

1. Most examples of good practice can show a multiple level and type of engagement between business and universities, usually over a significant period of time. Often these start from early, low risk, low cost activities such as graduate recruitment, student projects etc. Many develop on the basis of individual personal relationships. Consequently, there is an inherent volatility to the relationship and its development for any given university or business.

As an example, Coventry University has a long track record of working with Jaguar Cars. This is a relationship which has developed over the years through a range of activities including:

- Student placements
- Student projects in design/styling and engineering
- Development of a tailored post graduate engineering management programme
- Research projects and a large scale (12 associate) TCS programme
- Use of the technology Park conference facilities

Attached at Appendix A, there are two more detailed case studies of SME business interaction which, as seen in point 4 below require more complex and innovative interactions than large companies.

2. Businesses do not have time and do not see the University sector as adding value to their activities – indeed commercial sensitivities often stunt the growth of relationships between the sectors. Some businesses appear to retain a view that universities are a State subsidised consultancy.

Intellectual property issues are often poorly understood and managed by both parties sometimes resulting in early breakdown of a potential relationship. Currently, there is some evidence appearing from the U.S. that the relatively aggressive stance taken by the 'elite' universities there in relation to intellectual property is driving businesses elsewhere and the UK should beware of following a similar track.

Overall there remains a need for better understanding of the priorities of both parties in the relationship.

3. Quality of graduates is variable and tends to be anecdotal or based on past experience (eg 'we always recruit from Oxbridge'). There is also a tendency to recruit from 'elite' universities based on reputation for academic excellence rather than fully understanding and evaluating the compatibility between curriculum content and business requirements.

Communication of needs is also variable, often through milk rounds, personal contact, mailshot/adverts. It is rarely done collectively. Any collective expression of needs tends to appear subsumed in a position document from NTOs LSCs and government. Where there is a communication of needs direct from business these tend to be in relation to skills sets which one would expect to be developed elsewhere than in the university curriculum. There is some evidence that the desire to impart these "employability" skills is having detrimental impact on core curricula within the HE sector. It sometimes appears that the HE sector is now being required to fill inadequacies in earlier education.

4. Present financing arrangements by and large do not recognise that Universities are 'commercial institutions' who need to make money just like any other organisation. The reduction in unit funding exacerbates this problem.

Research intensive Universities tend to attract larger businesses with a significant R&D budget as they are drawn towards the highest quality research. Therefore, these contracts and interactions tend to generate significant income for the universities involved.

SME R&D on the other hand tends to be low value contracts and, often, lower technical requirement. Less research intensive universities are, however, often well placed to provide support to these businesses with closer to market technologies.

The R&D tax credit scheme does not usually go far enough to offset costs and other subsidies are normally required to attract these businesses to work with a university. Often these additional subsidies are secured through accessing EU structural funds that usually require an internal subsidy from the university itself.

The combined effect of the above is to further skew monetary rewards for business interaction towards the research intensive universities which already receive the lion's share of central research funding.

APPENDIX A

Sprue Aegis collaborating with Coventry University

RECHARGEABLE BATTERY SMOKE ALARM

Sprue Aegis has developed an unobtrusive rechargeable battery smoke alarm, the FireAngel PS101, which fits between a light socket and the light bulb, is covered by the lampshade and automatically recharges every time the light is switched on. It is easy to install and easy to test and re-set using the light switch. This innovative new product is designed to solve identified smoke alarm problems.

The company was set up to exploit the opportunities in the trade and consumer smoke detection markets. Its aim is to significantly reduce the number of fire related deaths and injuries by becoming the recognised world-wide brand leader in the supply of consumer led, innovative and high technology safety protection systems.

The full details of the collaboration between Sprue Aegis and Coventry University has been considered as 'commercial in confidence' until the launch of the product. Sprue Aegis would like their work with Coventry University to be considered for a 'New Collaboration' Award as they have not been able to announce the full details of the project until very recently. The company can demonstrate a 'first time' collaboration with Coventry University that has grown over a period and has developed from a concept to a successful product which is now on sale nationwide in B&Q, Comet, John Lewis stores and Alders.

BACKGROUND

The product was conceived by the company owners Nick Rutter and Sam Tate in the spring of 1998 following primary research that highlighted major weaknesses with existing domestic smoke alarms. In order to develop their idea further Nick and Sam approached Coventry University's Graduates Into Business Scheme to seek support for moving their idea forward. Their application was successful and in the autumn of 1998 they enrolled on the University's Graduate Enterprise Scheme's 12 week 'Start your own Business' course.

The company Sprue Aegis was incorporated later that year and Coventry University's Graduate Enterprise Scheme injected £55,000 into the company. In return for the University sourcing the grant of £55,000, and the business support mechanisms provided, the University took an equity stake of 20% in Sprue Aegis. The company based themselves in the University's TechnoCentre which gave them easy access to business support facilities allowing them to continue their collaboration with the University.

THE PROJECT

This was Sprue Aegis' first collaboration with a University which has lasted 3 years, from the initial concept to a finished product. The collaboration with Coventry University began in mid 1998 when the company initially approached the University's Rapid Prototyping Unit (now known as the Product Development Technology Support Unit (PDTSU)) with an idea for a smoke alarm but no actual design. Work then began on the development of such a product.

Initial research July 1998

PDTSU agreed to investigate the use of solar power as a source of power for the smoke alarm. As the Unit had no previous experience in designing solar powered equipment the first task was to undertake research into solar power. Following this research a solar powered alarm was developed but testing on this product proved the idea to be unfeasible.

First design developed September 1998

The Unit continued its work with Sprue Aegis, and in September 1998 the Unit developed a bayonet design and produced a casing of the first alarm design. The Unit used its expertise in CAD to develop a number of FDM components and produced a mock-up model of the bayonet style light fitting using its rapid prototyping equipment. Nick and Sam were able to use this model in their presentation to the Graduate Enterprise Scheme – the presentation was successful and clearly enhanced by the use of a model – Sprue Aegis were accordingly awarded £55,000 by GES.

Next stage design development November 1998

By the end of 1998 a second bayonet had been produced and prototypes were developed using CAD. The Unit were able to assist Sprue Aegis in marketing by producing Form-Z renderings using rapid prototyping to produce detailed drawings that could demonstrate how the product would eventually look. These images were used on the company's initial packaging which allowed them to approach potential clients with a packaged product. Work on the electronics side of the product continued throughout 1999.

Tooling January – June 2000

Between January 2000 and June 2000 the Unit produced silicon tooling for Sprue Aegis and five moulds were made for the top component and two moulds were made for the bottom component. A total of 17 sets of components were produced from 8090 high temperature resin, each one of the parts being heat treated up to 140 degrees.

Sprue Aegis utilised the vacuum casting facilities the Unit had to its full potential and were able to obtain a set of 22 casings. Although the casing produced were only prototypes the fact that they needed to resemble both the form and functionality of the injection moulded parts that eventually would be made meant that not many other processes could be used. In reality the facilities offered by the unit have saved Sprue Aegis a considerable investment in time and money.

Further development April – September 2000

Between April 2000 and September 2000 the Unit involved Sprue Aegis in working with the Centre for Advanced Joining also based at Coventry University. The Centre specialises in laser welding and plasma arc welding and was able to assist Sprue Aegis in developing contact springs for the product. The Centre was able to assist Sprue Aegis with laser cutting techniques to develop prototypes and also provided advice on materials and manufacturing.

Sprue Aegis was able to benefit from some of the best technology available in the market using the laser facilities offered by the Centre for Advanced Joining. This added further value to the quality of the smoke alarm and ensured that the prototypes were as close to a final product as possible.

Product CE Testing September 2000 – March 2001

Product testing took place between September 2000 and March 2001 and the Unit assisted Sprue Aegis in assembling each working prototype as the deadline for testing was very tight. In total 16 working units were supplied and tested and results of testing returned excellent results with minimal changes required in the design. The Unit was involved in making further modifications to the product in January 2001 in order to help it achieve a CE Mark and the product received CE Mark approval in March 2001.

Five further casings were required for demonstrational use of the product to clients including three 8090 sets and two SG95 sets. The latter was used to demonstrate the internal components and the method of assembly.

Sprue Aegis has received assistance at each stage of the development process and have greatly benefited from the work completed. The Unit always strove to achieve the tight deadlines set throughout the project and always delivered what was necessary. Sprue Aegis were able to evaluate each design iteration normally within less than two days by the use of a set of FDM prototypes, changes could be made quicker and a more appropriate design produced.

University of Warwick

Sprue Aegis would also like to draw attention to its work with the University of Warwick who offered significant assistance to the company in developing the smoke alarm for a European market. Working with the University of Warwick's SME Export Initiative the company were able to carry out electromagnetic compatibility testing of the product. They were also able to undertake market analysis of the European market and analyse relevant European legislation.

Sprue Aegis also worked with the University of Warwick to produce a set of SLA components as Warwick's Manufacturing Group (WMG) has more sophisticated rapid prototyping facilities than Coventry University. The components produced by WMG enabled Coventry University to then produce silicon moulds for vacuum castings.

COMPANY BENEFITS FROM COLLABORATION WITH COVENTRY UNIVERSITY

The benefits that Sprue Aegis has received from collaborating with Coventry University cannot be overstated. The company came to the University with an initial concept which has, over the period of three years, been developed in to a product with a substantial future market. The University's involvement has been wide-ranging and support has been offered in a variety of forms which are detailed all through this application. These benefits include:

Product development

The company were able to develop a product from an initial concept and were able to evaluate each design iteration normally within less than two days by the use of a set of FDM prototypes, changes could be made quicker and a more appropriate design produced. In basic terms Sprue Aegis was able to inexpensively test a range of prototypes before investing in the process of tooling. Before tooling commenced the company was able to have complete confidence in the product that they were developing.

Easy access to university expertise and services

Location in the TechnoCentre has meant that Sprue Aegis have been able to easily access the wealth of information that the University holds including intellectual property expertise, advanced laser joining technology and a comprehensive rapid prototyping service.

During the product development stage Nick Rutter was able to draw upon the wider network of business support that exists across Coventry University. Nick graduated from Coventry University's 'Transport Design' course and sought assistance from one of his previous tutors for help with the thermodynamics and fluid dynamics. The academic was able to undertake testing regarding smoke flow.

Marketing

The Unit played an important role in helping Sprue Aegis to market their product. As well as producing rapid prototyping models that could be used in presentations, the Unit was able to produce images that could be used on packaging using a technique known as Form Z renderings. These images were used on the company's initial packaging which allowed them to approach potential clients with a packaged product.

Minimum cost

The work carried out at the University has saved Sprue Aegis considerable time and investment in other processes. The company was able to undertake the work with the University at minimum cost save some small expenditure for materials.

Financial support

Sprue Aegis was able to access £55,000 from the Graduate Enterprise Scheme. The company also sought assistance from Coventry University Enterprises Ltd to source funding which led to a grant of £10,000 from the Montage project also based at the TechnoCentre

When the company was struggling to meet its financial commitments in the TechnoCentre the University was advised to withdraw support from Sprue Aegis. The University not only continued to believe in and back Sprue Aegis but also invested further in the business.

Intellectual Property

In the October of 1998 the company filed a patent to cover the intellectual property involved incorporated in the smoke alarm with assistance from the University's Intellectual Property Committee. Sprue Aegis was also able to undertake patent novelty searches at no cost using Coventry University Library's patent collection.

Access to up-to-date technology

Sprue Aegis was able to access some of the best technology available in their work with Coventry University including access to laser welding techniques.

BENEFITS OF COLLABORATION TO UNIVERSITY

Spin-out company

The company has worked in collaboration with the University since the initial concept in July 1998. The University has watched the company develop and Sprue Aegis is one of Coventry University's most successful spin-out companies.

Company based in University's TechnoCentre

Sprue Aegis remains based within the University's own TechnoCentre and the company has now expanded to office space six times larger than their original office.

Research

The company's collaboration with the University has been wide-ranging and has included support from working on an initial design to the more complex testing of the product. The design and development of the smoke alarm has enabled the University to undertake research into smoke flow and solar power alarm systems. Some of this research has enabled the University to develop techniques that can be used in other applications in the future. Continued collaboration with Sprue Aegis will provide the University with opportunities to develop further new techniques.

Financial benefits

The University has £25,000 worth of shares in Sprue Aegis and has options on £25,000 of stock.

New developments

The Product Development Technology Support Unit was able to use rapid prototyping as a marketing tool to help promote the smoke alarm. Using the rapid prototyping technique imaginatively the Unit were able to use this to effectively market the product in its early stages.

Raising the profile of the University

Nick Rutter was a graduate on the University's 'Transport Design' course which has an excellent reputation for providing graduates for business and industry. This has provided the University with an opportunity to demonstrate the quality of its graduates and to highlight Coventry University as an excellent institution in which to study. The University has also received good press coverage of its services that it offers to business.

THE FUTURE FOR SPRUE AEGIS

The company continues to expand and has recently appointed a Sales and Marketing Executive and an Electronics Engineer. Plans for the future are to employ 3 further sales staff and 2 more technical staff. The company is expected to more than double projected sales for 2001 and is currently in discussions for further sales with major organisations such as Age Concern.

Sam Tate sums up the benefits of its collaboration with Coventry University by saying "We wouldn't be where we are today without the assistance of Coventry University and it would be impossible to put a price on the work that they have carried out on our behalf. The University has taken us from just having an idea to having a fully developed product that is now being sold to B&Q, Tesco, John Lewis Partnership and others. We plan to develop our range of products further and our collaboration with Coventry University looks set to continue for the future"

Bowman Stor collaborating with Coventry University

Oil and Water Separation Environmental Improvement Programme

Bowman Stor have developed additions to their current BOSS (buoyant oil separator system) oil and water separation technology that will improve environmental performance and lead to new market opportunities.

The company was set up to provide a revolutionary solution to oil and water separation in the global condensate management market. The main aim of the technology is to improve the environmental performance for companies using compressor systems and increase the efficiency and handling of the waste products. In addition the new system helps to protect service engineers from the health issues associated with exposure to large colonies of bacteria found in traditional systems.

Developments to the technology will undergo patent application and continuing work between Bowman Stor and Coventry University is considered "commercial in confidence"

Bowman Stor would like their work with Coventry University to be considered for a Development in Innovation Award. The first phase of work has been completed, a report presented and a programme of collaboration is continuing.

Background

Bowman Stor began developing a revolutionary oil separation technology for use in the condensate management industry in 1998. The buoyant oil separator system or BOSS as it is called consists of a mesh bag containing polymer wool. Dissolved and degraded lubricating oil from the compression process is captured on the bag whilst other impurities are absorbed by a series of carbon filters.

As part of ongoing developments the Managing Director and inventor John Timmins was concerned with the apparent lack of information within the industry as to the identity of any materials that might be entering the water system. With environmental concerns as a priority and environmental legislation becoming ever more stringent John felt it was important to investigate this area further.

In addition with no standard performance tests being used within the industry John felt he needed to take on responsibility to identify the materials both to push forward the industry and to gain a better understanding of how successful his new technology was at removing the unwanted condensate products. Having little or no understanding of this would impede his future opportunities to improve the technology and develop his market.

With advice from the Burton Enterprise Support Agency, an approach was made through the local CONTACT network representative. The CONTACT network encourages the formation of links and development of collaboration between universities and industry in the West Midlands area. Using this network John was able to "put out a call" for expert support with his technology (CONTACT No 2). Utilising £5000 provided by the Birmingham Chamber of Commerce via the Mustard initiative a project was initiated with staff at Coventry University.

The University provided expert knowledge and facilities and instigated a program of investigation acting as a research and development arm for the company. Work is continuing to develop standard tests that John will be able to use in marketing and

improving the performance of his technology. In addition several innovative new projects are forecast to begin later this year.

The project

Oil and Water Separation Environmental Improvement Program

Project description

An identification and environmental assessment of the performance of an innovative oil separation technology.

Initial Research September 2001

This is the first interaction that Bowman Stor has had with a university and the relationship is continuing to develop. Discussions regarding the project began in September 2001 with initial investigations of the environmental impacts associated with lubricating oils and their breakdown products in addition to the bacterial issues associated with condensate systems.

The Research Program

After initial investigations into the lubricants a schedule of work was drawn up and visits made to one of the few sites in the UK where John had implemented his technology, in addition this site used the fully synthetic lubricating oil which is becoming more common to the industry. Several operating issues had come to John's notice that were creating a financial drain on Bowman Stor whilst they continued to service the equipment and try to move the technology forward.

October/November 2001

A number of samples were taken from the site and analysed using a variety of techniques. Observations of the working unit highlighted the fact that Bi-product materials from the compressor process were causing blockages to the new technology and were considered to be possible cause for concern for local water treatment companies. The issue needed to be solved fairly quickly and with no additional impact on the systems.

Solving the problem

During December and early January Dr Daniel Lynch researched the issues, identified the materials going to drain and provided the company with a scientific understanding of the processes that were occurring and inhibiting the performance of the condensate management technology.

Development of additional technology

During the final phase of the project Dr Lynch identified an environmentally acceptable method to inhibit the production of the unwanted materials. A pilot test was implemented on site and solved the problem within a very short time. The company was then able to more formally design an addition to their original technology that could be utilised in future settings. This new unit and method is now close to completion and the site where the original problems were observed is functioning causing no financial or environmental concern for Bowman Stor.

Company Benefits

Increasing awareness of marketing opportunities

By collaborating with the University the company has gained far greater understanding of the materials that are prevalent within the compressor industry and discussions with staff at the university have highlighted possible opportunities to exploit their technology further afield.

The Business Partnership Unit (BPU) introduced the company to the Midlands Innovation Relay Centre operated by Coventry University's trading company, Coventry University Enterprises Limited which is situated in the University's Technology park. The Midlands Innovation Relay Centre has recently sent out a technology call on behalf of the company. The company is now looking to apply their technology to other fields such as storm water drainage and/or where small amounts of oil need to be separated from large amounts of water.

Product development

The existing product has been improved and the company has the opportunity to include an additional feature that enables it to deal more effectively with the bi-products of compressor systems particularly fully synthetic lubricating systems thus making it more appealing to the market. This has in turn ensured that the company continues its relationship with its customers and removed the costs that were being incurred by Bowman Stor in providing on site support and replacement units.

Working with Coventry University has encouraged the company to develop its marketing strategy and move forward in the development of a web site. In addition the company has been supported in its innovative approach by looking at other technologies to employ and this has led to them seek out rota moulding company for producing the UK range of this technology

Easy access to university access and expertise

The Business Partnership Unit (BPU) facilitated the project and enabled Bowman Stor to access the Mustard fund via the CONTACT network. The BPU acts as the central communication focus and aims to encourage links and collaboration between the expertise in the university and the wider business community.

During the project the University acted as a research and development unit for the company. The BPU provided business strategy advice and Bowman Stor gained access to expertise in chemistry, including analytical services, and experts in the fields of environmental legislation and waste management.

The company was provided with interim reports at each stage of the project, face to face meetings and site visits. The collaboration is continuing and the BPU is in the process of developing a "rolling" program of work providing access for Bowman Stor to a "hot line expert" where the company can speak regularly with a member of university staff throughout the month.

Financial support and minimum cost

For a relatively small investment of £500 Bowman Stor were able to initiate a valuable project and were provided with a good quality of service by the team at Coventry University. The BPU enabled the company to draw down funds to support the project and the collaboration is continuing. The BPU are applying for support funding to enable further work to be carried out and are hoping to be successful with an application to the Manufacturing Advisory Service West Midlands. Future plans are considering a more substantial SMART award application.

Intellectual Property

The additional "dosing unit" is being considered for patent investigations and as a result of the company's greater understanding of the materials involved in the lubrication industry there are several future IPR opportunities and new product lines.

Benefits of collaboration to the University

Financial benefits

The University has gained a modest income of £5000 from the project that it is envisaged will grow as the collaboration continues.

Expanding the Universities links with industry

As a research and teaching member of staff the project has provided Dr Lynch with his first industrial collaboration which he is keen to expand upon and develop his professional skills further. The application of chemical analysis and knowledge to a practical application will also enable him to produce case study material for enhanced teaching.

Staff Development opportunities

The School of Science and the Environment has always encouraged links with industry and funds from such projects are used internally specifically for staff development and to encourage further research.

Money from this project work will enable academic Dr Daniel Lynch to use state of the art equipment not available in the UK to further his research and he has developed links with Griffith University in Brisbane, a trip is now planned for summer 2002.

Raising the profile of the University

The work carried out with Bowman Stor is the subject of a Case Study to be published in the University's business newsletter that helps to demonstrate how effective links with industry can be established.

Building expertise

Applying chemical theory to practice in this departure from the traditional teaching curriculum has highlighted a number of issues that business and industry have to deal with. This has provided the university with an opportunity to support a local business but also to take this knowledge further and perhaps offer bespoke training related to the treatment of waste. The materials used in lubricating systems are ubiquitous in industry and it is possible that training and other consultancy can be grown from this experience with further industry/university collaboration in the future.

Future collaboration

The relationship with Bowman Stor is set to grow with the "rolling hot line" expert about to begin. In addition the next stage of project is to develop quantification methods to measure the impact of future design changes and improvements to the system.

A project is also being timetabled to investigate the bacterial populations involved in both traditional systems and the innovative system that Bowman Stor has developed. This relates to the health issues surrounding older condensate management methods that will hopefully lead to a reduction in health risks for service engineers.

A project is also in the process of being initiated with the school of Mathematics and Information Systems possibly with a student placement, looking at modelling certain aspects of the technology performance with a view to designing new parts for the unit.

In the longer term Mr Timmins is interested in treating a number of other waste products and talks are in process to look at an entirely new system of treatment. The University is seeking funding in order to continue this work.

Future for Bowman Stor

Bowman Stor will shortly have the capability to manufacture and distribute the new technology in the UK and based on sales of the equipment in Europe this market will grow quickly. The company has developed a relationship with a European distributor but is looking to expand this further although a new partner may be sought. The company is hoping to take up to two other employees in the next 12 months and the company producing the moulds for the unit may also be involved in the manufacturing process thus two companies will increase their output. Bowman Stor are seeking to challenge the traditional ways of working in this established market and believe that their innovative solutions offer immense opportunities.

European countries are becoming more concerned with synthetic lubricating oils and legislation control will no doubt help to boost Bowman Stor's opportunity for increased sales once the performance testing has been developed.

Managing Director John Timmins sums up the benefits of its collaboration with Coventry University by saying "We have made substantial improvements to our existing product range with the assistance of Coventry University and our opportunities to develop a future range of products will keep us competitive in a challenging market. It would be impossible to put a price on the work that Coventry University has carried out on our behalf, they have effectively acted as a Research and Development arm that is so vital to small companies that struggle to deal with day to day pressures and often don't have sufficient time to plan ahead. We are delighted with our results of our work with Coventry University and this collaboration looks set to continue for the foreseeable future".