

QUALITY AND TRAINING - INTERACTION WITH INNOVATION

Full Paper

ACHIEVING RELEVANT CONSTRUCTION RESEARCH THROUGH INDUSTRY-UNIVERSITY PARTNERSHIPS

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ABSTRACT

This is to report an innovative work and study arrangement that has shown to be successful and has benefits to all parties involved. In short it involves an industry based Doctor of Philosophy (PhD) program whereby the student is placed into an organisation and undertakes full time study towards the PhD, as well as undertaking other research projects for the organisation. This has led to significant value added benefits for all parties that might otherwise have not been the case.

The Engineering Project Management Group (EPMG) at The University of Melbourne has developed the practice of industry focused engineering PhD's with several past graduates having spent significant time placed in government and industry. This specific case takes the theory one step further where the student is placed full time in industry through a collaborative arrangement with the employer, in this case Multiplex Constructions (Vic) Pty Ltd.

The University stands to gain excellent exposure through being closely involved with industry, whilst the industry organisation stands to benefit through having an in house researcher who has skills in searching for and disseminating relevant industry and academic material to the organisation. The student benefits by gaining valuable industry experience unlikely to be otherwise available to PhD students. The student has access to a wealth of information and expertise through both the University and the organisation, which is more likely to result in an industry grounded PhD of high academic merit.

This paper reports a specific case where the student has undertaken 18 months of candidature thus far, and has been able to maintain the balance between work and research, and is currently running to programme. It also lists the barriers that must be overcome for the programme to be successful, and contrasts Australian experiences with a similar programme in the United Kingdom. There is scope for this form of industry based PhD to become more commonplace.

Industry based construction research, PhD programme

1 INTRODUCTION

The concept of employer sponsored postgraduate study is not new. However, the majority of these programmes are based around coursework degrees such as a Master of Business Administration (MBA) or similar, with very few opting to sponsor a research based degree program such as a PhD. This is especially true in the Australian construction industry where research is not at the forefront of construction companies' priorities.

Difficulties arise from the perceived gap between industry and academia, with the commonly held view that academia operates in isolation. That is why this particular innovative arrangement merits further dissemination to dispel those views, and hopefully gain a more widespread acceptance of use within the engineering and construction industry.

1.1 INDUSTRY- UNIVERSITY PARTNERSHIPS:

The value of establishing effective industry-university partnerships has been realised by many construction engineering educators and industry leaders (Tener, 1996). Industry plays a large role in the co-operative model of education by way of development, management and work placements for students (Calway, 1994). Integrative collaborative project work for postgraduate students is suggested as a means of facilitating the broadening processes and also to promote the pooling of knowledge and experience from within the student group (Lowe, 1991).

The real educational issue however, is how to best prepare engineers and constructors to deliver a quality product to an owner (Schexnayder, 2003). Where full time students have been in industry placement, employers were often surprised at the contribution made by students and valued their contact with the university (Edward, 1998).

2 PROGRAMME OUTLINE:

Broadly speaking, the programme sees a PhD candidate placed full time in government and/or industry and undertaking work directly for the employer along with studying towards the PhD full time.

The employer, in this case Multiplex Constructions (Vic) Pty Ltd, employs the candidate as a "researcher", to perform research and report on any particular area of interest to the organisation. The candidate reports directly to the Managing Director, for whom the majority of research reports are performed, which are then disseminated to the appropriate directors or other nominated people.

The PhD thesis topic was determined at a joint meeting between Multiplex, the student and the university supervisors, which ensured the project was of relevance, not only to the organisation but also to the construction industry as a

whole. Whilst the organisation was consulted on what direction the research should take, it had no overriding say in the final topic, thus ensuring the academic rigour of the PhD is maintained.

The candidate is currently based full time at Multiplex, but spends 60% of time working directly towards the PhD, and the remaining 40% on Multiplex projects. This split can vary from week to week, as in the past there have been Multiplex projects which may have required a full week or 2 of work, however it is balanced out with the requisite PhD study later on. Residency requirements also state that 2 of the 3 years of PhD candidature must be spent at The University of Melbourne unless it is spent at an 'approved outside institution', which in this case it is not. Most of the first year of candidature was based at the University, and it is envisaged that portions of time in the following year will be spent back in the Department of Civil and Environmental Engineering in order to meet the residency requirements by the due date.

Whilst there are certain added pressures with this mix of work and study which could be detrimental to the success of the PhD, it is up to the individual candidate and supervisors to ensure the industry work doesn't interfere too heavily with the PhD programme. So far this has been managed successfully, with the PhD on schedule for completion by the due date.

2.2 ADVANTAGES TO THE PARTICIPATING PARTIES:

2.2.1 The University

The Engineering Project Management Group (EPMG) through which the student is supervised has pioneered the practice of industry focused Engineering PhD's with many past graduates having spent significant time placed in government and industry (Refer Table 1). This specific case takes the theory one step further where the student is placed full time in industry through a collaborative arrangement with the employer. The University stands to gain excellent exposure through being closely involved with industry, and confirms the EPMG as an industry focused group whilst still maintaining its academic integrity.

2.2.2 The Organisation

The organisation stands to benefit greatly through having an on site researcher who has skills in searching for and disseminating relevant industry and academic material to the company. In this case, much of the research towards the student's specific PhD topic has relevance to the company; therefore the student is able to provide a low cost information source on current industry best practice. The organisation also stands to benefit from the added incentive it has provided the student to stay loyal to the company once the PhD program is complete. No time periods have been set for compulsory work once completed, however it is much more likely the student harbours a greater desire to remain with the company. The program also provides tax benefits under Australian Taxation Laws through the provision of Research and Development.

2.2.3 The Student

Possibly benefits the most through the program, by gaining valuable industry experience not otherwise available to PhD students. The student has access to a wealth of information and expertise through both the University and the organisation, which is much more likely to result in an industry grounded PhD that retains its academic merit. The student also stands to benefit financially through the additional work for the organisation.

The student has recently embarked on a 3 month research trip to the United Kingdom to investigate a number of case studies of direct relevance to the PhD, as well as working within the London office of Multiplex Constructions, preparing research reports on various topics. Again this proved to be a good experience for all parties involved, whereby the student gained valuable international exposure, as did the university through increased links and collaborations with overseas institutions, and the organisation stands to benefit through increased knowledge transfer between international offices.

2.3 MAJOR BARRIERS TO SUCCESS:

2.3.1 Intellectual Property

The issues of ownership of the intellectual property arising from such arrangements can be viewed as being for the benefit of the industry as a whole, the benefit of the academic institution and for the benefit of the organisation.

The preferences of the three participants can generally be met by prior agreement without jeopardising the academic criteria fundamental to the degree granting institution. With the rapid advance in technology and the transient nature of the building and construction industry, intellectual property often has a limited sole ownership life span. It can also be possible in some cases to place a short-term embargo on public access to theses. The related issue of confidentiality is commonly addressed by academic institutions but may also be required by the placement organisations.

2.3.2 Remaining Impartial

As the student is based at the organisation, there may be a view that there are certain 'pressures' to report on projects involving the organisation in a different manner to their competitors. This impartiality is ensured by all PhD candidates from The University of Melbourne having to abide by a Code of Conduct for Research, or risk being removed from the PhD programme.

2.3.3 Confidentiality Issues

When investigating various case studies and performing industry surveys within the bounds of the PhD research, there is an obligation under the Code of Conduct to state all affiliations and sources of funding. In doing so, a number of organisations in the industry have questioned the nature of the confidentiality arrangements – that is how they can be assured of their confidentiality when information is being given to an employee of a competitor.

This is maintained in a number of ways; firstly all confidential information gained from any survey must be kept secured on University premises with access only to the named researchers. Any information which is then published from the data will be anonymous and have all connecting information to that company removed. Some cases have arisen however, where there are issues of anonymity through small sample sizes, which at the top end of the construction industry is quite evident. These issues are some of the points covered under the University Ethics Approval Process.

2.3.4 Ethics Approval

Research conducted at universities in Australia is obliged to be submitted to selected committees for “ethics approval”. This process is conducted under the stringent National Health and Medical Research Council rules. While these may be appropriate for research involving the health and welfare of individual personnel, they are not considered appropriate for the academic research discipline being undertaken by the EPMG. It is noted that such a process does not appear to be common outside Australia.

3 OTHER INDUSTRY BASED PhD PLACEMENTS:

The Engineering Project Management Group has had a number of very successful industry placements of PhD students in the past. Areas of previous research and associated government and industry participation are presented in Table 1.

Table 1: Previous industry based PhD placements

Research Topic Area	Placement Organisation	Researcher's Industry Participation	Year
Environmental management systems	Australian Antarctic Division	Engaged at Casey Station, Antarctica, establishing environmental reporting systems	2002
Construction project management in developing countries	AusAID, Orica	Conducted training needs analysis in Vietnam, and consulting work on an Indonesian project	2002
Privately funded infrastructure evaluation	State Treasury, Victoria	Developed agreements for the delivery and operation of a range of public private partnership projects, including risk management investigations	2001
Risk allocation in the private provision of infrastructure	State Treasury, Victoria	Employed in developing risk management criteria for Victorian Government PPI projects	2000
Housing delivery in less developed countries	Urban Land Authority, Victoria	Engaged in urban land residential developments in outer suburban Melbourne	1999
Estimating and tendering in the Australian civil engineering construction industry	John Holland Group	Employed in estimate & tender preparation, and tender review	1996

3.1 UNITED KINGDOM (UK) EXPERIENCES:

Despite its huge contribution to the UK economy, the construction industry still appears to view research and development with suspicion, a sentiment echoed in the Australian construction industry.

The Centre for Innovative Construction Engineering (CICE), based at Loughborough University, UK was launched in 2000 and offers a four year Doctor of Engineering (EngD) qualification which has set about overcoming difficulties of combining the needs of industry with research. The degree provides a more vocationally oriented doctorate in engineering, and is better suited to the needs of industry than a traditional PhD (Fleming, 2002).

Topics for research within this programme have so far included innovative procurement and management practices, advanced analysis and design, sustainable construction, novel construction techniques and innovative construction materials.

As distinct from a traditional PhD programme, EngD projects must demonstrate innovation in the application of knowledge to the engineering business. They therefore must make a significant contribution to the performance of the industrial partner and thus have to be in the mainstream, not a 'student' project performed on the side of little consequence.

Where a company or industrial partner has an interest in a certain area of research, they can approach the EngD programme at Loughborough University to obtain a suitable 'research engineer'. The industrial partner is involved in the selection of candidates, and together with academics and the newly selected candidate, jointly design the research and course work programme that the research engineer will undertake.

Doctor of Engineering students will be expected to spend at least 70% of their time with the industry partner, and therefore any benefits flowing from the ongoing research will be immediately seen by the sponsor, not years down the track as in more traditional programmes.

The course also involves a course work component comprising modules of study administered by the CICE. Should the candidate choose to complete the requisite amount of modules, an MSc (Master of Science) en route to the final doctorate qualification is then awarded as well. The advantage for companies is that they can undertake research in an area where they have real technical or business needs at relatively low cost, and have access to expertise across the whole of the university.

4 FUTURE POSSIBILITIES:

To make the programme more marketable to the construction industry, and to other related engineering disciplines, a rebranding must occur. That is the notion that an academic programme such as a PhD solely leads to academia and has no place in industry, must be overturned. This will not be as easy task, but dissemination of information regarding successful programmes such as the one outlined here can only help influence the industry into greater acceptance.

An alternative route to that of a full time research based programme may be to include a number of coursework subjects of direct relevance to the employer's field. These might be management, law, or any other area of potential benefit to the student or the organisation. It is very common for engineers who commence their careers in technical roles to move on to senior management roles, and may end up taking on management training then, whereas through this programme they would obtain similar training along the way.

This concept has been tried successfully in the United Kingdom through the Engineering Doctorate programme at Loughborough University, and there is significant scope for a similar programme to be established in Australia. This would also require a change in thinking from the Universities who run traditionally

academic PhD programmes, to understand the need for a more vocationally oriented degree.

5 CONCLUSION:

Successful programmes such as that involving The University of Melbourne and Multiplex Constructions provide evidence to the Australian construction industry of the benefits to all parties involved.

The University gains valuable exposure in the Construction industry, and keeps itself at the 'cutting edge' whilst remaining grounded in actual industry practices, which is a danger of more traditional PhD programmes. The industry organisation gains a valuable source of information, and can prepare research reports on any aspect of the organisation or industry which may not have been possible without a dedicated researcher, a person very few organisations would have. There are also significant tax incentives to supporting Research and Development programmes under current Australian Tax Laws.

Finally, the student stands to complete a PhD of high industry relevance. This could see the student progress much faster in industry than the traditional academic based PhD, simply because they have gained valuable experience along the course of study and will not be starting at a 'graduate' level, as other PhD students may find.

It is clear that there is significant scope for industry based research programmes, such as a PhD, to become more commonplace, but this does require a major shift in traditional thinking from all parties involved.

6 References:

Calway, B (1994) "Involving industry in the continuing improvement of higher education", IFP Transactions A: Computer Science and Technology, A-52, Applications and Impacts, 696-701

Edward, NS (1998) "Granting of academic credit for Work Based Learning in Scottish Higher Education", Journal of Engineering Education, 87(1), 15-17

Fleming, Diarmaid (2002) "A Doctor in the House". New Civil Engineer May: 24-25

Lowe, John G. (1991) "Interdisciplinary postgraduate education for construction managers" Journal of Professional Issues in Engineering Education and Practice, 117(2), 168-175

Schexnayder, Cliff J. (2003) "Full Circle in Construction Education?", Construction Research Congress, Winds of Change: Integration and Innovation in Construction, Proceedings of the Congress, 513-520

Tener, Robert K. (1996) "Industry-University Partnerships for Construction Engineering Education", Journal of Professional Issues in Engineering and Practice, October: 157-162