor tenants in the emergence and development of regional clusters. Section 3 then introduces our specific URI case study and research questions, while Section 4 outlines our methodological approach. Section 5 presents our empirical results, while in Section 6 we consider their wider implications for our case, and more generic cluster development. Finally, Section 7 briefly concludes.

2. Anchors and the Cluster Dynamic

2.1 Anchors as Magnets

It is in the genesis of high technology clusters where anchor tenants can play a key role, acting as magnets for new investments by firms and other institutional actors external to the cluster (Braunenjelm and Feldman, 2006). Anchors can mobilize and orchestrate cluster knowledge flows, strengthen networks, promote new spin-offs and technological opportunities (Baglieri et.al, 2012). Indeed, it is often the presence of large private anchor tenants which facilitates agglomeration economies, notably through developing skilled labour pools and the procurement of (locally sourced) specialised inputs. In dynamic clusters, the private anchor’s research programme can also generate a new pool of entrepreneurs and spin-offs, who may become involved in the anchor’s open innovation projects (Feldman, 2003). For instance, Baglieri et.al (2012) document the significant role played by a private anchor tenant - STMicroelectronics - in providing highly qualified employment and R&D investment, while also fostering high tech spin-

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2 In 2017 the focal URI received £39 million of public funding to build a Global Centre of Excellence in its research field. It is scheduled to open in 2020.

3 Firms located in the UK also include UK based subsidiaries of non-UK firms.
off ventures and attracting international firms/suppliers and public funds in the emergence and development of both the Grenoble and Catania nanotech clusters.

Public anchors can also play a crucial role in establishing and supporting local networks, making the region attractive for entrepreneurs, and in some cases, enticing private anchor tenants to the cluster (Smedlund, 2006). Universities, for instance, may provide facilities, expertise and technical support to cluster-based firms (Mowery et al., 2004). They can also offer unique, socially inclusive spaces that attract and retain highly skilled researchers and students in the region (Gertler and Vinodari, 2005). These add to the cluster’s stock of tacit knowledge and expertise, as well as to the skillsets and thickness of the local labour market (Bets and Lee, 2005). For Etzkowitz and Klofsten (2005), the ‘entrepreneurial’ university is part of the triple helix, supporting government and industry in cluster development and ‘found at the root of virtually any high tech region (ibid, p.246)’. As such, they play an active role as public anchors in developing human capital and research resources, as the seedbed for interdisciplinary scientific cross-fertilisation, and for facilitating social interaction and networking capacity for (local) actors to tap into shared knowledge bases. The enhancement of regional assets enhances the cluster dynamic and strengthens its magnetism to (external) actors.

Yet, while both private and public anchor tenants act as (re-enforcing) magnets within clusters, their roles (and remit) are distinctly different, which has implications for cluster (and network) dynamics, the types of firms and activities attracted to the cluster and as such, the value creation and capture process. Private anchor tenants such as multinational firms (and/or OEMs) are also often engaged in their own global networks – such as global value chains - that are external to the cluster and in which they seek to innovate and become leaders in new ‘technological domains’ (Liu et al., 2013; Lorenzen and Mudambi, 2015; Mudambi et al., 2017). They therefore participate in both value creation activities through innovation and engage in value capture by commercialising this innovation in (global) markets (Wright, 2014). In contrast, public anchor tenants are primarily engaged in value creation activities; their public funding base provides the space to conduct ‘blue sky’ research where their applications are highly uncertain but which can underpin radical innovation. Public anchors therefore typically fulfil a role as knowledge generators and conduits for knowledge diffusion (Agrawal and Cockburn, 2003).

2.2 Anchors, Knowledge and Business Networks

It is widely acknowledged successful knowledge creation, diffusion and innovation within dynamic clusters is not so much a function of geographic proximity, but instead the relational embeddedness of firms within networks (Maskell and Malmberg, 1999; Capello and Faggian, 2005). However, unlike a regional clustering of firms, usually in the same or related sector, regional networks are selective groups of actors purposefully formed as members to co-operate over a shared objective4. Thus, in nascent clusters, a critical policy adjunct is to nurture and strengthen both regional and international networks among, and between, local and external actors so as to develop learning linkages, synergies and enhance knowledge transfer. Yet any such facilitation ought to recognise the distinction between knowledge and business networks, each of which are distinct entities that do not necessarily overlap (Giuliani, 2007).

4 Clusters may include networked firms and actors, but also other firms and actors who are not purposively linked with each other in some way yet operate in the same regional (industrial) cluster (Maskell and Malmberg, 1999).
Knowledge networks involve actors deliberately sharing knowledge and collaborating to deliver innovative solutions to complex technical problems. They are highly selective networks and are shaped by actors (which may include both private and public anchor tenants), with the capabilities to engage in such activities. The network will reflect what Giuliani (2007) describes as the heterogeneous and asymmetric distribution of partners’ knowledge bases (and their technical capabilities), with actors deliberately seeking partners that can offer them different levels of technical expertise and innovative solutions (to specific problems). Thus, anchor tenants with strong knowledge bases may be identified as technology leaders and will be sought out by other actors for advice and technical expertise. These technological leaders are likely to be central to the knowledge network and will act as facilitators of innovation and technology transfer, especially to other technically advanced organisations with the capacity to absorb and utilise such information (Giuliani, 2007; Boschma, 2005). In regional clusters, either the private and/or public anchor tenant is likely to play the key role in this process (Feldman, 2003).

In contrast, a business network is a group of firms and entrepreneurs which are deliberately connected to explore, create and jointly pursue business opportunities (Österle, et.al, 2001) in delivering a product/service to end-users. This can be achieved through co-operation in a value chain value, although horizontal collaboration may also arise in regional clusters - often spontaneously - where market, social and institutional ties co-exist (Beccattini, 1990; Porter, 1998). Private anchor tenants will, however, often play the key role within business networks by co-ordinating activities such as inter-firm asset sharing (including knowledge and information) and providing ‘platform services’ (such as technology and equipment) along the value chain. Much of this knowledge sharing relates to the business application and exploitation of existing knowledge, such as technical compatibility (over inputs) and ensuring appropriate interfaces between technical systems and subsystems within products as well as operational, managerial and marketing knowledge (Autio, 1998). In business networks, there is a much greater emphasis - vis-à-vis knowledge networks - on creating and capturing value with innovation geared towards creating and exploiting market opportunities (Wright, 2014), with the lead often taken by a private anchor tenant (Clarysse et.al, 2014).

It is the possibility of gaining access to a private anchor tenant’s (wider) business networks (and the commercial opportunities therein) that acts as a magnet for some (supplier) firms, while similarly the attraction of the public and private anchors’ (global) knowledge networks (and expertise/resources therein) can lure (more) technical and specialist firms to an emerging cluster. Yet, in nascent clusters, it has long been assumed that by nurturing local knowledge networks an associated business network will also naturally emerge and thrive, and thus facilitate both value creation and capture opportunities and eventually, a dynamic cluster (Clarysee et.al, 2014). However, since the dynamics and structure of each type of network are fundamentally different this evolution may not occur (Iansiti and Levien, 2004). In developing nascent clusters, it is therefore important to purposefully build links between both types of network, with ideas and practices from each network being transposed to the other (Clarysse et.al, 2014).
2.3 (Private) Anchors as Bridges

Anchor tenants may act as bridges for different types of actors across both knowledge and business networks. Figure 1 illustrates how this may play out within a typical cluster. Panel A illustrates several clusters (the focal one being the larger one (for illustrative clarity) to the left). In the focal cluster, multiple firms exist, and some may have direct linkages to other firms (not illustrated – see note below figure 1) both within the focal cluster and beyond it. Figure 1, Panel B illustrates the same cluster, but now with a university acting as public anchor tenant within it. As discussed above, a public anchor tenant can play a key role in the knowledge network. They may facilitate direct bilateral knowledge linkages with local actors, with this firm-specific knowledge transfer being supplemented further by the public anchor tenants’ role as a bridge between various firms, so that additional knowledge is received by a firm indirectly from the public anchor’s other, multiple external linkages. Universities, and especially their research institutes, can be important public anchors in knowledge networks in this regard, by i) functioning as a local knowledge hub that develops new capabilities, and fosters knowledge exchange and learning activities (Youtie and Shapira, 2008) and; ii) being a bridge/conduit for cluster firms to access expertise from global academic research networks (Bramwell and Wolfe, 2008).

[Insert Figure (1) Here]

However, large private anchor tenants are in the prime position to act as a bridge between cluster knowledge networks and broader business networks (Figure 1, Panel C). This is because private anchors are attuned to developing products and services for commercial exploitation within markets. In its role as a ‘bridge’, knowledge created within the knowledge network can be utilised in innovative activities within the private anchor’s business network to create value. The structure of the business network can then identify the value capture (profit) opportunities and apportion this to the various actors involved in the production process (Pitelis and Teece, 2009). Where obstacles or gaps arise, these can be fed back into the knowledge network stimulating new research and innovation opportunities. Without the ‘bridge’ provided by the private anchor tenant, the knowledge derived from knowledge networks in regional clusters may have more limited value in, and of itself. It is this ‘bridge’ that propagates the cluster dynamic, strengthens its magnetic appeal (to external actors) and ensures the development of the cluster (see also Clarysse et al. 2014).

In clusters where both private and public anchor tenants reside, the connection between knowledge and business networks is especially strong when both anchors collaborate together closely. This may arise, for example, when a private anchor tenant utilises technological platforms developed by a local university that will assist the transposition of the more technical knowledge from publicly funded research into commercialised output. For instance, the Fraunhofer institutes in the German Landers act as ‘bridges’ between knowledge and business networks by working closely with the private sector, conducting joint research, open innovation, technology transfer and critically bringing new products to market (MIT, 2015, Andreoni, 2016). These type of activities strengthen both the dynamism and magnetism of a cluster, allowing it to develop a

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5 These external linkages are akin to ‘global pipelines’, which can enhance local knowledge or ‘buzz’ (Bathelt et.al 2004).
regional system of innovation in which (local) university research is more likely to be absorbed by local firms, thereby stimulating local industrial R&D, enhancing the cluster’s reputation as a location for inward investment by non-local firms.

3. Case Background and Research Questions

The conceptual issues considered in Section (2) highlight the potential roles of private and public anchor tenants within a cluster. In the conception of a new cluster and/or in nascent clusters, where decisions on new public investments in research facilities are being made, policymakers are interested in the role of both public and private anchors as magnets to external actors, that can spur cluster growth. This was especially important within the context of our case study - where significant funding has been awarded to establish a new public anchor - which we now consider.

In July 2017, University X [Removed for Anonymity] announced it had been awarded funding jointly from the UK Research Investment Fund (UKRPIF) and its Local Economic Partnership, to establish a £60 million Automotive-related Research Institute to be based in an established science park within the region. The URI’s aim is to be a Global Centre of Excellence delivering transformational R&D for future generations of low carbon vehicles. The URI is to be one of the 6 spokes in the UK’s Advanced Propulsion Centre network and is unique in being conceived as the only facility to allow ‘precise systems level examinations of the whole powertrain, facilitating whole vehicle assessments under real-world driving conditions’.

It is anticipated the URI will work closely with global Original Equipment Manufacturers (OEMs) (initially in the automotive industry), manufacturers, SMEs and other universities and partners to deliver low carbon technologies and more efficient combustion engines, alongside developing electric and hybrid systems as well as alternative fuels. There are also possibilities of such technologies being utilised in the aerospace sector for which the region has a global reputation, potentially through developing links (and research synergies) with a nearby aerospace OEM and through (local) supplier firms in aerospace diversifying their skills and interests into advanced automotive propulsion systems. University X itself has world leading research capabilities in Advanced Mechanical Engineering, has delivered 15 Innovate UK and APC funded projects and received research income in excess of £11 million between 2011-2015. It has long, extensive experience of working with global automotive OEMs, including Ford and Jaguar Land Rover. In short, the expertise already resides in the University (and hence region), there is an existing (albeit distant) client base, yet the lack of a modern facility and equipment is a constraint on future growth.

In preparing the bid, it was important for University X to demonstrate the wider benefits of the public investment in the facility, particularly with regard to small and medium sized firms (SMEs) in the UK automotive and related industries and, for the interests of its LEP, the development of a new regional cluster. As a public anchor tenant, if the URI is to thrive it is important it fosters productive relationships and technological synergies with SMEs in this process, since this is likely to facilitate knowledge transfer, innovation and value creation/capture. Of particular interest then, were the types and characteristics of firms – especially in terms of their existing activities and network links - that might be attracted to the future cluster, and form links with the new URI facility.
Understanding the attractiveness (captured through firms’ perception of benefits) of the URI from the viewpoint of possible users, was not only important to justify the allocation of public funds, but also aids the URI’s management team to co-ordinate and tailor the facilities (and wider benefits), to attract the calibre of firms most likely to generate a dynamic cluster.

Given this, this study sought to specifically address the following (from a firms’ perception of potential future benefits to be gained by the creation of the URI and their likely use of it):

1. What are the main perceived benefits of the URI to private firms in terms of: i) research and testing facilities and ii) specialist knowledge and scientific expertise?
2. What are the main perceived benefits of a private anchor’s (e.g. an OEM) co-location with the URI in terms of: i) regional benefits and ii) the firms’ involvement with the URI?
3. Is the perceived attractiveness of the URI as a standalone entity and/or the co-location of it and a private anchor (e.g. an OEM) in the cluster stronger or weaker for firms that: i) have higher R&D intensity ii) are more innovative iii) are already highly embedded in existing business and/or knowledge networks and iv) are more financially constrained?
4. Does the co-location of the URI and a private anchor (e.g. an OEM) in the cluster amplify the attractiveness of the URI as a public anchor tenant?

4. Methodology

4.1 Survey and Sampling Frame

This study collected data with a survey of 1100 firms operating in the UK automotive and aerospace industries. The rationale for the sectoral sampling frame is that whilst the URI will primarily focus upon propulsion systems for the automotive industry, there are likely to be strong synergies with technologically proximate sectors, especially aerospace. The sampling frame was drawn from the membership directories of the main industry trade associations; The Society of Motor Manufactures and Traders (SMMT), the Aerospace, Defence, Security, Space Group (ADS) and a ‘regional’ (for anonymity) Aerospace Forum. The directories provided contacts and background information on member firms operating at the 4-digit Standard Industrial Classification (SIC) in both sectors.

The survey was addressed to the Managing Director of each firm and sent by post – with an option to complete online – during June and the first half of July 2016. A two-page leaflet, that included a link to an online video, explaining the concept of the URI, its remit and the full facilities it would offer was also sent out with each survey to provide respondents with information on the proposed facility. The questionnaires sought information on each firm’s research and innovation capabilities, their interest in the URI and its proposed facilities, along with firms’ background information. The survey itself included background questions relating to the previous three years of trading (2012-2015), such as firm size, supply chain status, and firms’ R&D intensity. In addition, one section of the survey asked several questions relating to firms’ perceptions of the likely benefits, and their utilisation of the URI. Additionally, firms
were asked whether their responses to the former would be enhanced with the involvement of a collocated OEM (a private anchor tenant). Survey questions were largely based upon previous academic studies and where applicable, utilised a 7-point Likert scale. In total, 116 usable responses (10.5% response rate) were received, with 57 (a 14.0% response rate) from the automotive industry, and 59 (8.9%) responses from the aerospace industry.

### 4.2. Model and Variable Construction

In light of our discussion in Section 2, and our research questions outlined in Section 3, we explore the partial correlation between firms’ existing i) R&D intensity ii) innovative capacity, iii) involvement in business and/or knowledge networks and iv) financial constraints, and the perceived attractiveness of the URI both as a standalone entity and when it is co-located with a private anchor (e.g. OEM) in the same science park. More formally:

\[
\begin{align*}
\text{Benefits}_i &= \beta_0 + \beta_1 \text{RDI} + \beta_2 \text{Innov}_i + \beta_3 \text{Business Network}_i \\
&+ \beta_4 \text{Knowledge Network}_i + \beta_5 \text{Size}_i + \beta_6 \text{Age}_i + \beta_7 \text{Industry}_i \\
&+ \beta_8 \text{Region}_i + \beta_9 (\text{Industry}_i \times \text{Region}_i) + \epsilon_i \\
\text{Benefits}_i &= \gamma_0 + \gamma_1 \text{RDI} + \gamma_2 \text{Innov}_i + \gamma_3 \text{Business Network}_i \\
&+ \gamma_4 \text{Knowledge Network}_i + \gamma_5 \text{Size}_i + \gamma_6 \text{Age}_i + \gamma_7 \text{Industry}_i \\
&+ \gamma_8 \text{Region}_i + \gamma_9 (\text{Industry}_i \times \text{Region}_i) \\
&+ \gamma_{10} \text{Financial Constraints}_i + u_i
\end{align*}
\]

where firm size, age, industry and regional affiliation act as controls. In order to further explore how the perceived benefits of the URI relate to the different types of firms, we augment Eq. (1a) and Eq. (1b) with two-way interaction terms between innovativeness, R&D intensity, business and knowledge networks:

\[
\begin{align*}
\text{Benefits}_i &= \beta_0' + \beta_1' \text{Innov}_i + \beta_2' \text{RDI}_i + \beta_3' \text{Business Network}_i \\
&+ \beta_4' \text{Knowledge Network}_i + \beta_5' \text{Size}_i + \beta_6' \text{Age}_i \\
&+ \beta_7' \text{Industry}_i + \beta_8' \text{Region}_i + \beta_9' (\text{Industry}_i \times \text{Region}_i) \\
&+ \beta_{10}' (\text{Innov}_i \times \text{RDI}_i) + \beta_{11}' (\text{Innov}_i \times \text{Business Network}_i) \\
&+ \beta_{12}' (\text{Innov}_i \times \text{Knowledge Network}_i) \\
&+ \beta_{13}' (\text{RDI}_i \times \text{Business Network}_i) \\
&+ \beta_{14}' (\text{RDI}_i \times \text{Knowledge Network}_i) \\
&+ \beta_{15}' (\text{Business Network}_i \times \text{Knowledge Network}_i) + \epsilon_i'
\end{align*}
\]

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6 We took advice from University X’s senior staff involved in the focal URI project on the framing of particular questions.

7 We add the “financial constraints” variable in a separate equation because values for this variable exist for a subsample of 104 observations. This additional specification also serves as a robustness check.

8 We tested both the main and the interaction effects of Size, Age, Industry with the four variables indicating different firm types on each of the four perceived attractiveness constructs we use. In each case, size, age and industry effects were highly insignificant suggesting that there are no differences in perceived attractiveness by firm size, age or industry. These results are available upon request.
\[
\text{Benefits}_i = \gamma_0' + \gamma_1' \text{Innov}_i + \gamma_2' \text{RDintensity}_i + \gamma_3' \text{BusinessNet}_i \\
+ \gamma_4' \text{KnowledgeNet}_i + \gamma_5' \text{Size}_i + \gamma_6' \text{Age}_i + \gamma_7' \text{Industry}_i \\
+ \gamma_8' \text{Region}_i + \gamma_9' (\text{Industry}_i * \text{Region}_i) \\
+ \gamma_{10}' \text{Financial Constraints}_i + \gamma_{11}' (\text{Innov}_i * \text{RDintensity}_i) \\
+ \gamma_{12}' (\text{Innov}_i * \text{BusinessNet}_i) + \gamma_{13}' (\text{Innov}_i * \text{KnowledgeNet}_i) \\
+ \gamma_{14}' (\text{RDintensity}_i * \text{BusinessNet}_i) \\
+ \gamma_{15}' (\text{RDintensity}_i * \text{KnowledgeNet}_i) \\
+ \gamma_{16}' (\text{BusinessNet}_i * \text{KnowledgeNet}_i) + u_i'
\]

The variables specified in the models are described below.

4.2.1 Dependent Variable(s): Perceptions of the Public Anchor’s Attractiveness

To capture the perceived attractiveness of a) the URI, as a standalone public anchor tenant and b) the URI, when it is co-located with an OEM (as a private anchor tenant), we asked respondents to indicate the extent to which their firms would expect to utilise the URI’s facilities, on separate 7-point Likert scale items. We interpret that firms that expect to utilise the facilities to a greater extent, perceive they will derive greater benefit from the URI than firms that would expect to use them to a lesser extent. We also interpret that the greater the perceived benefits of working with and utilising the URI, the more attractive the facility is to the individual private firms. The questionnaire items were used to create constructs by combining them into single factors through Exploratory Factor Analysis (EFA), employing an oblique (direct oblimin) rotation of the extracted factor matrix. We assume the resulting factors to be potentially correlated since they all constitute different and potentially overlapping measures of firms’ perceptions of benefits (see below) and, contrary to orthogonal rotations, oblique rotations allow for solutions with such correlations (Fabrigar et al., 1999:281)\(^9\). The determinant of the correlation matrix was non-zero and could therefore be inverted, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.885 exceeded the minimum threshold (0.6), while Bartlett’s test of sphericity supported its factorability.

We extracted four factors that constitute our constructs.\(^10\) These four constructs relate to our first two research questions, with two of these constructs identifying the perceived attractiveness of the URI as a standalone facility, and two constructs relating to the perceived attractiveness of having an industry specific OEM colocated with the URI. These constructs, which jointly explain 62.41% of the variance of the correlation matrix,

\(^9\) Oblique rotation of the factor matrix also enables us to obtain factors with a simple and interpretable structure (Thurstone, 1947; Gorsuch, 1983:177; Sass and Schmitt, 2010). There is not much “justification for using orthogonal rotation as a general approach to achieving solutions with simple structure” (Fabrigar et al., 1999:283). We experimented with an orthogonal rotation (varimax) of the extracted factor matrix, and while the interpretation of the factors did not change, many complex variables (i.e. items with significant loadings – greater than 0.40 – in more than one factor) emerged, hence, violating one of Thurstone’s (1947) criteria. These results are available upon request.

\(^10\) We also employed the Harman’s single factor test and since not a single factor was extracted and no factor accounted for the majority of the covariance of the items, we may conclude that there is no undue influence of common method bias on the results (Podsakoff and Organ, 1986).
are briefly described below, with full details of the items utilised (and the EFA) provided in Appendix A.

**URI Facility-Specific Knowledge benefits:** this construct captures the extent to which firms perceive the URI as a means to enhance their own stock of knowledge, through its scientific and technical advice, support and training, information sharing and/or wider industry networks.

**Region-wide benefits stemming from URI-OEM co-location:** this construct captures the perceived attractiveness of the potential regional synergies arising between the URI (as the public anchor tenant), and an unnamed, but industry specific OEM (as the private anchor tenant) and private firms. Potential benefits include higher quality (regional) labour pools, the co-location of professional ancillary service companies and investor interests within the cluster.

**URI Facility-specific Physical benefits:** this construct captures the extent to which firms expect to utilise and derive benefit from the URI’s proposed facilities (powertrain research, climatic vehicle performance and vehicle testing facilities) and laboratories (energy storage, electric propulsion, and gas dynamics and fluid flow laboratories).

**Firm-based benefits stemming from URI-OEM co-location:** this construct captures how the presence of a direct relationship between the URI and an OEM would generate benefits for the firms that may render them more willing to establish a relationship with the URI. These range from the OEM adding (commercial) credibility to the URI’s projects to opportunities for private firms to access (and utilise) the OEM’s existing value networks.

The values of each construct (i.e. factor scores) were calculated as loading-weighted averages of the values of their items, which has the advantage that items with large loadings on the factor exert more influence on the factor score than items with smaller loadings. Finally, for each construct, Cronbach’s alpha exceeded the minimum threshold (0.7), indicating they are both internally reliable and consistent (Hair et.al, 2007); [see Table (1)].

### 4.2.2 Independent Variables

**Innovativeness:** Firms were asked to indicate on a 7-point scale the extent to which they had introduced new product and process innovations over various activities (Molina-Morales and Martinez-Fernandez, 2009; Corredoira and McDermott, 2014; Tomlinson and Fai, 2016). By using loadings from EFA (KMO value of 0.856; Cronbach’s alpha: 0.892), a loading-weighted variable was constructed where the top quartile of its distribution indicates ‘high’ innovation outputs and it is captured by a dichotomous variable (1 if firm is highly innovative, 0 otherwise).

**R&D intensity:** this is a binary variable, where firms investing over 10% of their turnover (either in direct budget or staff time) in R&D, were classified as having a high level of R&D intensity (De Propris, 2002).

**Business Networks:** we requested firms to indicate on a 7-point scale the extent to which they were involved in existing business networks (Clarysse et al., 2014).
loading-weighted variable was constructed (KMO: 0.676; Cronbach’s alpha: 0.834) where the top quartile of its distribution indicates firms ‘highly’ involved in business networks and it is captured by a dichotomous variable (1 if highly involved in business networks, 0 otherwise).

**Knowledge Networks:** we requested firms to indicate on a 7-point scale the extent to which they were involved in existing knowledge networks (Giuliani, 2007). A loading-weighted variable was constructed (KMO: 0.680; Cronbach’s alpha: 0.771) where the top quartile of its distribution indicates firms ‘highly’ involved in knowledge networks and it is captured by a dichotomous variable (1 if highly involved in knowledge networks, 0 otherwise).

**Financial Constraints:** This is a dichotomous variable distinguishing between firms indicating they face financial constraints (coded 1) in their current line of business and those that have not. Financial constraints can inhibit firms from accessing resources to undertake a wide range of innovation related activities, including R&D, networking and utilising public research facilities (Gorodnichenko and Schnitzer, 2013; Howell, 2016). This variable is only relevant for a subsample of 104 firms that indicated whether or not they were financially constrained.

**Firm size (micro and SMEs):** This dichotomous variable distinguishes between SMEs or micro-firms (coded 1) and large firms based on the EU recommendation 2003/361, where large firms are those exceeding 250 employees.

**Age of firms (young firms):** This dichotomous variable distinguishes between younger firms (coded 1) being in the bottom quartile of the age distribution (i.e. founded in 2003 or later) and older firms (i.e. founded earlier than 2003).

In addition, we included an industry dummy, where automotive firms were coded as 1, and a regional dummy, where firms currently based in the region were also coded as 1. Table (1) below provides descriptive statistics for the whole sample and the two industry subsamples.

**Insert Table (1) Here**

### 5.0. Estimation and Results

Equations 1(a), 1(b), 2(a) and 2(b) were estimated by Ordinary Least Squares (OLS) using Stata v.13, with the results being reported in Table (2)\(^{11}\). Overall, the Ramsey tests indicate the models are well specified, while the low Variance Inflation Factors (VIFs) suggest multi-collinearity is not a problem. The adjusted R squared values are also reasonable for exploratory cross-sectional studies of this type (Greene 2003:37).

\(^{11}\) The robust regression estimation (rreg command in Stata) was also employed to check the robustness of our results to leverage points. The results were generally robust, indicating that there is no undue influence of leverage. These results are available upon request.
We should also note the intention of the models is not to infer causality, but to identify, statistically, the types of firms (and their characteristics) for whom the URI is most attractive.

5.1 Public Anchor’s Perceived Attractiveness and Firm Characteristics [Eq.1(a) and Eq.1(b)]

With regards to Eq.1(a) and Eq.1(b), the estimation results indicate that more innovative firms are significantly more positive about each of the perceived attractiveness measures relating to the URI (vis-à-vis less innovative firms). That is to say, highly innovative firms tend to report between 0.569 and 1.272 points higher in the Likert scale across the four attractiveness constructs compared to the low innovative firms, ceteris paribus (see Table 2, Panel A, Row 1). This is not surprising, since university-industry collaboration tends to be more frequent in highly innovative firms (Loof & Brostrom, 2008, Cowan and Zinovyeva, 2013). The URI is being established as a public research facility, and as such it intends (and is likely) to attract highly innovative firms capable of utilising its powertrain research, climatic vehicle performance and vehicle testing facilities and associated laboratories. These firms also view the URI positively as a means to acquire technical and specialist knowledge, while also accessing new knowledge pools around propulsion systems. Highly innovative firms are also significantly more positive about a potential link-up between the URI and a private anchor tenant (an OEM), which may (among other things) allow them to access the latter’s value networks and also gain from the (wider) potential regional synergies arising (from the link-up) within the cluster.

There are, however, differences in firms’ perceptions of benefits with regards to R&D intensity. Firms with high R&D intensity (vis-à-vis low R&D intensive firms) are only significantly more positive about their attraction to the URI’s specific facilities. Highly R&D intensive firms are more likely to use knowledge from universities and research centres in their innovation activities than low R&D intensive firms (Laursen and Salter, 2004) and the indicated future facilities of the URI may provide highly R&D intensive firms with this possibility. In contrast, the negative coefficients indicate high R&D intensity firms are less convinced by other types of potential benefits (although these are only significant in the context of the perceived enhanced regional benefits derived from both types of anchor tenants working together). We interpret this result as a signal that in fact, low R&D intensive firms perceive they have more to gain from regional synergies arising from a relationship between the URI and an OEM, than high intensity R&D firms do. It is possible, low R&D intensive firms are less endowed with technological skills, and so have most to gain from any growth in the quality of the regional labour pool, professional/ancillary services and new investors.

Firms already highly engaged in business networks hold (significantly) more positive perceptions of both the URI’s specific facilities and the potential knowledge benefits it can convey, which may provide them with an opportunity to better align their value creation and capture activities. These firms are also significantly positive about a potential link-up with an OEM (Table 2, Panel A, Row 3), which may allow them to extend their own business networks and commercial opportunities, especially in global markets. As expected, financially constrained firms (Table 2, Panel A, Row 8) have less
favourable perceptions of the potential benefits of the URI, although this is only (negatively) significant with regard to the co-location of the URI and an OEM in the cluster where the associated benefits are greater (see Section 5.3 below). Financially constrained firms may lack the capacity and resources to participate in such projects and benefit from regional synergies arising from the co-location of the URI and an OEM in the region, and if they are to do so, they will require additional support (Meuleman and Maeseneire, 2012; Mateut, 2018).

Regionally-based automotive firms are more likely to benefit from knowledge exchange with the URI. This may be due to a better alignment of the URI’s facilities and activities to their own research orientation and expertise. However, aerospace firms based in the region perceive fewer facility benefits than firms from the same industry based in the rest of the UK. This may be due to existing facilities in the locale that place local aerospace firms at an advantageous position when compared to their counterparts in the rest of the UK. Finally, there are no significant differences in the attractiveness of the URI, with regards to firms’ (involvement in) knowledge networks, their size or age.

5.2 Pairwise Comparisons (Eq.2)

The estimation results for Eq.(2a) and Eq.(2b) are presented in Panel B of Table (2). The interpretation of the coefficients on $Innov_i$, $RDintensity_i$, $BusinessNet_i$, $KnowledgeNet_i$ and their respective interaction terms is somewhat more complex, and not directly meaningful. Hence, we compute predictive margins and the corresponding “marginal effects” for these variables (the latter reported in Panel B, Table 2) and employ multiple pairwise comparisons across the combinations of types of firms (as defined by these four variables) which yields more tangible results (Long and Freese, 2006)\textsuperscript{12}. To militate against Type I errors, we also use the Bonferroni correction and retrieve the Bonferroni-adjusted p-values (Bland and Altman, 1995). These multiple pairwise comparisons are our main interest in Eq.(2a) and Eq.(2b), and a (qualitative) summary of the key results are presented in Table (3; Panels A-F).

Overall, Table (3) illustrates the potential URI holds most appeal for research intensive innovative firms already highly engaged in their own business and knowledge networks. The key details are:

- Highly innovative firms operating with high levels of R&D intensity (indicated by 1,1) are significantly more positive about the benefits of the proposed facility and the potential link up with an OEM (compared to firms which are not innovative and operate with low R&D intensity - indicated by 0,0). Although

\textsuperscript{12} The Stata command \textit{margins} and \textit{contrast} were used.
less R&D intensive firms perceive more regional benefits than highly R&D intensive firms (see Table 2), firms which are at the same time highly R&D intensive and highly innovative may be in a better position to exploit the wider synergies and commercial opportunities from the OEM’s involvement in the region (Panel A).

- Highly innovative firms that are strongly engaged in business networks (1,1) have a more positive perception of the knowledge benefits from the URI, and of benefits arising from its co-location with an OEM in the same science park (vis-à-vis low innovative firms with weak engagement in business networks - 0,0) (Panel B).

- Innovative firms which are also well engaged with knowledge networks (1,1) are significantly more positive about the URI’s facilities, are more inclined to become involved with the URI and exploit the regional synergies offered by the collocation of the URI and an OEM (relative to firms which have low innovation and knowledge network engagement - 0,0) (Panel C).

- Finally, those firms highly involved in both existing business and knowledge networks (1,1) expect to appropriate more facility and knowledge benefits from the URI (vis-à-vis firms not highly involved in either type of networks (0,0) (Panel F). Although knowledge networks on their own may provide limited access to benefits from the URI (see Table 2, Panel A), firms that are also embedded in business networks may exploit dynamics from both types of networks and better capture value from the public investment within the cluster.

5.3 The Amplifying Benefits of an OEM Link Up to the URI

Our analysis also sought to ascertain whether there were any amplifying effects on the perceived attractiveness of the proposed URI when an OEM becomes a local partner. To do this, we derived the difference between the following two constructs:

**URI (only) benefits:** this captures how attractive the URI is to the firm overall (in terms of both its proposed facilities and potential knowledge base, combined). (Cronbach’s alpha is 0.90); and

**URI-OEM co-location benefits:** this captures how attractive the URI becomes when a global OEM co-locates to work with the URI (i.e.in terms of region-wide and firm-based benefits, combined) (Cronbach’s alpha is 0.94).

The difference between these two constructs is positive (1.06 points) and statistically significant at the 1% level, suggesting that the attractiveness of the URI is clearly amplified when an OEM is co-located in the region. This is indicative of a potential ‘halo effect’ that the OEM may have not only on the URI specifically but also on the region itself more broadly. This may act as a critical “enabler” of an emerging technological cluster in the region.

6. Wider Discussion and Policy Considerations

As a public anchor tenant, the URI potentially offers a range of physical facilities and knowledge enhancing benefits. In general, these perceived benefits appear to be more
highly valued by private firms that are already R&D intensive, highly innovative and well-embedded in existing business networks (Clarysse et al., 2014). From the URI's perspective, such firms should be identified as targets with whom early productive relationships may be established given this group of firms is most likely to have the absorptive capacity to benefit from knowledge transfer and technological advances the URI seeks to generate. Fostering such relationships will be critical in stimulating the nascent cluster’s dynamism. In this regard, an important adjunct for the URI developers is to establish an on-site knowledge transfer team, specifically tasked with nurturing and building a technology focused (SME) network and facilitating their engagement in URI related projects. In due course, such support may be extended to firms identified as having potential to work with the URI, but whose current financial constraints mean they are less likely/precluded from participating in the project in its earliest phase.

It is also evident that the attractiveness of the public anchor tenant is amplified if a private anchor tenant, such as a global OEM, becomes involved. The involvement of a private anchor tenant (Iansiti and Levien 2004) within the cluster provides a ‘halo effect’ to the public anchor tenant by signalling that there are potential commercial benefits to come from this research facility in future. This in turn may attract more firms to the region contributing to the dynamic growth of the cluster. The (local) firms may look to the OEM as a beacon of the direction of travel for the future commercialisation of technologies generated by the URI. Moreover, where the technological specialization of the cluster is in a novel area/related to emerging technology - such as low carbon propulsion - the value network of the private anchor tenant may be fairly open, or in flux, and this may provide a window of opportunity for prudent firms with the right capabilities to join the OEM’s value chain.

There are, of course, caveats regarding the close involvement of an OEM. For instance, their larger resources can crowd out locally based SMEs by attracting the best talent from the local labour pool. Moreover, a private anchor tenant may orient the cluster’s research focus to its own benefit and hence dominate the cluster’s technological trajectory, which – in adverse scenarios – can lead to technological ‘lock-in’, potentially inhibiting long-run growth (Bailey, 2003; Hill et al. 2008). To counteract this, the URI will need to help fully embed the R&D activity of the OEM into the wider cluster innovation system, and in doing so, support knowledge circulation within the cluster and between the private anchor and other clustered members (Guimon and Salazar-Elena, 2015, Guimon et al. 2017).

7. Conclusions

This paper has explored the potential for a new university research facility to act as a public anchor tenant and its attractiveness in the conception of a new cluster. Its attractiveness appears as concentric circles emerging from the facility. The facility itself can be perceived as an attractive public anchor in an emerging cluster, this is enhanced if it can offer user-firms not only the benefit of access to its facilities, laboratories and equipment, but also knowledge enhancing benefits that go beyond scientific and technical advice and include nurturing localised knowledge networks as a second, outer ring. Moreover, the perceived ‘value’ of the university public anchor is likely to be
enhanced further still if it can link up with a global OEM – potentially gaining commercial validation for its research. With the addition of an OEM, the attractiveness of the public anchor tenant spills over into potential regional growth effects. For many firms, the corporate partner creates a halo effect for the public anchor tenant (and the region) whilst the OEM itself, acts as a magnet for other firms to potentially access leading-edge knowledge in more applied settings than scholarly research programmes, and a means to access international/global business networks. Private anchor tenants can play a critical role as bridges between specialised knowledge networks and commercial business networks; this enhances value creation and capture within the cluster.

These perceived benefits of the public anchor tenant are generally greatest for firms that are R&D intensive, highly innovative and are already engaged in networks. Identifying such firm level characteristics and the types of relationships with the public anchor tenant that are likely to be most desired by such firms gives university executives and technology transfer advocates, tasked with delivering greater local impact and regional growth, important insights as to the key targets for their outreach and engagement activity in the conception stage of a cluster lifecycle. We suggest this can contribute to making the research facility more attractive and raising the possibility of forming a local cluster. More generally, our study highlights the attraction of securing a collaborative link up between public and private anchor tenants in the conception and emerging stages of clusters.

Finally, we should note some limitations of the study and possible avenues for future research. First, our study is limited to a single UK case and it is difficult to draw wider conclusions. Future work should seek other comparative cases, to provide a more generic identification of the attractive characteristics of anchor tenants in new cluster formation. Secondly, our analysis is at a specific point in time and based on managerial perceptions of the likely benefits of a conceptualised facility and cluster. Clearly, once the focal URI facility has been formally and physically established, it would be useful to conduct a follow-up study, to explore whether its perceived attractiveness and potential to stimulate cluster formation are being/have been realised. This type of evaluation would be particularly helpful for policy-makers and will assist in our understanding of the dynamic role of anchor tenants in the genesis of clusters. We intend to return to this case and conduct such an evaluation in future work.
References


Long, S., Freese, J., 2006. Regression Models for Categorical Dependent Variables Using Stata. 2nd Ed. College Station, TX: Stata Press.


Tomlinson, P.R., Fai, F.M., 2016. The impact of deep vertical supply chain relationships upon focal-firm innovation performance. R&D Management 46(S1), 277-290, DOI: 10.1111/radm.12181


Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Whole sample 116 observations</th>
<th>Automotive 57 observations</th>
<th>Aerospace 59 observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (standard deviation)</td>
<td>Min - Max</td>
<td>Mean (standard deviation)</td>
</tr>
<tr>
<td>Public anchor constructs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility attractiveness</td>
<td>2.134 (1.166)</td>
<td>.881 1-7</td>
<td>2.334 (1.327)</td>
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<tr>
<td>Knowledge attractiveness</td>
<td>3.635 (1.458)</td>
<td>.868 1-7</td>
<td>3.781 (1.517)</td>
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<td>Public and Private anchor constructs</td>
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<td>Regional attractiveness</td>
<td>3.499 (1.407)</td>
<td>.886 1-7</td>
<td>3.555 (1.365)</td>
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<td>Firms' involvement attractiveness</td>
<td>4.146 (1.681)</td>
<td>.944 1-7</td>
<td>4.313 (1.431)</td>
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<td>Private anchor amplifying effects</td>
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<td>OEM amplifying attractiveness</td>
<td>1.056 (1.368)</td>
<td>n.a. -2.72 -4.45</td>
<td>1.011 (1.332)</td>
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<td>Focal URI's attractiveness</td>
<td>2.775 (1.133)</td>
<td>.896 1-7</td>
<td>2.956 (1.264)</td>
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<td>Combined URI-OEM attractiveness</td>
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<td>.940 1-7</td>
<td>3.968 (1.225)</td>
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<td>Firm characteristics</td>
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<td>Innovativeness</td>
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<td>.2982 (.4616)</td>
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<td>R&amp;D intensity</td>
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<td>.4386 (.5006)</td>
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<td>Business networks</td>
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<td>.834 0-1</td>
<td>.3509 (.4815)</td>
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<tr>
<td>Knowledge networks</td>
<td>.2500 (.4349)</td>
<td>.771 0-1</td>
<td>.3333 (.4756)</td>
</tr>
<tr>
<td>Financial constraints</td>
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<td>.3529 (.4826)</td>
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Notes. 1 Due to missing observations, the “financial constraints” dummy variable applies to 51 observations for the automotive and 53 observations for the aerospace industry (i.e. 104 observations for the whole sample).
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Panel A</th>
<th>Panel B</th>
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<td>(1) (2) (3) (4) (5) (6) (7) (8)</td>
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<td>R&amp;D intensity</td>
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Table 2. OLS estimation results (Robust standard errors in parentheses: *** p<0.01; ** p<0.05; * p<0.10).
### Table 3. Multiple pairwise comparisons: Qualitative summary table

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<tr>
<th>Facility attractiveness</th>
<th>Knowledge attractiveness</th>
<th>Regional attractiveness</th>
<th>Firms’ involvement attractiveness</th>
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<td>Eq.(2a)</td>
<td>Eq.(2b)</td>
<td>Eq.(2a)</td>
<td>Eq.(2b)</td>
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<td>A. Highly R&amp;D intensive # Highly innovative</td>
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<tr>
<td>(0 1) vs (0 0)</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(1 0) vs (0 0)</td>
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<td>+</td>
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<td>(1 1) vs (0 0)</td>
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<td>(1 1) vs (0 1)</td>
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<td>(1 1) vs (1 0)</td>
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<td>0</td>
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<tr>
<td>(1 1) vs (1 1)</td>
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<tr>
<td>B. High business networks #</td>
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F. High knowledge networks
High business networks

Key: +’ve / -’ve indicate positive/negative and statistically significant at the 10% level; 0 indicates not statistically different from zero.
Figure 1. Clusters, networks and anchor tenants

Panel A. Cluster without anchor tenants
Panel B. A public anchor tenant (e.g. university) located in the cluster
Panel C. Public and private anchor tenants co-located in the cluster

Note: We assume that some inter-firm linkages exist both between firms within the specific cluster(s) and between firms within and beyond the specific cluster, but for the purposes of clarity in the figures, we have illustrated only those linkages which pertain to the roles of the central actors in our analysis – private and public anchor tenants.