Managing University-Industry Research Centres: Five Principles of Good Practice

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About this document

This document reports the results of a multi-case study of university-industry research centres at a research-intensive UK university. It identifies a series of management principles that enable successful collaboration between universities and firms. The analysis is based on information gathered during interviews with 25 individuals involved in four centres, including representatives from industry, administrative functions, academic faculty and PhD students.

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Table of Contents

Executive Summary ........................................................................................................... 3
Background ........................................................................................................................... 4
Research Method ................................................................................................................. 5
Managing University-Industry Centres .............................................................................. 5
  Iterative Objective Setting ............................................................................................... 6
  Identify High-Potential Areas of Work ........................................................................... 7
  Programme Managers as Boundary Spanners ................................................................. 8
Performance Management Through Pacing ..................................................................... 9
Attract and Retain Junior Staff Through ‘Zoning’ ............................................................. 10
Conclusions ......................................................................................................................... 10
Executive Summary

This report presents findings from an analysis of four university-industry centres at a research-intensive UK university. University-industry centres are large, multi-annual research alliances between universities and firms. The management of university-centres faces specific challenges due to well-documented cultural differences between universities and industry. The objective of the research was to identify how university-industry centres should be managed in order to overcome these challenges and achieve success.

Five management principles were identified that represent good practice in managing university industry centres. These management principles are:

(1) Iterative objective setting: Set centre objectives using an iterative process that takes the partners’ pre-existing expertise and interests into account.
(2) Identify high-potential work areas: Establish work programmes on topics that are relatively insensitive to intellectual property concerns
(3) Programme managers as boundary spanners: Employ programme managers with industry experience who can act as translators between industry and academia.
(4) Performance management through pacing: Ensure achievement of objectives via a pre-defined schedule of reports and deliverables.
(5) Attract and retain scientific talent: Provide an adequate working environment for junior researchers enabling them to pursue high-quality, publishable research.

Drawing on the results, the report proposes the following recommendations for good centre management practice.

• Spend time on learning about each others’ priorities and existing fields of expertise, and generate work programmes built into academic teams’ research agendas. Consider initially bringing more academic research teams to the table than can be ultimately incorporated into the partnership, to allow for matching between priorities and participants.

• In terms of the research programme, choosing areas of precompetitive research, the creation of analytical tools and instrumentation, or the generation of public goods, will allow partners to minimise transaction costs, accelerate the establishment of centres and facilitate its operation, without curtailing the exploitation of inventions that may arise from the alliance.

• A programme manager with experience in both the industrial and academic world should be employed to ensure the operational management of the centre.

• Time should be invested in familiarizing academic staff with project and performance management principles used in industry.

• To facilitate the staffing of centres with talented and motivated junior researchers, an environment should be created that enables them to publish in peer-reviewed journals, and practice their scientific curiosity.
Background

University-industry centres operate outside the traditional departmental system. They draw on a mix of public and private funding to pursue both academic and practice-oriented activities. Most centres tend to focus on research, and associated consulting and commercialization, rather than teaching programmes (with the exception of special programmes linked to their mission). They often cut across disciplines, link research with practical application and employ staff specializing in research or consulting. Compared to the rather decentralized structure of traditional academic departments, centres tend to be managed more stringently, in line with the interests and requirements of stakeholders.

Centres differ from small-scale, individual university-industry collaboration in two key respects. On the one hand, they are larger in scale and are established as multi-project collaborations in a multi-annual timeframe. On the other, they usually involve a more formalized organizational set-up, reflecting their size and duration, than smaller-scale ad-hoc collaborations.

Participation in centres offers firms direct access to state-of-the-art research carried out by scientists in an academic setting, providing numerous potential benefits. First, research within centres is less constrained by short-terms operational, budgetary and commercial considerations than in-house R&D and offers access to blue-sky research. Secondly, universities offer a wealth of talent, from relatively inexpensive PhD students to world-leading academic scientists - for the firm this reduces the expensive recruitment process, allowing them to benefit from the skills of scientists who have chosen an academic career and would not have been available to them as employees. Thirdly, through their access to academic scientists, firms may be able to influence the direction of academic research in specific fields. Finally, by participating in centres, firms may be able to mobilize public funds and thus leverage their R&D expenditures. In view of these benefits, some firms have made university-industry centres a formal cornerstone of their R&D operations.

For universities, centres also provide a range of potential benefits. Centres usually generate a substantial influx of resources, financial and in kind, from either the participating industry partners or public or charitable research organizations. Additionally, participation in centres may furnish academic researchers with real-world problems that inform their research and result in novel knowledge and inventions. They also may obtain access to data, equipment, personnel and production settings that would otherwise have been closed to them. In addition, the close relationship with firms offers universities various indirect benefits, such as employment opportunities for graduates or the provision of technical or executive education to company employees.

Yet, the evident advantages of centres to both universities and firms also create challenges. Centres facilitate interactions between organizations with very different cultures, objectives and standing procedures. They also bring together staff working within different professional systems, responding to different incentive structures and oriented upon different value systems. At its starkest, this is exemplified by the contrast between the academic imperative to publish discoveries in open science journals and the industrial approach to guard intellectual property for competitive advantage. Furthermore, academics conventionally value their autonomy to pursue their choice of research topics, while in industry senior management will exert stronger influence on the allocation of research resources.

Despite being aware of these structural and cultural challenges, many firms see university-industry centres as part of their R&D activity portfolio. Rolls-Royce, for instance, has established about 30 centres at different universities around the world,
each specializing in a specific technological field. Experienced industry managers know that the value of working with academics lies in the difference between the university environment and the corporate environment. Managing university-industry centres therefore does not consist of transforming the academic context into an outsourced corporate R&D department but in creating value whilst maintaining difference. Firms sponsoring centres must therefore strike a fine balance between exerting control and influence while maintaining the specificity of the academic context. Similarly, for universities, the challenge is to satisfy the requirements of the sponsor firm while maintaining their identity as academic institutions and preserving the academic career progression of centre scientists.

The above suggests that the management of university-industry centres requires a careful approach to management, allowing participants to extract the potential benefits whilst successfully managing the inherent tensions in these collaborations. The research underpinning this report was designed to provide insights into this specific challenge. The research question was accordingly: How should university-industry centres be managed to achieve success?

**Research Method**

We conducted in-depth case studies of four centres located at a research-intensive UK university. We chose centres that were exclusively industry-funded, rather than centres that were directly subsidized by public or charitable funding. Within purely industry-funded centres, the potential structural and cultural tensions between academia and industry were accentuated because industry partners have ‘more skin in the game’, and hence are more likely to insist on industry-relevant outcomes. All the centres involved multi-annual work programmes, ranging from four to ten years and included various projects led by multiple principal investors. The funding contributed by the industrial partners ranged from £2m to more than £10m.

The centres studied operated in different industrial sectors and different academic fields. The centres had also differing approaches to how intellectual property and control over outputs was managed, and exhibited varying degrees of multi-disciplinarity. The BIO centre involved work on exploiting information technology tools for biotechnology applications. MINE investigated various ways of extracting raw materials under specific geological conditions. DRUGS performed research into drug discovery and validation in collaboration with a pharmaceutical firm and SOLID helped the sponsoring firm to develop insights into the physics underpinning a complex engineering product.

Our main source of information was interviews with centre participants. We conducted a total of thirty-two interviews with individuals drawn from both the sponsor firms and participating universities, and from a variety of job grades, from senior to junior. We followed a semi-structured interview protocol and all interviews were recorded and transcribed. We use pseudonyms when referring to the centres in order to protect the identity of the centres and our respondents.

**Managing University-Industry Centres**

In our analysis, we explored the management techniques that participants used to ensure benefits were generated for both academic and industry partners while simultaneously overcoming the tensions stemming from the fundamental differences between academia and industry. We isolated five different techniques that were used in the centres we studied, described in detail below.
**Iterative Objective Setting**

University departments and research groups are organized around their primary missions to teach students and conduct academic research, and are not primarily organized to conduct commissioned research for industry clients and other users. Individually, university scientists usually undertake multi-annual or even decade-long research programmes and may therefore not be equipped to respond to client requirements that are not in line or at least related to these research programmes.

These university structural characteristics have consequences for how work programmes are decided with university-industry centres. For the most part, the existing specialisms of the individual academics play a major role in deciding what should be done in the centre. We found that rather than starting from the industrial partners’ ex-ante requirements, partners usually worked iteratively towards establishing compatibility between the academic partners’ existing research programmes, and industrial partners’ problems and requirements. This process allows participants to match existing expertise and research interests to objectives, and so overcome the potential tension inherent in university-industry collaboration, caused by academics’ preference for research autonomy and ‘curiosity-driven’ research. We refer to this technique as ‘iterative objective setting’.

In the centres we studied, objective setting was usually conducted in three stages. The process began before the establishment of the centre, usually on the basis of a high-level objective sought by a firm. For instance, the corporate sponsor of BIO wished to build competence in a specific area of technical expertise - systems biology. During this exploratory stage, negotiations were pursued at a high level, typically between university leaders and heads of R&D. In one case, this top-level interaction even involved high-ranking government representatives.

Once a broad strategic fit was found and a decision to mobilize funding was taken in principle, an instigation phase followed involving a larger number of senior academics, R&D managers and industrial scientists. This phase was often initiated at a workshop meeting where both sides provided information on their activities, interests and capabilities, followed by roundtable discussions of potential objectives. The instigation phase continued through a series of negotiations that result in a statement of work or similar document setting out the broad agenda of the centre.

In some centres, this instigation phase was organized as a ‘dating game’ through which academic researchers and their teams were matched with company objectives and requirements. For instance, over a period of 5 years, DRUGS supported almost 50 projects, which were selected from proposals submitted by researchers. Project proposals were often constructed in round-table discussions with representatives of the sponsor company. During these sessions, academic faculty would give presentations on their capabilities, interests and objectives, and company R&D scientists would in turn comment on these proposals and suggest how they could be amended to match requirements and ongoing research programmes within the company.

In order to increase the likelihood of successful matches, the process initially involved a much larger number of academic participants than eventually required for the work programme. An important aspect to consider here is to manage expectations to avoid unhelpful competition on the part of the academic participants for the corporate resources available. To this purpose, a clear communication policy outlining the criteria and processes in place for the selection of project participants and project objectives was indicated as helpful.

Once the centres were established, an operational phase followed. The
specifics of the research agenda were now finalised through formal and informal dialogue between senior academics, post-doctoral researchers, PhD students and representatives from the partner firm. Although these discussions took place within the constraints of the agreed statement of work, there was usually significant room to manoeuvre in order to accommodate the interests of all parties. In BIO, the sponsors adopted a ‘co-creation’ approach to objective setting during which academic and industrial participants were presented with a blank slate and invited to construct a research agenda from their combined interests and objectives.

Overall, iterative objective setting is initiated with a high-level decision to co-operate at a point when relatively little detail is available and occasionally when not even the participants have been determined. Over time, through a process of matching interests and people to objectives, centre objectives are defined and agreed to form work programmes. This process helps to reconcile diverse interests and ideally create a win-win situation allowing the sponsor firm to pursue commercially relevant projects and academics to maintain their academic work programmes. The iteration processes described was sometimes repeated several times before work programmes were agreed. Apart from objective setting, the iterative nature of the process also provided the opportunity for participants to ‘test drive’ their working relationships.

Identify High-Potential Areas of Work

Academics and firms treat new, valuable knowledge differently. In academia, open publishing is fundamental. The number and quality of publications influence career progression, and new knowledge is seen as valuable to the extent that it can provide the basis of a new paper. In industry, by contrast, the value of knowledge is judged by its ability to inform new products and services so firms protect valuable new knowledge via intellectual property. For work within university-industry centres, these cultural and strategic differences may generate tensions particularly when utilizing the results from joint research.

Common to all centres was the recognition by the industry partners that open publishing was an important need of the academic partners. Although a minority of industry personnel viewed the academic writing process as a ‘necessary evil’, generally the published output of the centres was seen as a desirable outcome and represented a significant channel for knowledge transfer within the sponsor companies. Usually, firms insisted on some degree of editorial control. Typically this took the form of ad hoc submission of draft manuscripts to company representatives who would screen them for confidential information, such as forthcoming products or internal processes.

However, the centres had different approaches for avoiding potential issues with publishing and disclosure. Some emphasized objectives that sidelined intellectual property considerations in favour of the precompetitive nature of a new technology and its more general utility. For instance, in MINE, most research projects related to early-stage research into carbon-friendly technologies that were not viewed by the sponsor as particularly commercially sensitive. In SOLID, the sponsor pursued a strategy partly aimed at helping to create a public good by generating a critical mass of skills. In these centres, open publishing was not particularly contested, providing that publications did not contain the privileged information which sponsors did not wish to divulge. In other centres, the emphasis was on the production of novel tools and methods, rather than the generation of product-specific technologies. For instance, in BIO, the sponsors sought access to computer simulation methods for use on in-house product development efforts.

The above results illustrate the importance of choosing high-potential
research areas where issues with intellectual property are less likely to arise. This enables arrangements whereby academics are able to publish, for the minimal cost of light ‘censoring’ of their material. Meanwhile, firms benefit directly from published outputs as well as private competitive advantage from their access to unpublished datasets underlying published material, and access to authors for clarification, development of ideas and aids to knowledge absorption.

It should be noted that the above arrangement does not curtail potential commercialization of research results arising from a centre’s activity. In fact, all centres had intellectual property stipulations in place that specified the rights and duties of the partners with respect to discoveries and inventions deemed worthy of exploitation.

**Programme Managers as Boundary Spanners**

Most centres we studied had established three different levels of management. At the top, a bilateral body set strategic objectives and exerted oversight. These strategic steering committees were formed of 4 to 8 individuals drawn from both the university and sponsor firms. Most of these individuals were usually also involved in one or several of the centre projects and therefore had relatively detailed insights into its activities.

Below this, academic and technical direction was provided by a centre director, usually an experienced professor and principal investigator with a track record in fund raising and industry collaboration. Some centres had an operational or technical bilateral committee, with representatives from both university and industry sponsors. In MINE, a bilateral technical committee was instituted to support the director with research related decisions, devise project plans, recruit staff and facilitate project shaping by the sponsor firms as they unfolded.

The day-to-day operational management was undertaken in many centres by a programme manager who played an important role in managing the information flows between the partners at all levels ranging from senior management to postdoctoral researchers.

Programme managers were usually employed by the university but had, in most cases, an industrial background and were consequently able to act as ‘boundary spanners’. For instance, in MINE, the programme manager had a science PhD, had previously worked within the energy industry and had lived for many years in the country where one of the partners was headquartered. This blend of education, skills and experience made him particularly able to manage the relationship between the academic and industrial partners in MINE. The DRUGS centre chose to appoint separate Research Alliance Managers employed by the university and the sponsor firm, respectively. BIO was alone in not allocating a full-time role to manage the relationship; however, the boundary spanning function was de facto filled by an employee of the university business liaison unit. This individual had an academic background in life sciences, and several years’ business experience which equipped her to step into the role of boundary spanner. Having business experience also contributed to programme managers’ ability to ensure adherence to administrative requirements defined by the sponsors, such as invoicing and reporting.

There was usually a well-defined division of labour between the programme managers and the centre director. While the latter were responsible for managing research-related, technical and financial aspects, as well as staffing, the programme manager operated without exercising direct authority over centre staff. Specifically, they were engaged in the following activities. First, they were responsible for organizing meetings and events and pacing participants’ work to suit the reporting requirements. Second, they communicated with the industrial partners at various
levels and ‘translated’ their concerns and requirements for the benefit of the academic partners. Third, they were also the main point of contact for centre staff, especially in cases of incipient conflict, and were thus positioned to acquire a bottom-up view of centre activity.

Several lessons can be drawn on centre management. First, whilst managing a centre puts a considerable administrative burden on the director, this burden can be alleviated by employing a programme manager responsible for operations. These programme managers should be ‘boundary spanners’ familiar with both academic and industry contexts. Second, interaction between the university and industrial partners should occur at all levels of management, not merely at the top level of bilateral strategic committees. In our study, collaboration worked best when industry R&D personnel interacted directly and informally with the university researchers.

**Performance Management Through Pacing**

Given the considerable resources invested in such centres, industrial sponsors have a legitimate interest in ensuring that outlined objectives are met. So – despite a general acknowledgement of the special nature of universities as research partners – firms were intent on exerting some degree of control even though the centres were formally situated with the participating universities. Here firms are faced with the challenge of managing the activities of a distinct professional group, at arm’s length and without direct authority.

The industrial sponsors addressed this challenge by emphasising *pacing* as part of their performance management. Sponsors typically required six-monthly management reports detailing the work of the Centre and setting out progress against plans. A more comprehensive annual report was also required. In all cases, these reports were written by senior academic staff and were compiled by the Programme Manager. Formal reports were supplemented with regular meetings involving all academic staff including PhD students, and representatives from the sponsoring companies. During these meetings, researchers were expected to give presentations on their work to company representatives.

The management and reporting structures used in the centres reflected the acknowledgement that micro-management of outputs was hard to achieve, given that the bulk of the work was carried out by relatively junior university staff, supervised by senior academics. Nevertheless, via the installed reporting requirements, the pacing of activities ensured that work was met the objectives outlined in prior meetings, and could be adjusted and redefined while projects were in progress.

This approach to performance management allows firms to assess progress and manage risk while allowing the academic the latitude they require to accomplish their work. As an industry participant said: “The academics sometimes do it their own way, and that might be the right way or the wrong way. That’s a freedom of research we will tolerate, of course, because otherwise you may as well go to a consultant, and that’s not the idea.” Simultaneously, the sponsor was able to ensure that the centre generated regular outputs and could influence the relevance of these outputs to the firm.

The more junior academics in particular were usually unfamiliar with this kind of pacing exerted by the industry partners, and at times resisted the practice. However, in many cases, staff came to value the reporting regime as a source of structure and focus, and an opportunity to reflect critically on recent work. For the centre directors, this industrial oversight provided a fall-back ‘stick’ they were able to use for managing the work schedule of their staff.
Attract and Retain Junior Staff Through ‘Zoning’

University-industry centres face a potential challenge in that they employ academic staff to pursue work relevant for industrial application. While more experienced, senior academics in many scientific and technical fields have worked with users, more junior staff are less or not all acquainted with the industrial requirements and modes of working. Furthermore, junior staff are at the beginning of their academic career, and have a stronger interest in furthering their academically relevant output. Yet, as with the conventional departmental context, it is these doctoral students and postdoctoral researchers who will be entrusted with the day-to-day scientific work within university-industry centres. This situation poses a potential staffing problem for centres as junior researchers will face a possible conflict of interest between working towards their academic outputs and working towards the objectives pursued by the industrial partners.

To address this problem, the centres we studied had adopted a practice that we call ‘zoning’. The academic principal investigators who led specific projects tried to ensure that their junior members of staff were able to work towards their academic agendas despite potential pressures from industrial partners towards more applied and practical outputs. As a result of creating such academic ‘zones’, researchers’ work hardly differed from their equivalents in a typical academic department.

The zoning work was shared between the principle investigators and the boundary spanners. The former would translate the requirements of the sponsor into suitable material for junior academic researchers and PhD students to build their research careers. The boundary spanners would manage regular communications and intervene where potential conflicts arose. This was as much motivated by a desire to protect the relationship with the industry partner from unguarded input from junior staff, as it was to provide them with a suitable working environment.

Zoning contributes to the efficient operation of the centre by creating an ‘academic zone’ in which the scientific core work can be conducted by the junior researcher. This practice allows the centre to attract and retain young talented researchers, representing a key factor for successful university-industry projects. Indeed, in one of our cases, the effectiveness of zoning decreased over time thus exposing the junior researchers to direct pressure to produce commercially relevant output. This situation contributed to staff disillusionment and increased turnover as the ability of junior staff to produce publishable, state-of-the-art research was curtailed.

Conclusions

In this study, we identified five management principles that underpin the successful establishment and operation of university-industry research centres. The first two principles apply to the initial phases of a collaboration. They suggest that objectives should be set up iteratively, and work areas need to be carefully chosen in order to derive maximum value from exploiting the complementarities between academia and industry. Industry collaborators can get most value from work in the research areas which are at the core of academic collaborators’ research agendas, and hence the collaborative projects should be closely aligned with these areas. This will ensure the academic researchers are highly motivated, and are able to exploit findings and insights for their academic agendas.

Principles three to five apply to the management and ongoing operation of centres. They suggest that centres should employ personnel that is able to span the cultural divide between universities and industry. Furthermore, industry collaborators are able to influence progress by pacing a centre’s work. Finally, the attraction and
retention of scientific talent can be achieved by creating a work environment for young researchers that allows them to work towards high-end scientific goals. This requirement implies a responsibility on the part of the senior academics to structure a centre’s work in a way that both industrial and academic objectives are sought.

The findings are synthesised in the executive summary which also contains some detailed recommendations for those involved in establishing and managing university-industry research centres.
## Overview of university-industry centres studied

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<th>DRUGS</th>
<th>MINE</th>
<th>BIO</th>
<th>SOLID</th>
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</thead>
<tbody>
<tr>
<td><strong>Timeframe</strong></td>
<td>5 years</td>
<td>10 years</td>
<td>4 years</td>
<td>5 years</td>
</tr>
<tr>
<td><strong>Academic</strong></td>
<td>Life Science and medicine</td>
<td>Geology and chemistry</td>
<td>Computing and life sciences</td>
<td>Physics</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Pharmacetical company</td>
<td>Two resources companies (linked by supplier relationships)</td>
<td>Biotech firm</td>
<td>Defence company</td>
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<tr>
<td><strong>Industry</strong></td>
<td></td>
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<tr>
<td><strong>participants</strong></td>
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<tr>
<td><strong>Objectives</strong></td>
<td>Contribute to basic R&amp;D in drug discovery</td>
<td>Contribute to basic R&amp;D. In addition, train R&amp;D scientists and contribute to capacity building</td>
<td>Acquire competence in new area of expertise</td>
<td>Generate and train professional staff within specific field of technology by investing in fundamental research</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>Steering committee. Two Research Alliance Managers, appointed by university and company, respectively.</td>
<td>Centre Director (academic). Management committee chaired by company representative. Technical Committee chaired by company representative. Programme Manager (University Staff) for day-to-day operations</td>
<td>Centre Director (academic). Bilateral committee. Programme management via university’s Industry Liaison office.</td>
<td>Centre Director (academic). Governed by an Operations Management Board chaired by the Centre Director and includes representatives from the company. Programme Director for day-to-day operations.</td>
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