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Setting up University-Industry Links through Sponsoring Undergraduate Engineering Programmes*

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Although there has been a reduction in demand in the current recession, it has been widely reported that the UK has been facing an increasing shortage of high quality engineers entering industry. Industrial sponsorship of students and degree programmes is one way of contributing towards the developing University-Industry (U-I) links. This study highlights the issues of the relationship between employers and students during their undergraduate study from the perspective of students, employers and academic staff. It takes a mixed-method approach to assess the attitudes and perception of individuals from these parties and identify the barriers which limit further engagement in order to propose guidelines for further improvements. Data were collected from the undergraduate engineering students, companies, and the academic staff of engineering departments at Loughborough University using questionnaires, interviews and documentary analysis. The results show that greater awareness of the details of sponsorship schemes, including how they work and what is involved, would make employers more likely to offer sponsorship and encourage more students to apply for sponsorship. Conclusions are drawn on recommendations to develop sponsorship schemes in the way that the parties' expectations are met and their benefits maximized.

Keywords: industrial sponsorship; employers-students links; engineering education; professional skills

1. Introduction

Traditionally there was a distinction between university and industry. While university has been considered as the place of education and research, industry was the centre of innovation [1]. However, industry and universities should move with the times and with the current tendency, it is essential for academics and industry to work together to bring about crucial improvement and mutual benefits [2–4]. University-Industry (U-I) links represent a developing movement for progressing knowledge and new technologies and benefits all involved parties, in addition to the benefits generated for economy from technology transfer [5–7].

1.1 The need for University-Industry (U-I) links

The need for universities to meet the requirements of industry has been recognised for some time [8]. Technology is rapidly improving, and it is increasing skills requirements across the economy. Industry faces increased skills needs to succeed in the new global economy and graduate employment is a part of firms' success of any size. It highlights the role of engineers in society and developing a successful economy and the importance of skills over the coming years [9, 10].

In the last decade, higher education has faced new challenges such as sustainable development and a debate has arisen on whether enough engineers are being trained, and whether they receive relevant training. The National Employers Skill Survey stated that 95% of manufacturing and engineering firms have found it difficult to recruit graduate level engineers, and skills shortages have a negative effect on their business [7, 11].

The Lambert Review [12] also reported that there is a mismatch between the industry requirements and university courses in particular areas. Specific gaps have been identified in technical, practical, communication skills, and problem solving. Undergraduate engineering education therefore requires input from the engineering professions, industry and academia to meet the demands of the 21st century [4, 9, 11, 13].

University programmes must recognise the real and continuously growing requirements of industry and develop in line with these requirements, attract and maintain the inspiration of students, and provide students with practical and novel problem-solving skills to work effectively in industry on graduation. At the same time, employers need to increase their investment in skills [4, 9, 14, 15].

Engineering, most likely more than any other scientific discipline, has a long practice of collaboration between academia and industry. It should be noted that industry is an engineering department's main client, after students, and universities need to

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recognise this and express their importance to industry [4]. Effective links between industry and university engineering departments could support the combination of theoretical knowledge and industrial practice in universities programmes and provide the opportunity for universities to recognise the changing requirements of industry. Even small companies can make a difference to students' understanding of the skills industry require [14].

These links enhance student learning and could ensure that graduates have the required skills and they are ready to contribute to the organisations that hired them. In addition to this, industry input into the curriculum is a requirement of accreditation by professional bodies in the UK [16, 17].

Sponsoring engineering degree programmes is a dynamic link between industry and university in learning and teaching. In education, sponsorship is financial assistance provided by a sponsor in the form of a salary, bursary, award or allowance during the course of study. Sponsors mostly offer sandwich courses or industrial placements and provide opportunities for the students to gain work experience and professional training throughout their degree studies.

Despite the benefits of industrial sponsorship to the students, universities and employers, there is a lack of evidence about:

- the degree of attractiveness of sponsorship to the parties,
- the barriers that stop more students, universities, and companies being involved in sponsored programmes, and
- the areas that need improvement.

This paper includes the assessment of attitudes and perception of students, academia and industry in order to assesses the barriers that inhibit more growth of industrial sponsorship of undergraduate students. It also proposes guidelines for future developments and a sustainable model of effective practice for further dissemination.

2. Methodology

This research is a mixed-method study which observes engineering students, academic staff, and employers' experiences of sponsorship. A variety of quantitative and qualitative methods were used to explore the parties' views on sponsorship.

Several sources of evidence were used to obtain multiple measures of the same phenomenon and triangulation was used to utilize how the research findings match with each other. Interviews, observations, review of the documents, and questionnaires were exploited to gather evidence from multiple sources such as different groups of students in different years, academic staff and employers. In this research three cross section studies were carried out and data were gathered from 13 groups of the first and final year students in three years between 2007 and 2009. The result of the each group of students was compared with the results of the students in the following year (for example, the first year students' results in 2007 were compared to the results of the first year students in 2008 and 2009). The analysis of the data has been done using Statistical Package for the Social Sciences (SPSS). The quantitative data was analyzed using descriptive statistics and the qualitative data analyzed by identifying themes.

3. Results

This paper presents the analysis of a subset of the data obtained from the parties involved, as well as the relevant literature reviewed in order to answer the following research questions:

- Why do not all students apply for sponsorship when it is available?
- What are the factors that prevent more departments offering sponsored programmes?
- What is the degree of sponsorship attractiveness to the investigated companies?
- What can be done to overcome the barriers?
- How to set up new sponsorship schemes?

A group of 669 undergraduate students in the Civil and Building Engineering, Mechanical and Manufacturing Engineering, and Systems Engineering were surveyed. The total number of students who completed the questionnaire was 448, giving an overall response rate of 67%.

The research also includes the results of interviews with seven senior academic staff across the faculty of engineering in Loughborough University. Thirty four senior managers in major companies in construction, mechanical and manufacturing engineering, and systems engineering took part in the research. Twenty eight of the companies offer sponsorship to students and 6 do not offer sponsorship but do employ students for a year out placements.

3.1 Why do not all students apply for sponsorship when it is available?

Despite all the benefits of sponsorship, the results of the students' survey revealed that 23% of students did not apply for sponsorship when it was available. Students who did not apply for sponsorship were asked to rate on a scale of 1–6 (1 = Not at all, 6 = Considerably) the impact of the following factors on their decision not to apply for the sponsorship scheme runs by their department: already spon-

sored, lack of information about the scheme, lack of interest, and complicated application process. The results are illustrated in Fig. 1, where they are presented in descending order of mean value.

As the figure shows being already sponsored and lack of information about the scheme have influenced the students in some way not to apply for the sponsorship scheme run by their department.

The results suggest the application process should be run as early as possible in the academic year to make sure that students are not getting other offers and also sponsoring companies have vacant positions to offer to the students. In addition, students are not aware that sponsorship exists before choosing a University course. Therefore, providing students with detailed information about the sponsorship schemes including requirements and expectations could increase the number of application for the schemes. However, it should be noted that students do receive an extensive amount of information. The results suggest that in some cases, there is a mismatch between the information provided and what is required, and it is important to know what extent information is needed and what the best way is to present them.

3.2 What are the factors that prevent more departments offering sponsored programmes?

The Departments of Aeronautical and Automotive Engineering, Chemical Engineering, and Institute of Polymer Technology and Materials Engineering do not run sponsored programmes. However, they have different and strong links with industry and the majority of students get sponsorship after their placement. The academics who took part in this research were asked on a scale of 1–6 (1 = Not at all, 6 = Considerably) how the following factors would influence their decision not to develop employer sponsorship in their department: staff commitment, lack of interest from employers, time commitment, and lack of interest in the department. As Fig. 2 shows there is concern amongst the interviewees about the staff and time commitment needed to introduce and operate the new schemes. Staff have to spend lots of time dealing with sponsorship and administration issues.

The results also reveal another challenge to establish new sponsorship schemes which is increasing the demand from employers. It is very important to make the employers aware of the benefits that can arise from this type of collaboration with academia, especially those employers who do not have experience of working with universities at undergraduate level. Creating some case studies will help academics to approach industry staff and show industry the benefits which can be a starting point for successful partnerships and promote demand from employers.

3.3 What is the degree of sponsorship attractiveness to the investigated companies?

The employers who are not members of sponsorship consortia were also asked on a scale of 1–6 (1 = Not at all, 6 = Considerably) how the following factors would influence their decision not to offer sponsorship: lack of information, resources commitment, time commitment, and overall cost. The results are

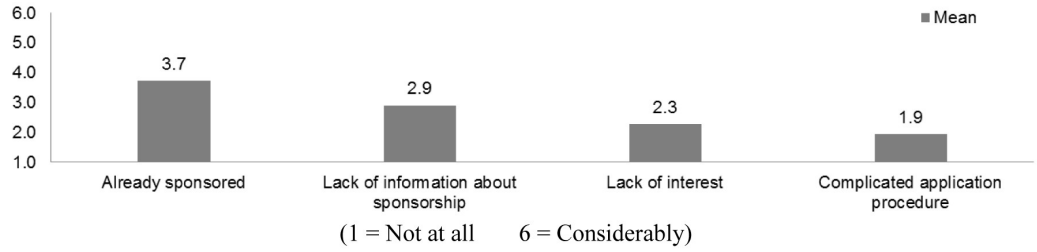

Fig. 1. Reasons not to apply for sponsorship (Means).

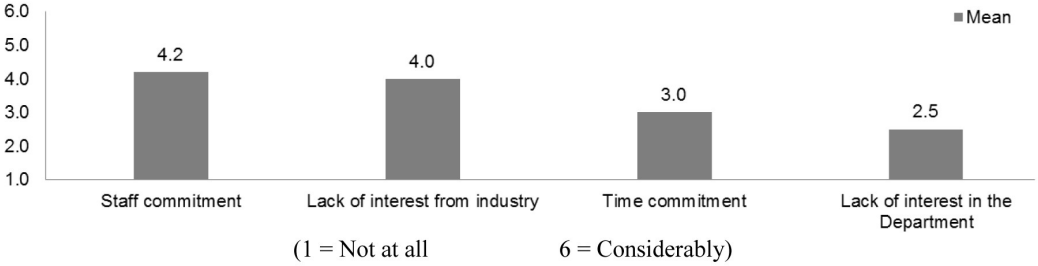

Fig. 2. The main reasons for the departments not to offer sponsorship (Means).

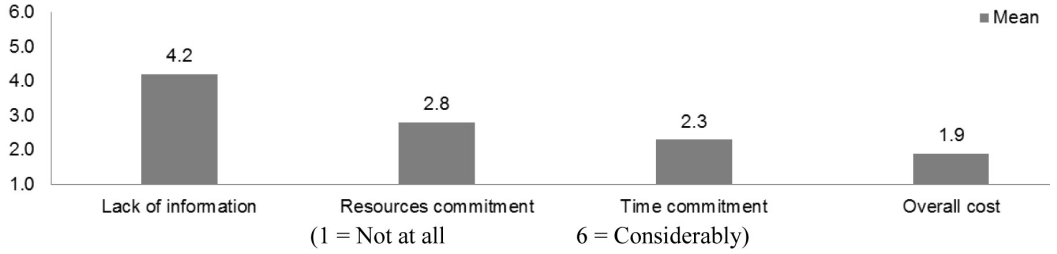

Fig. 3. The main reasons for the employers not to offer sponsorship (Mean).

illustrated in Fig. 3, where they are presented in descending order of mean value.

As the results show the lack of awareness of the schemes and not knowing how they work and what they involve is the main reason for not offering sponsorship by the companies. It is also interesting to emphasise that the respondents stated that time commitment and cost has no significant impact on their involvement with sponsorship and if they have information and details about the schemes, they would like to join the consortium.

3.4 Guidelines to improve the existing schemes

In general, the results revealed that there were no major problems with the schemes from students, academics and employers' point of view. However, the participants felt that there is still room for improvement. This section brings together views from the stakeholders about what changes need to be made and how they might be brought about in developing the sponsorship schemes to ensure that their expectations are met and the benefits derived from the schemes are maximised in the future.

- The students' awareness of the benefits that accrue from sandwich training and financial aid availability has to be increased. They need to be educated on the value of gaining a technical skill as an essential building block for subsequent progression into the profession. An expectation that students should be sponsored and/or go on industrial placements needs to be developed. More universities should go down the sponsorship route and encourage their students to apply for it, if they want to be competitive in the graduate job market.
- More information needs to be provided to the parties to ensure that they understand the level of commitment, roles and expectations of each other. This could encourage more students to apply for sponsorship and develop both employers and academia engagement in the sponsorship schemes.
- Effective lines of communication should be in place during the sponsorship period, especially when students are at university during academic semesters.
- It is obvious that the sponsorship schemes are beneficial for all the parties involved, but employers and students cannot set up the schemes. It is therefore, the academics responsibility to launch new schemes which requires lots of time and effort. The schemes are usually established by the enthusiasm of individuals and it is important to make sure that the enthusiasm and dedication for the programme do not dissipate when those individuals move on.
- The scheme process should be kept simple and transparent. The administration issues should be facilitated to minimise the time and staff commitment required from both the department and the employer in order to avoid all miscommunications.
- The right time for running the application process has to be considered. Late running applications schedules will lead companies to look for students somewhere else and students to apply for other available schemes.
- The schemes need to be evaluated to assess their success in achieving their expected objectives and generate feedbacks on their performances. The information must be provided about schemes to both the companies and the students in order to:
  - widen the parties' views,
  - raise the employers' interest to offer sponsorship, and
  - encourage more students to apply for sponsorship.

One key issue in sponsorship is: 'does it give value for money?' Some companies and departments do not track graduates, and therefore they do not know if sponsorship is beneficial, especially from an economic point of view. It is important for both parties to evaluate the schemes and provide all information and values for reviews.

3.5 The important factors for setting up new sponsorship schemes

The partnership between companies and universities is a challenge to both sides, as they are not natural partners and have different missions and cultures [12]. However, industries, universities, and

the economy as a whole will be benefited by: encouraging, improving, and facilitating communications; identifying the benefits of industry involvement; and developing a more trusting approach by all those involved. The research sought to explore the academics' view about what factors are important for the university departments to choose their partner companies and how the employers can be encouraged to be involved in the learning and teaching of undergraduate students through the sponsorship schemes. The results provide an understanding of how university-industry relations could be set up by identifying the parties' requirements and their expectations.

The most common responses from the academic staff regarding the choice of their partner companies centred on the alignment of the course contents with companies' requirements and personal relationship between department and company contacts.

The employers who participated in this research were also asked, based on their own personal experience, how the employers can be encouraged to sponsor degree programmes and undergraduate students. The important factors identified were as follows:

- giving employers early access to good engineering students for the purpose of helping them recruit,
- sufficient supply of good quality graduate, and
- providing more successful case studies and examples of companies who sponsor students.

Therefore, when setting up and running the sponsorship links it is vital to recognise industry needs and reflect them in the course contents, build the links and, more importantly maintain them, and finally provide the information about the added values of sponsorship to the stakeholders. Industry therefore needs to be alerted about the benefits of sponsorship as this can be a starting point for a successful partnership and could promote demand from employers.

A recent study has shown that 45% of SMEs currently have no links with universities [14]; therefore, improving engagement with the small and medium-sized firms may be the greatest chance for university departments to establish the links with the employers.

3.6 Model

The research highlights sponsorship schemes are working very well for some engineering disciplines such as Civil and Building Engineering. The views and experiences of the parties involved in this engineering discipline have therefore been brought together to develop a model of good practice. This model is a range of practice standards that could be adapted by other engineering departments to help them design and operate sponsorship schemes for their undergraduate engineering students. Fig. 4 illustrates the key elements of the model.

The research revealed three major issues preventing the development of new sponsorship schemes: lack of awareness and information among the parties about what they expect to gain, and what they expect to give; lack of understanding of their responsibilities; and lack of evaluation of the existing schemes. By taking these factors into account, the reality of the schemes will meet the parties' expectations and their benefits will be maximised thus making the sponsorship schemes successful and sustainable.

As Fig. 4 shows, the model consists of a conception phase plus a design phase, an implementation phase, and a maintenance phase in a continuous loop.

In the conception phase the information has to be collected about the following issues:

- what is happening in the university and what the university can offer,
- what the employers can offer,
- the level of time and staff commitment required from the employers and the academic staff, and
- the level of the student's commitment to the sponsor during their studies and following graduation.

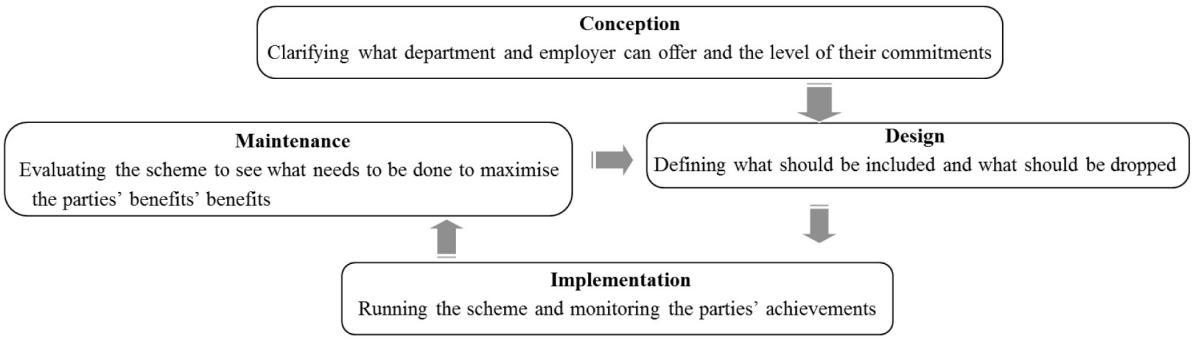

Fig. 4. The proposed model

This information generates the stakeholders' expectations from the scheme which is the input to the design phase. The purpose of the design phase is to create the scheme plan and make it clear what should be included and what should be dropped from the schemes.

As the results show, gaining experience is one the most important part of sponsorship. However, it should be noted that having experience is not enough. In fact, reflection on work experience is the important part in the learning process. Therefore, one key point that should be considered in designing sponsorship schemes is selecting learning activities that support students as they learn from experience while working on a real-world project. Each activity of the work placement should include the four phases of Kolb's experiential learning cycle so that students would engage in a continual cycle of experiencing, examining, explaining, and applying. The learning cycle might begin with students' personal involvement through concrete experiences; next, they should be given opportunity to reflect on this experience and look for meaning; then they can apply this meaning to form a logical conclusion; and finally, they experiment with similar problems, which result in new concrete experiences [18].

In the design phase, tasks should be allocated to the parties and their responsibilities (which are the input to the implementation phase) should be defined.

In the implementation phase, the proposed plan is implemented and the parties' views on the schemes are monitored through surveys and case studies and reports of their achievements and progress reports are produced. These attainments of the scheme are the inputs of the evaluation phase which aims to provide feedback for modifying the design. This stage should determine:

- how the achievements of the parties from sponsorship meets their expectations,
- how the scheme adds value to the education of the students, the employers and the department,
- how the schemes provide students with sufficient opportunity for reflection on their experiences, and
- what changes need to be made to improve the added values of the schemes.

This model could be used to provide better consistency of understanding, promote improved communication and relationships, and aid best practice and consistent levels of support.

4. Limitations

It is important to acknowledge that, as with any other research, there are a number of limitations to take into account when assessing the findings. Whilst the effort has been made to represent a range of industry views, it has to be acknowledged that there are sectors whose perspectives have not been captured. Additionally, whilst the scope of this research is on the sponsorship schemes among the Faculty of Engineering in Loughborough University, a number of other schemes were investigated. The academia study was drawn from a particular group of the staff who had experience of working with industry and their views may not be representative of the experience of other academic staff.

5. Conclusion and future work

Amongst the most important findings of this study were the close views of the students, industry and the academic staff on the sponsoring of undergraduate engineering students. Also there was no significant difference according to demographic factors such as different engineering disciplines or industry sectors. The resulting findings can be summarized as follow in order to increase the parties' interests and demands to be involved in sponsorship: improving the structure of courses to make them relevant to the business and attractive to potential students, providing employers with early access to the good quality students, supplying good quality engineers, raising students' awareness of their roles and responsibilities in industry, providing continuous follow up and feedback on the performance of the schemes, and facilitating the U-I relations to minimise the time and resources commitment by the parties. In addition to this, the sponsorship schemes need to be evaluated in order to identify how successful the schemes are in helping the departments and employers to achieve their objectives, and students to acquire employability skills. The evaluation provides evidence and feedback about sponsorship that allows decisions to be made and highlights the benefits which arise from this type of University-Industry links. Companies should be made more aware about the success of programmes, especially economic benefits, in order to encourage them to extend their links with universities through sponsorship. Further longitudinal and cross section studies should be carried out to include a larger survey sample, including other universities, other engineering disciplines, and industry sectors over a longer timescale. The results obtained should be presented to individuals and experts within industry and universities for them to comment on. The propose model should be discussed with employers and the academic staff in order to gain their views and examine its sustainability.

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