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An Investigation of the Development and Management of University Research Institutes

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Abstract

Multidisciplinary research institutes provide universities with an important vehicle to conduct research across traditional disciplines, and this can be an attractive capability for external funding bodies. However, there can be particular challenges, including managing different reporting lines, the need for effective research coordination, and the development of collaborations across institutes. These issues are especially relevant in the early development stages of institutes. Consequently, this paper will describe a case study investigation of the Institute of Shock Physics, a university research institute at Imperial College London in the United Kingdom. The case study will provide a discussion of the key strands of management activity that have been pursued in the first two years of operations for the Institute, together with details on how any difficulties were overcome. Management areas discussed in the case study include collaboration development, financial program management, research project management, program reporting and governance, and risk and safety management. This analysis will be carried out in the context of supporting research from the literature and through building on the findings from the case study a set of recommendations have been formulated on developing and implementing management systems for new research institutes.

Keywords: Multidisciplinary university research institute; university-industry research collaboration

Introduction

Historically, much academic work has been organized according to traditional subject areas, such as geography, business management, materials science, aeronautical engineering, mechanical engineering, and so on. Whilst a university's ability to provide a firm education and scholarship in these fundamental academic areas remains essential, not least in the sciences to ensure there is adequate coverage of the core underpinning scientific subjects (namely mathematics, chemistry, physics, and biology), there is nevertheless an increasing focus on multidisciplinary academic work. Multidisciplinary approaches offer the potential to bring together different perspectives to address otherwise intractable problems (Haythornthwaite, 2006), and this is especially pertinent to academic areas that have developed in recent years and in parallel with modern technological advancements. Such multidisciplinary areas could include, for example, nanoscience and nanotechnology, forensics and criminal science, biomedical engineering, environmental science and climate change studies, systems engineering, and cybernetics. Correspondingly and over the last couple of decades there has been a proliferation of multidisciplinary institutes and research centres created at universities and other organizations such as hospitals to focus on these emerging areas of research. In this context, complex scientific, technological and engineering research problems increasingly require cooperative and collaborative efforts, as distinct from approaches in the past that involved highly individualised studies by scientists. Moreover, multidisciplinary research that crosses traditional academic boundaries and that can be governed by an implicit need for collaborative working has been described by Karlsson et al. (2008) as an important enabler of the learning process. This work emphasized the importance of open and honest communication within the collaborative environment, and that in collaborative learning the relationship between collaborators can be just as important as the actual knowledge generated.

In accordance with the emergence of multidisciplinary thinking at universities, there has been a greater availability of research funding for multidisciplinary research. This has provided universities with an external and financial stimulus to increase the level of collaboration among their departments (Harris, 2010) and specifically to develop and establish multidisciplinary institutes and research centres to deliver research and training capabilities to meet such a need. This interest spans the social sciences, such as geography (Bishop, 2009), as well as the physical and life sciences. In the latter case and as an illustrative point, there has, for example, been for a number of years substantial funding available for research on synchrotrons (Thompson, 2007), such as studies involving neutron scattering as a technique to probe the structure of condensed matter on a molecular scale. Synchrotrons are used to investigate a range of materials at the microstructure level, as well as biological systems, nanomaterials, and composite materials; these research endeavours inevitably require multidisciplinary efforts involving specialists from different areas.

This paper includes a literature review on the management of multidisciplinary research institutes, which will focus on identifying some of the challenges and issues associated with organizing academic work according to such structures. A case study

investigation of a research institute located in the United Kingdom will allow the formulation of a systems view of institute management. Further analysis will include examination of the international dimensions of the case study. Concluding remarks will include recommendations for the management of university research institutes, as well as possible areas for further investigation. Within this article, institutes will be regarded as being broadly equivalent to research centres, although a range of organizational forms can be meant by either term.

Managing Multidisciplinary Institutes

Multidisciplinary institutes are generally regarded as 'centres of excellence' for a specific research topic (as opposed to a traditional discipline), and have often been established as a response to either a national research objective or a commercial funding opportunity. As can be discerned from the previous discussion, there are sound reasons for setting up multidisciplinary research institutes, but what are the challenges for managing these initiatives? Bozeman and Boardman (2003) have examined multidisciplinary university research centres as a nationally significant enabler for academic innovation. Their work included an analysis of the types of research centres and how they differ from traditional academic departments. Research in academic departments was perceived as highly decentralized, with principal investigators pursuing their own research agendas. Research centres, on the other hand, will likely feature a coordination of research from different faculty members to address a particular problem area. In regard to the operation of research centres, the authors point to the need to have effective reporting lines for leadership staff. Arrangements should take account of the historical context of the university, e.g., if there is a particularly strong school of engineering, it would make sense for the director of an engineering-based centre to report to the dean of this school and not to another part of the university. Bozeman and Boardman also emphasize the importance of research coordination and the distinctions between centre directors and administrative directors within centres, with the latter naturally taking the lead on managing administrative processes related to internal operations. The need for collaboration both within the centre and with other academic areas (within the university and also externally with other universities) is also mentioned.

On the matter of research collaboration, Ponomariov and Boardman (2010) have elucidated that university research centres can help facilitate multidisciplinary working between academic faculty, thereby improving institutional productivity. Their study found that association with research centres can increase the level of collaborative activity, leading to more joint publications with other disciplines and institutions. As a mechanism to focus collaborative academic work in a problem area that draws on different disciplines, university centres would therefore appear to be effective in producing the tangible outputs of such academic work, namely collaborative research publications. Further, a supportive climate for the generation of intellectual property (through patents and licence agreements) will also be required to contribute to research collaborations that involve companies (Thursby et al., 2001). This matter has been

covered widely (Harris, 2007), and there is an obvious requirement for the necessary contractual arrangements to be in place to support the technology transfer process, such as contract clauses relating to the allocation of intellectual property (IP) rights for both background and foreground IP.

Returning to the management characteristics of university institutes, Feller et al. (2002) highlight the problems for U.S. National Science Foundation (NSF) engineering research centres in gaining continued funding beyond the initial period of investment. This analysis underlines the need for new university institutes to establish robust business cases that will ensure funding over the medium-to-long term. This will likely be contingent on the institute positioning itself in a particular technical problem space in relation to relevant government and commercial sponsors of research, and then delivering research and teaching services in a sustainable framework. The challenges in managing new university institutes in this context would appear significant, and hence an adequate focus on financial sustainability for such initiatives is sensible.

Management of university centres can be viewed in terms of a development cycle, and Geisler et al. (1990) have identified critical success factors for industry-university cooperative research centres. They identified five groups of factors that can play a part in the development of centres: relations with the focal university, relations with industry, internal management, research and technology strategies, and the individual attributes of the founders and managers. Over the life of centres, different factors were of prominence, and in the early stages the founders need to have the required motivation and entrepreneurial vigour to bring together academics at the university and external associates. Later in the development of centres, there is a need for more extensive engagement with industrial partners as well as other activities, such as succession planning and the retention of key staff. This research provides a useful assessment of the management challenges for multidisciplinary institutes and the identification of factors that are important at different stages in the development of institutes.

Aligning research centres to the needs of government funding agencies or commercial sponsors can be an effective route to obtain funding, but such an approach can also bring inherent challenges. In this regard, Speier and Palmer (1998) looked at the Centre for Management Information Systems (MIS) Studies at the University of Oklahoma. They found that there can be an ongoing "struggle" (p. 459) to ensure that the technical work carried out in the centre is of the required academic standard so that it can be published. This would infer the need for an appropriate balance between pursuing problem-driven work that is relevant to companies (although some of this may be consultancy-based) against intellectually rigorous research (either basic or applied) that can be published. They considered strategies for addressing this point and suggested that within such centres, the research agenda needs to be led by individual faculty, i.e. a bottom-up approach. This way, principal investigators will be supervising research that they have confidence in and are also content with the prospects for publishing the results arising from the research in journals of an appropriate standing.

Case Study Investigation

The case study investigation involves reflective analysis on the management of a multidisciplinary research institute in the United Kingdom, the Institute of Shock Physics at Imperial College London (the Institute). The Institute, created in early 2008, has received its funding through a five-year program of work that is provided by an industrial organization. Although the Institute also received initial funding from Imperial College as well as supporting funding of individual academic teams from other funding bodies, it is the program of work initiated to deliver the contract with the industrial organization that has been the main driving force for establishment of the Institute. There were significant challenges encountered in the initial development and subsequent management of the Institute, and consequently the case study will focus on a number of key management areas that were pursued and that contributed to the successful establishment of the Institute over its first two years of operation.

Figure 1 provides the organization structure for the Institute, and includes four main elements: the core staff and students at Imperial College; the four university partners that each receive subcontracted projects from Imperial College, the industry customer grouping (the primary interface point with the sponsor company), and the main steering and reporting mechanisms. A major feature of the Institute is the program of

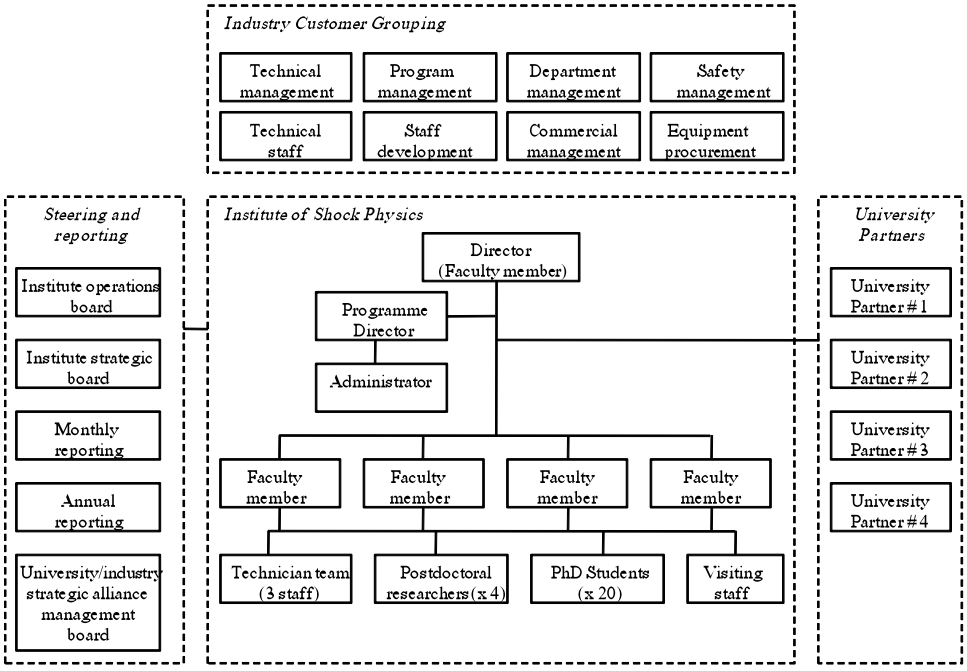

Figure 1: Institute of Shock Physics organization structure.

work (see Figure 2) that is delivered to the main industrial sponsor of the Institute, which is governed by a five-year, multi-million-pound contract. From the perspective of the company, such large-scale university-industry collaborations can be attractive sources of innovation (Mansfield, 1995), both through the knowledge acquired (Fabrizio, 2006), and also from exploitation of existing and new ideas (i.e., relating to technology transfer of intellectual property) (Thursby and Thursby, 2001).

In the wider area of university-industry collaboration, Buganza and Verganti (2009) have identified certain underpinning features of such strategic research collaboration, including the need for involvement of senior management from the company, as well as the importance of formalizing the management of the collaboration and the supporting processes. Moreover, sustainability of university-industry research collaboration has been viewed in terms of the "give-and-take" (page 111) between university faculty and industrial partners (Lee, 2000), and this analysis underscores the cooperative nature of research collaborations and the need for both parties to secure appropriate benefits.

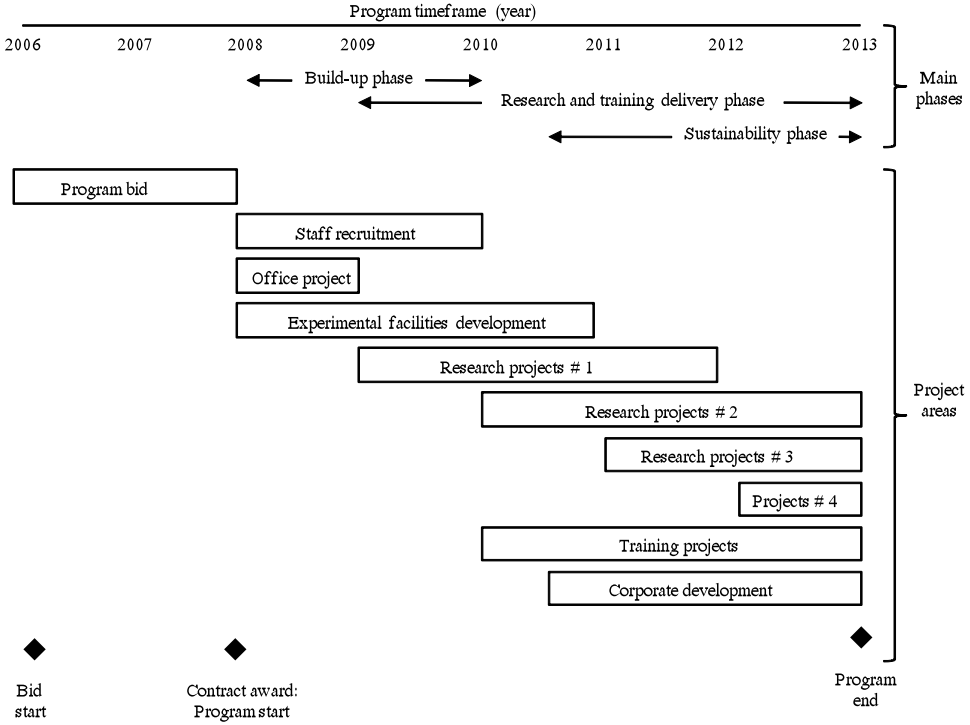

Figure 2: Institute outline program schedule.

As additional background material, Figure 2 provides a schematic view of the program schedule for the Institute, and includes the main project activities set out over a seven-year timeframe (2006 to 2013); this shows the program bid stage from 2006 to 2008, followed by the funded program from 2008 to 2013.

Following on from introducing the Institute and the supporting program of work, it is appropriate to provide details of the management activities that have been undertaken in the first two years of operation for the Institute. This analysis is provided according to the following five management areas as part of the supporting case study investigation.

Collaboration Development

The Institute was formed in March 2008 and from the outset there was an intention to secure the participation of relevant partner universities that possessed complementary research capabilities. The partner universities would be funded through subcontracts from the Institute as part of the overall industrially funded program. This inclusive approach has helped to foster a collaborative culture within the Institute. The partner universities have received subcontracts that include funding for staff, doctoral students, and research materials, as well as investment in new equipment and facilities.

The strategic planning for the Institute has been formulated according to the main areas of operation, namely management, facilities, research, and training. The Institute itself is receiving investment in capability across all these strategic areas, and this broad level of investment has been cascaded on to the partner universities, which is helping to strengthen the collaboration. The intent to develop a broad-based partnership was not without its difficulties, however. Setting up the partner subcontracts required an extended period of negotiation, involving discussions on contract clauses, funding levels, technical scope of work, and the required equipment and facilities development to underpin the research work. Understandably, negotiation of the subcontracts included extensive discussion on intellectual property rights (IPR). This was resolved without any significant difficulty, since the Institute had the IPR policy that foreground IP should reside where it is generated, and so the partner universities were able to retain a favourable IP position for the research undertaken at their premises.

In addition to the partner universities is the central collaboration between the Institute and the industrial sponsor. This collaboration developed gradually over both the program bid stage (from 2006 to 2008) and through the first two years of program delivery (2008 to 2010). The industrial collaboration was also underpinned by a university level strategic alliance between Imperial College and the company. This strategic alliance involves board level staff from the company and dean level staff from the university.

The ability to engage the support of senior staff from both organizations has been a highly important factor contributing to the Institute's development. Indeed, when

the Institute was formed, there was a need for the university to make an investment decision on whether to approve a capital expenditure project to develop new experimental research facilities for the Institute. Consequently, this investment was approved by the university's projects review board (PRB), but this required the support of senior management and members of faculty from the university. If this support had not been available to the bid team working to secure the program's industrial funding for the Institute, it is doubtful that the PRB would have approved the investment, and the Institute would not have been created. This decision was, of course, also underpinned by a favourable business case for the investment as well as a fully documented technical project scope of work and supporting cost plan.

Financial Program Management

As part of the program of work that supports the Institute, there are a range of research and teaching projects, depicted in Figure 2, which provide an outline program plan for the Institute.. The program includes funding for 20 doctoral studentships and four postdoctoral research assistants. Each of these projects has been allocated an individual budget, which is delegated to the respective principal investigator. Materials and minor items of equipment procurement for the main high-pressure experimental research facility are delegated to a technician team, and budgets for training courses and Masters degree are delegated to the course organizers. This approach of moving responsibility for expenditure and cost control at the project level out to the academic and technical teams ensures that at the program level it is possible to monitor and control the overall financial position of the program without excessive centralized control of smaller budget items.

Financial oversight at the program level is undertaken by the program management office (PMO), comprised of the program director and institute administrator. This oversight includes monthly tracking of expenditure against a program budget as well as a range of financial modeling activities. This focus by the PMO on financial management extends to overall operations management for the Institute. Conversely, along with overall leadership, the institute professorial director has responsibility for overseeing the technical strategy for the Institute as well as directing involvement with the main sponsors. This separation of responsibilities has helped ensure a clear distinction between the administrative direction undertaken by the program director and the technical and outreach direction carried out by the institute professorial director. The main industrial sponsor has been appreciative of this approach, and it has allowed the Institute core as well as associate staff to readily comprehend how the Institute is managed.

Financial program management within the Institute extends to value for money assessment of the financial position of the program in terms of the level of leverage (Philbin, 2010a). This is defined as the extra sources of income and financial support, in addition to the primary industrial funding, which are attracted into the Institute. The ability to identify this financial leverage has helped the sponsor company to continue its justification for investment in the Institute, since a supporting value for

money case can be properly substantiated. Indeed, after the first two years of Institute operations, it was possible to demonstrate that for every pound spent at the Institute, another pound had been attracted.

This form of leverage included the financial value associated with a range of different items, such as the value of donated equipment to the Institute, value of research contracts secured from third-party organizations, value associated with visiting staff at the Institute, and any costs that would have been incurred through the use of government research laboratories. This ability to calculate in monetary terms the level of financial leverage was a powerful mechanism for ensuring continued support from the main industrial sponsor, since the company could readily assess the value for money case for its investment through the additional knowledge and equipment access that was being attracted into the Institute.

Research Project Management

Through its program funding, the Institute has been able to undertake research projects across a range of underpinning areas of shock physics research, including plate-impact studies, pulsed-power driven shocks, and static high-pressure work as well as computational and theoretically focused research initiatives. The research funding is concentrated on supporting four PDRA positions as well as 20 doctoral projects, which were planned to start at a rate of five per year each year for four years. This phased approach to the research work was an important feature of the planning for the Institute, since there needed to be an initial build-up phase for the Institute that included staff recruitment, renovation of an office/headquarters facility to house Institute staff, and an extensive experimental facilities development project to provide an advanced research capability to undertake shock physics experiments. In program planning terms, the build-up phase was followed by the research and training phase, which was overlapped by the sustainability phase. This planning framework helped ensure that in the early stages the Institute's faculty were not overloaded with supervising too many research projects, especially not before the key experimental facilities were operational.

The research direction of the Institute is guided by its director, and this is primarily driven according to academic interests and capabilities at the university and partner institutions. However, the industrial sponsor also provides a research agenda that is set out in the main contract to fund the Institute's program of work. The research agenda gives an overall view of the areas of research that are of interest to the company, but the actual research projects are proposed by the individual academic faculty. In the case of PhD projects, a research summary written by a faculty member is submitted to the company for technical assessment.

If the proposal passes a technical review and is viewed as consistent with the overall research agenda, it is approved. The actual project is then contractually administered through a call-off, or tasking contract, whereby the necessary contractual

terms and conditions have already been agreed and there is a pre-approved firm price costing regime. This contracting mechanism has helped ensure a streamlined approach to the placement of research projects. Furthermore, the bottom-up approach, in which the specific research topics are provided by the faculty, helps to maintain the intellectual calibre of the projects and also ensures there is a good fit with the faculty's existing research profile.

Once a research project has been technically and contractually approved, the principal investigators have delegated authority from the PMO to manage the project within the approved budget. The research projects are carried out within distributed teams across three departments at Imperial College and also within academic departments at each of the four respective partner universities. There are therefore seven academic departments spread across five UK-based universities within the Institute. This spread of involvement and distributed nature has presented certain challenges. These challenges include coordination and communication across the Institute's distributed teams led by the institute director and program director; there will be further discussion of this aspect of the Institute's management in the next area.

Program Reporting and Governance

Program reporting and governance has been an important element of the Institute's management framework, and this is in part due to the Institute's primary funding being provided by a single industrial company administered through a five-year contract. The main contract provides a series of performance milestones, which are associated with the recruitment of Institute staff. Achievement of these milestones triggers the payment of the funding corresponding with the employment post, and this arrangement has ensured the university is motivated to recruit staff in a timely fashion. The Institute has been able to deliver all but one of the milestones on time, since the appointment of one of the academic staff members had to be delayed. This situation was communicated to the sponsor early on, and so the impact of missing this milestone could be managed by the Institute's senior management.

Program reporting across the Institute is undertaken through a number of channels. Monthly update reports detail progress according to key highlights, health and safety, management, facilities, research, training, and external links. These reports tend to be around 5-10 pages long and provide regular coverage of progress on all areas of activity in the Institute. Progress in certain research areas may not be reported every month; there may be an update every three to four months for a given area. A comprehensive annual report prepared according to the same sections provides further details on progress through the year, as well as analysis of the performance of the Institute against a pre-defined set of annual targets.

This program reporting is complemented by a series of board meetings, where progress is formally reviewed. Operations board meetings are held every three months

and involve representatives from the Institute and the industrial sponsor. Membership of this board includes the Institute director, program director and administrator, plus representatives from the university's contracts and safety departments. Members of academic faculty also attend. The operations board is complemented by a strategic board that meets once a year. This grouping includes a smaller number of senior staff from the university (director and dean levels) and from the company (director and head of department levels), together with an independent chair of the board. The strategic board is primarily focused on reviewing and scrutinizing the Institute's annual report and providing long-term guidance to the institute's management. Finally, the university and sponsor company have a university-level strategic alliance, which is governed by a management board that meets twice a year, and this board also provides oversight of the Institute.

There are quarterly review meetings held with each of the partner universities; these meetings tend to be more technically focused, whereas those previously mentioned cover reporting and progress across all aspects of the Institute's operations.

The reporting and governance arrangements described above are extensive and understandably require significant time and commitment from the Institute's management. However, establishing this close relationship with the industrial sponsor has ensured an alignment of views from both the university and the company. For example, at the operations board, the company representatives (detailed in Figure 1 as the industry customer grouping) span all the relevant stakeholder areas within the company, such as technical, management, commercial, staff development (i.e. training), and safety. Bringing these stakeholders into the initiative through inclusion on the operations board has meant that when decisions over direction of the Institute were taken, they were part of the decision-making process, and so their views were adequately reflected in any decisions. Any difficulties, such as the need to delay a certain training course, or the recruitment of a faculty member, can be discussed and debated openly at these meetings. These reporting and governance arrangements have helped to build up the necessary social capital within the Institute, as the need to develop trust and open communications can be a significant enabler for successful university-industry collaborations (Philbin, 2009 and 2010b).

Risk and Safety Management

Risk and safety management has been undertaken within the Institute by the PMO. General risks are identified in the Institute risk register, which provides analysis of the risks, with details on their likely occurrence, severity, mitigation, action required, and owner. The risk register is reviewed every three months and updated accordingly. Within the Institute, risk management has evolved; during the program bid phase, it was used to capture the risks associated with delivery of the program of work. This early focus on risk management ensured development of a fully documented compliance matrix, which detailed how all the program outputs would be delivered. Also, during the bid phase, risk management was used to inform the university's approval process by the PRB to approve the investment in new experimental research facilities.

During the research and training delivery phase of the program, there was a need to develop a technical engineering risk management approach for the experimental research facilities. The FMEA (failure modes and effects analysis) technique was selected for this purpose, and used to identify and mitigate engineering risks during the design and construction stages of the facilities development project.

Another major area of risk to the Institute is the long-term sustainability of its funding base, especially sustainability beyond the initial five-year funding term. Consequently, the third main phase for the program can be regarded as the sustainability phase, which includes a greater emphasis on corporate development activities. This corporate development includes marketing the Institute's research and training capabilities to other industrial companies, exploring the application of the shock physics research facilities to different applications beyond the initial program, as well as engaging with and submitting proposals to UK government funding councils. This strand of work represents an ongoing area, which will be gradually developed and enhanced so that this major area of risk can be adequately mitigated.

Since the Institute is responsible for commissioning a significant level of experimental research involving high-pressure equipment with associated hazards, it has been important to establish a clear safety management framework. Consequently, a safety code of practice was prepared that includes a rigorous approach to the management of safety risks within the Institute. This code of practice integrates the technical safety work carried out within the research projects and also the facilities development work, with the corporate safety management procedures of the university.

Specifically the code of practice includes guidance on safety management according to issues associated with different research theme areas, organization-level policies and procedures, safety management organizations structure, roles and responsibilities, safety planning and auditing arrangements, facilities development considerations, offsite work arrangements for institute staff, arrangement for visiting staff and students at the Institute, subcontract safety management considerations, safety training, and safety communications. Moreover, the safety management practice adopted within the Institute (Philbin, 2010c) builds on recognized best practice for safety management, where technical safety hazards together with social interactions and hierarchical control processes are considered (Leveson, 2004).

Analysis of the Case Study Findings

The case study investigation has highlighted the level of interconnectivity between the groups of management activities; consequently, it is possible to generate a diagrammatic systems view of the five areas, illustrated in Figure 3. The five management areas can therefore be conceptualized as subsystems within the overall institute management system, where there is interconnectivity between subsystems and which collectively contribute to performance of the system (Buede, 1999). In other words, there are interactions between the

activities conducted in the different management areas and effective management across all five areas contributes to the overall performance of the Institute.

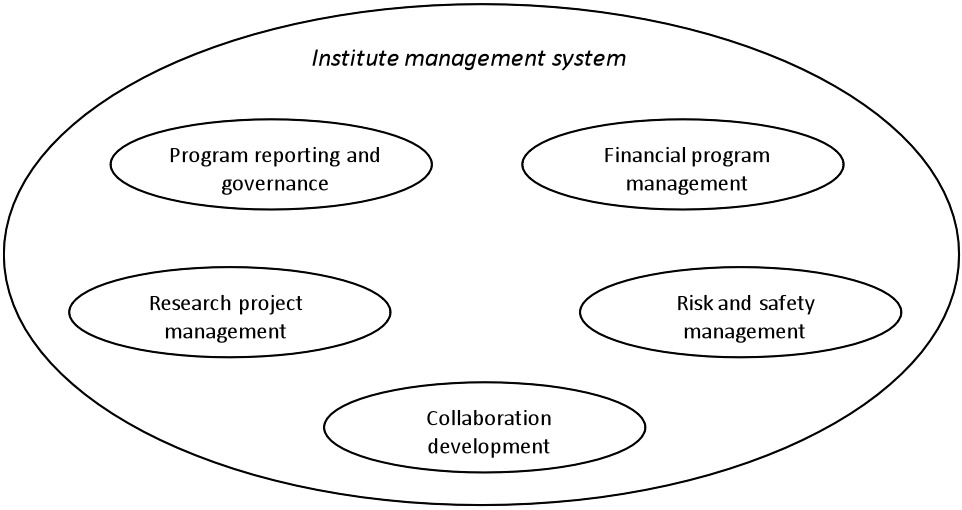

Figure 3: Systems view of institute management.

This interconnectivity can be explored through examination of the following examples. In the case study, within the area of collaboration development there was negotiation of IPR for the Institute's main industrial contract, as well as the IP clauses of the subcontracts from Imperial College to the partner universities. This commercial activity was required to facilitate the collaborative environment, but specifically to allow collaborative research projects to be undertaken. Therefore, the placement of research tasks as part of the call-off contractual process in the research project management area is predicated on an agreed framework for the allocation of IPR to the parties involved. Consequently, there is interconnectivity between the collaboration development and research project management areas, since the performance of one management area is directly dependent on the other.

Furthermore, an activity within financial program management includes the value for money assessment of the Institute's program through the identification of additional sources of income, i.e., the level of financial leverage. Similarly, as part of the program reporting and governance area, quarterly reporting of financial leverage is carried out. As a component of the quarterly reporting cycle, the Institute updates data on the financial leverage report so that the industrial sponsor is provided with up-to-date information. An inability to gather the data within the financial program management area will therefore have an impact on the performance of the program reporting and governance area, thereby demonstrating interconnectivity.

A final example involves risk and safety management, and specifically the identification of financial sustainability as a major area of risk. As part of the approach to risk management, this area receives particular attention at the Institute's management meetings. But the development of a long-term business model for the Institute that will underpin sustainable operations is also a feature of the financial program management area. Moreover, such a business model will likely involve strategies for working with partner organizations, such as other universities, government labs and industrial companies. Development of such collaborative relations is a feature of the collaboration development management area. This further example therefore illustrates the interconnectivity among three of the management areas.

Adoption of the institute management system within a university organization will need to take account of the university's existing structures and processes that are in place, as well as the existing strategy for research administration. Moreover, strategy development for multidisciplinary institutes should ideally be consistent with the corresponding strategies for the larger units of the university within which the institute is located, e.g., school, division, or the university itself. This strategic planning is expected to benefit from a structured approach, such as the one described by Drummond (2003), which includes seven main steps: foundations; articulating mission, vision, and values; strategic thinking; creating the action items; key indicators; completing the written plan; and implementing the process.

The international dimensions of the findings reported in this paper can be viewed in terms of the need for institutes to develop research networks at the most appropriate levels, which will benefit from being consistent with the Institute's strategy for long-term development. Consequently, an institute that positions itself as a leading international centre of excellence will likely be seeking to establish collaborations and in some cases funded partnerships with overseas organizations that are in addition to existing national level interactions. For example, in the biomedical sciences discipline, many leading universities and institutes partner together on funded programs, such as those administered by the Bill & Melinda Gates Foundation (McCoy, 2009), and within Europe, for example, on the EU Framework Programme (Roediger-Schluga and Barber, 2008). Conversely, a university institute that has positioned itself as a regional source of innovation and technology development may be more concerned with pursuing a strategy that ensures close cooperation with companies that operate within that part of the country (Looy et al., 2003), and more expansive collaborations may be restricted to the national level.

Where an institute is pursuing an international agenda, there are a number of activities that can be carried out to support this objective. For example, academic faculty can present at international conferences and publish in internationally leading journals. The institute itself could host an international conference, symposium or research meeting where leading practitioners from overseas are invited. Such activities will need to focus on building up the profile of the institute with international stakeholders so that collaborative networks and alliances can be established, and crucially, that such

alliances receive necessary funding. In some cases, academic partner universities within an international alliance will be able to seek funding for their own participation in the alliance from the respective government funding agency, and consequently this aspect may also be considered. In any case it is suggested that developing an international profile for a multidisciplinary institute should only be undertaken where there are clear scientific benefits to be secured, and also where there is strong support from the participating institutions. If this is not the case, it is unlikely that such international activities will be long lived.

Concluding Remarks

This paper has provided a discussion of the development and management of university research institutes, including a case study investigation of a new research and teaching institute in the United Kingdom, supplemented by a literature review on the management of multidisciplinary research institutes and centres. Work in the literature points to a number of benefits of universities adopting multidisciplinary institutes as a mechanism to facilitate research and teaching that draws on different underpinning disciplines, and which can be focused on a particular problem area. This problem area will most likely be driven by a government program, philanthropic or commercial need for research in this area, and which can advance the level of understanding through a range of university-based activities.

As a vehicle for bringing together researchers from different disciplines and as part of an integrated offering to industry or government labs, institutes offer clear benefits. However, there are certain challenges. Traditional academic work will have been carried within existing departmental structures, and so initiating a new institute will require a major stimulus to ensure the new institute can become properly established. This stimulus could be in the form of a major push by the university to develop and strengthen an emerging research capability, i.e., analogous to a 'spin-off' from an academic department. For example, a bio-nanotechnology institute being created by faculty from a biochemistry department. In terms of stimulus, there will also need to be a highly motivated and driven founder or group of founders for the institute, since in the early stages of development they will need to contribute a significant level of personal, management, and academic commitment to the initiative.

The case study investigation has identified a range of management activities that can be undertaken and which contribute to the establishment of university institutes. During the early development stage, which can be intensive, there needs to be an emphasis on rapidly assembling the main assets of the institute, namely the key staff (academic, program and administration, technical and research); establishing an appropriate headquarters and office accommodation for the institute; acquiring suitable experimental research facilities (where appropriate). There also needs to be a major focus on quickly establishing the main governance arrangements for the institute, such as convening the required oversight committees and boards. Following this intensive

build-up phase, institutes need to move into a delivery mode, where research and training activities are undertaken. As delivery becomes properly embedded within the institute, there then needs to be an increasing focus on external engagement with other interested parties and wider stakeholders (i.e. beyond the initial sponsor community) towards the goal of achieving a sustainable level of operations for the institute.

Whilst university institutes may be geared towards delivering research in a specific problem area that is both scientifically challenging and of interest to government, charitable or industrial sponsors, the actual realities of being part of an institute will be closely associated with the professional and social relations that are formed and that facilitate the workings of the institute. Embedding a new institute within an existing university structure can be a non-trivial process, and forming links with external partners and funding bodies can also require a sustained effort. However, a failure to develop these supporting relationships, both within the host university and with external stakeholders, can be highly damaging to the long-term prospects for any new research institute or centre. Staffing institutes with people who have the enthusiasm, drive and determination, as well as leading technical competencies in the specific area of interest, is therefore of paramount importance.

Through building on the case study investigation, the following recommendations are made for the management of multidisciplinary research institutes and centres:

1. Collaboration development: Fostering an open culture and an inclusive approach with academic and administrative teams that will be contributing to the work of a new institute is important, both in the host university and at any partner institutions. The support of senior staff from the university and from major sponsor organization(s) will also be required. Any such collaboration will need to be supported by appropriate contractual mechanisms, which set out clearly the funding and any program requirements for institutes, together with the performance measurement criteria and specified program outputs.

2. Financial program management: Institutes can be centrally managed by a program management office, which oversees central budgets, but the budgets for individual research projects and other areas, such as materials and small equipment procurement, can be delegated to principal investigators and technical staff. A clear distinction between the financial and administrative responsibilities of the administration director, with the outreach and technical responsibilities of the institute professorial director, is advisable. Institutes will need to develop financial models to support their sustainability planning, and where there are industrial sponsors, there may be a need to demonstrate appropriate value for money benefits.

3. Research project management: It is suggested that research proposals within institutes should be generated from the bottom-up, and not mandated from external sources or from senior university management. Adoption of a principal

investigator-driven approach will more likely lead to intellectually rigorous studies that are of interest to the members of faculty, although there still needs to be an appropriate alignment to the strategic direction of the institute. Research projects may also be planned in an incremental fashion, so that faculty and institute resources do not become overloaded in the early stages.

4. Program reporting and governance: When external sponsors provide significant financial support for an institute, they will no doubt have their own reporting requirements that need to be adhered to. This will likely include necessary oversight committees and boards, together with periodic reporting and meetings. These activities and mechanisms need to be established rapidly, to ensure that stakeholders are kept briefed on key developments and that their support is maintained. In fact, an inability to manage the interests of such stakeholders can seriously damage an institute's prospects and ultimately its survivability.

5. Risk and safety management: Adopting effective risk management can be an important activity for all organizational units. In the case of university institutes, an early focus on risk management will highlight potential problems and issues in the later delivery stages of the institute. Risks such as the financial sustainability of an institute need to be effectively managed. For experimental research institutes, there also needs to be an adequate focus on safety management together with a supporting safety culture.

Through an initial case study investigation, this paper has explored the merits of universities establishing multidisciplinary research institutes. The resulting institute management system is proposed as an approach that can be adopted by different academic institutes. However, presently this approach has only been investigated at a single institution. Therefore, it is suggested that future studies examine application of the institute management system to different institutes. This study would include different types of institutes, such as those from different multidisciplinary areas, institutes of different sizes and scope of operations in terms of research and teaching activities, as well as institutes from different countries. It is further recognized that there are a range of different organizational forms of institutes and centres at universities, and so research on developing an appropriate taxonomy that takes account of the range of management structures and processes would be appropriate.

References

Bishop, M. P. (2009). International multidisciplinary research and education: A mountain geography perspective. *Journal of Geography. 108*(3), 112-120.

Buede, D. M. (1999). *The engineering design of systems: Models and methods*. New York, NY: John Wiley & Sons, Inc.

Buganza, T., & Verganti, R. (2009). Open innovation process to inbound knowledge. Collaboration with universities in four leading firms. *European Journal of Innovation Management, 12*(3), 306-325.

Bozeman, B., & Boardman, P. C. (2003). Managing the new multipurpose, multidiscipline university research center: Institutional innovation in the academic community. Washington, DC: *IBM Center for the Business of Government: Transforming Organizations Series*.

Drummond, C. N. (2003). Strategic planning for research administration. *Journal of Research Administration, 34*(2), 4-10.

Fabrizio, K. R. (2006). The use of university research in firm innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.). *Open innovation: Researching a new paradigm*. Oxford: Oxford University Press.

Feller, I., Ailes, C. P., & Roessner, J. D. (2002). Impacts of research universities on technological innovation in industry: Evidence from engineering research centers. *Research Policy, 31*(3), 457-474.

Geisler, E., Furino, A., & Kiresuk, T.J. (1990). Factors in the success or failure of industry-university cooperative research centers. *Interfaces, 20*(6), 99-109.

Haythornthwaite, C. (2006). Learning and knowledge networks in interdisciplinary collaborations. *Journal of the American Society for Information Science and Technology, 57*(8), 1079-1092.

Harris, T. (2007). *Collaborative research and development projects: A practical guide*. Berlin: Springer Science & Business Media.

Harris, M. (2010). Interdisciplinary strategy and collaboration: A case study of American research universities. *Journal of Research Administration, 41*(1), 22-34.

Karlsson, J., Anderberg, E., Booth, S., Odenrick, P., & Christmansson, M. (2008). Reaching beyond disciplines through collaboration. Academics learning in a national multidisciplinary research programme. *Journal of Workplace Learning, 20*(2), 98-113.

Lee, Y. S. (2000). The Sustainability of university-industry research collaboration: An empirical assessment. *Journal of Technology Transfer, 25*(2), 111-133.

Leveson, N. G. (2004). A new accident model for engineering safer systems. *Safety Science, 42*(4), 237-270.

Looy, B. V., Debackere, K., & Andries, P. (2003). Policies to stimulate regional innovation capabilities via university–industry collaboration: An analysis and an assessment. *R&D Management, 33*(2), 209-229.

Mansfield, E. (1995). Academic research underlying industrial innovations: Sources, characteristics, and financing. *Review of Economics and Statistics, 77*(1), 55-65.

McCoy, D., Kembhavi, G., Patel, J., & Luintel, A. (2009). The Bill & Melinda Gates Foundation's grant-making programme for global health. *The Lancet, 373*(9675), 1645-1653.

Philbin, S. P. (2009). Management framework for developing university-industry research collaborations. *Annual Meeting and Symposium of the Society of Research Administrators International, Seattle, WA, USA, October 16-20*.

Philbin, S. P. (2010a). Value for money model for industrial investment in university research. *Proceedings of the 21st ISPIM (International Society for Professional Innovation Management) Conference on the Dynamics of Innovation, Bilbao, Spain, June 6-9*.

Philbin, S. P. (2010b). Developing and managing university-industry research collaborations through a process methodology/industrial sector approach. *Journal of Research Administration, 41*(3), 51-68.

Philbin, S. P. (2010c). Developing an integrated approach to system safety engineering. *Engineering Management Journal, 22*(2), 56-67.

Ponomariov, B. L., & Boardman, P. C. (2010). Influencing scientists' collaboration and productivity patterns through new institutions: University research centers and scientific and technical human capital. *Research Policy, 39*(5), 613-624.

Rigby, D. & Zook, C. (2002). Open market innovation. *Harvard Business Review, 26*(3), 3-17.

Roediger-Schluga, T. & Barber, M. J. (2008). R&D collaboration networks in the European Framework Programmes: Data processing, network construction and selected results. *International Journal of Foresight and Innovation Policy, 4* (3-4), 321-347.

Speier, C., & Palmer, J. (1998). Creating and sustaining a university affiliated research center: The center for MIS studies at the University of Oklahoma. *International Journal of Information Management, 18*(6), 457-459.

Thompson, A. W. (2007). Synchrotron radiation sources: a focal point for multidisciplinary research. *Interdisciplinary Science Reviews, 32*(2), 135-148.

Thursby, J. G., Jensen, R. & Thursby, M. C. (2001). Objectives, characteristics and outcomes of university licensing: A survey of major US universities. *Journal of Technology Transfer, 26*(1-2), 59-72.

Thursby, J. G., & Thursby, M. C. (2001). Industry perspectives on licensing university technologies: Sources and problems. *Journal of the Association of University Technology Managers, 15*(4), 289-294.