

**Design Supporting Business – *Research-through-practice by practice as research***  
(Portfolio)

This research investigates methods in which companies (Large Enterprises (LE's) and Small to Medium sized Enterprises (SME's)) can be supported effectively in utilising design in their New Product Development (NPD) strategies – thus benefitting the economy through efficient innovation. This represents a highly original body of work bringing together findings from over 180 design research projects across private sector commissions (LE's and SME's) and a number of Government funded design support schemes (Improving Business by Design, Manufacturing Advisory Service - Design Pilot Scheme, European Development Fund - SME Design Support) all proposed and implemented by the investigator.

The research compares a number of combined design and funding support scenarios using the 'success' of products to market (generating revenue, creating/securing jobs) as evidence of the relative efficacy of these methods. It proposes that companies who do not have design capability will have increased success when supported by a design capable body, that can manage and oversee all aspects of the design process from securing funding through to manufacture (activity that extends beyond design consultancy alone). The research identifies an 80% success rate for companies that utilise such support and a 90% failure rate for those that don't. The research also indicates that there is little difference between projects which are 100% Government funded with those that are %50 Government funded or with those that are %100 Private sector funded. This has implications on how Governments can most cost effectively implement funding for SME's in NPD.

Dissemination includes: Guest speaker, Origin Oman's Product Design and Packaging Workshop: Panel member for the PEIE 2009 (Oman): Guest speaker, opening event of the University of Pelita Harapan, 2010 (Malaysia) Be Transformed Festival. Findings culminated in a conference paper presented Boston 2012 and Antwerp 2012.

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## Output Description

This portfolio outlines three design support projects proposed and delivered by this investigator and a number of private sector design research commissions (also undertaken by this investigator),

It highlight the benefits of a 'Design Capable Body' (undertaking 'Management and Integration' of New Product Development (NPD) activities for companies – see Fuzzy Front End Paper) that can undertake specific design research projects in addition to proposing, implementing and delivering design support schemes; that is:

- Secure and manage funding
- Produce design specifications
- Manage and co-ordinate Creative Economy support in delivering design research projects
- Manage and co-ordinate Innovation Networks (e.g. iNET's) in delivering design research projects
- Manage and effectively pool together resource and expertise (in a neutral capacity), skills and resources from what are normally competitive companies within the Creative Economy
- Provide time and resource to see projects through to production that would fall outside the scope of 'normal' consultancy activity

This design capable body is acting as an external 'heavy weight project manager' on behalf of companies who do not have experience of design and NPD. This body is more than just a funding or networking agent, it possesses design expertise and experience in its own right in order to propose and manage design research projects and all aspects of new NPD in order to achieve product success. The design capable body is in effect acting as a translator for client companies for all aspects of the projects between all parties involved.

**Key findings** from this research indicate (based on over 181\* individual design research interventions (undertaken by this investigator) for LE's and SME's) **that:**

- This approach can lead to a 90% success rate in products through to manufacture (especially for SME's)
- Where companies who don't have design experience and try to manage projects without the support of a design capable body, there is an 80% failure rate of projects through to manufacture
- Where projects are actively 'sought out' and are relatively long in duration (intensive), there is little difference in the success rate whether design research projects are 100% funded or 50% funded (by Government or similar).
- Where projects are not actively sought and relatively short (light touch), the success rate of projects through to manufacture is 25% at best; representing poor value for money for funders.

## SUMMARY OF DESIGN RESEARCH SUPPORT INTERVENTIONS – THE ENGAGED SCHOLARSHIP MODEL

Three design support schemes, designed, implemented and delivered by this investigator from 2005 (the 2005 to 2007 scheme is included for context only as it falls outside the census period) to the present, are compared and contrasted. Each was structured and delivered in a different way these in turn have been compared with a group of design research projects directly commissioned from the private sector (also undertaken by this investigator). This represents the 181\* design research projects and has led to the findings described above.

### **Improving Business by Design (IBBD) – note, included for context only.**

*Commenced October 2005 – Concluded February 2007 (outside the census period for REF 2014)*

IBBD was included in the investigators RAE 2008 submission (and as such no material for it is presented here), although results of this research have been obtained for the current census period and form part of one of the UoA34 Impact Case studies and the findings presented in the 'Fuzzy Front End' paper.

<http://webarchive.nationalarchives.gov.uk/+http://www.dti.gov.uk/ministers/speeches/sainsbury221105.html> (paragraphs 18 and 19)

IBBD was the first of three design support research exercises undertaken by the Design Unit design research group at De Montfort University.

16 projects of various types were undertaken.

#### Key Features:

- All design aspects projects were 100% funded by the East Midland Development Agency (EMDA) in terms of the design activity, the 'client companies' investing in any subsequent manufacturing.
- Scheme open to SME's only.
- All projects were actively identified (via company and project analysis) by the Design Unit, as was the production of all the design project specifications, the contracting of delivery collaborators, all project monitoring and after project support.
- All projects were undertaken by commissioned, product design consultants.

#### **Key Findings:**

- High success rate achieved; 15 out of the 16 projects reached manufacture.
- The Design Unit and the group of commissioned consultants combined were able to provide much more effective resource for the client companies.
- The 100% EMDA funding did not have an impact on the quality of projects, the client companies and the success rate.
- Many projects took three years or more to reach manufacture, difficulties in obtaining capital investment funding being a significant in this.
- A dedicated, '**design capable body**' supporting the client companies over this period was essential considering the time taken to fund the production of the product.

## **MAS (Manufacturing Advisory Service) Design Pilot Scheme**

*Commenced October 2008 – Concluded September 2009*

Funding £335,000 – (£218,000 MAS, £117,000 Private Sector)

The East Midlands Development Agency (EMDA) had for some time been considering the best way to support Design within the East Midlands, commissioning a number of studies on it typically the COMEDIA report of 2002/2003, the TRENDS report on design in Leicestershire 2004/2005 and the PACEC report of 2008.

EMDA had been considering the Design Councils 'Designing Demand' scheme; however EMDA had concerns over its value for money.

As the Improving Business by Design (IBD) scheme had been so successful, EMDA approached this investigator to develop a design support scheme that could be delivered under the MAS banner, hence the MAS Design Pilot.

The MAS scheme built on IBBB but primarily differed in that the design elements of the project were only 50% funded (and not 100% as with IBBB) and that individual projects were undertaken by both the Design Unit and commissioned, product design consultants.

Like IBBB this Design Pilot scheme would enlist design consultancies to undertake design projects (although the investigators design research group (the Design Unit) at DMU also undertook some of the specific interventions), it differed in that projects would be %50 funded by the MAS and 50% funded by the private sector (the SME's).

13 projects of various types were undertaken; 3 case studies are presented later in this portfolio.

### **Key Features:**

- All design aspects of the projects were 50% funded by the MAS and 50% by the Private Sector client companies for the design element of the project, the client companies investing in any subsequent manufacturing.
- Scheme open to SME's only
- Again all projects were actively identified (via company and project analysis, supported by the MAS network), as was the production of all the design project specifications, the contracting of delivery collaborators, all project monitoring and after project support.
- 6 projects were undertaken by the Design Unit and 7 by commissioned product design consultants.

### **Key Findings:**

- High success rate achieved; 11 out of the 13 projects reached manufacture.
- The Design Unit and the group of commissioned consultants combined continued to provide much more effective resource for the client companies.
- The 50% MAS funding did not have an impact on the quality of projects, the client companies and the success rate
- The initiative enabled to possibility for 'mixing' staff from different consultancies (maximising skill and experience base) on a single project. The 'design capable' managing body was able to orchestrate this from a neutral perspective.
- Again many projects took three years or more to reach manufacture, difficulties in obtaining capital investment funding being a significant in this.

- Again a dedicated, '**design capable body**' supporting the client companies over this period was essential considering the time taken to fund the production of the product.

## **ERDF SME Design Support**

*Commenced January 2009 – Concluded January 2013*

Funding £450,000 – (European Development Fund)

Again this scheme built on the findings of both the IBBD and MAS projects; it differed however in that the funding was provided by the European Regional Development Fund but primarily that 'client companies/projects' were **not** 'actively' sought by the Design Unit, the scheme was open to all SME's who passed the minimum project requirements; therefore a larger number of projects were undertaken of varying durations (two days minimum to 30 days maximum - typically). As such a greater number of projects were undertaken.

The Regional SME Design Support project represented a significant strategic investment opportunity in the East Midlands design and innovation infrastructure, providing demonstrable benefits for the regional economy whilst contributing to development policy goals. Additionally, this scheme directly addressed a major conclusion of the Cox Review of Creativity that addresses the strategic future of the UK's design and creative industries, a key recommendation being that universities and SMEs should form stronger links, particularly through the provision of capital facilities at universities that support SMEs. (Ref Cox Review of Creativity, HM Treasury, November 2005).

As with IBBD and the MAS Design Pilot scheme the De Montfort University Design Unit was in effect acting as the link in this instance between academia industry and the Creative Economy, acting as the 'design capable body', establishing, monitoring and delivering not just the design support scheme in itself but monitoring projects through to manufacture.

110 projects of various types and durations were undertaken; 3 case studies are presented later in this portfolio.

### Key Features:

- All design aspects of the projects were fully funded by the ERDF, the client companies investing in any subsequent manufacturing.
- Projects not actively sought, but invited through application.
- Scheme open to SME's only.
- 110 projects/interventions undertaken including 25 'deep' interventions lasting more than 20 days of support.
- Individual design research projects were undertaken by both the Design Unit and by commissioned product design consultants.

### **Key Findings:**

- High success rate achieved with the 25 deeper interventions with well over 20 in or proceeding to manufacture.
- The success rate of the remaining 85, 'less deep' interventions, drops dramatically to 25%
- With the option of lighter interventions (2 days minimum) and free funding, client companies are more likely to just 'have a go' with moderate or little expectation of proceeding with the project and seeing it through to manufacture

- In circumstances where the client company did not want to take advantage of the Management and Integration (M&I) opportunities of the design capable body and undertake project management themselves, success rate dropped to less than 20%
- The Design Unit and the group of commissioned consultants combined, continued to provide much more effective resource for the client companies. In addition the project was able to enlist the support of the Regions Innovation Networks (iNET's).
- The initiative continued to 'mix' staff from different consultancies (maximising skill and experience base – where appropriate) on a single project. Again the 'design capable' managing body was able to orchestrate this from a neutral perspective.
- Again many projects are taking three years or more to reach manufacture, gain difficulties in obtaining capital investment funding being a significant in this.
- The dedicated, '**design capable body**' supporting the client companies over this period was essential considering the time taken to fund the production of the product.

### **Private Sector Commissions**

Of the 181 design research projects forming this study 52 were private sector commissions, many of these being from Large Enterprises.

In most of these cases these companies regularly undertook NPD and possessed their own 'in-house' design teams and or project managers, the Design Unit design research team in effect expanding these in-house teams.

In these circumstances (LE's) project success was dependant on the skill and experience of these in-house design research teams and project managers which in reality proved to be very mixed. In a number of circumstances where this experience was actually relatively low, projects were successful simply because the client company was too big to let it fail.

With private sector commissions from smaller SME's (with limited experience of NPD) success was very much more dependent on the Management and Integration (M&I) capability of the design capable body.

In these circumstances however it was also observed that a 90% success rate was achieved when the client company took advantage of externally provided Management and Integration and an 80% failure rate when they did not.

A significant benefit of undertaking these private sector design research commissions was also to enhance the experience of the design capable body which in turn is of benefit to the SME's who need the M&I support.

2 case studies are included later in this portfolio to illustrate how successfully a design capable body can be integrated into and LE's design provision and how this experience can help benefit (directly or indirectly) SME's in the development of their projects.

### **THIS PORTFOLIO ALSO PRESENTS:**

- Two international conference papers communicating and disseminating the findings of this research
- Abridged project reports for the MAS and ERDF Design Support Schemes
- Evidence of how this work has provided international benefit

**Design Supporting Business**

**Output Highlights – MAS Design Pilot Scheme**



<http://www.sheltonsdrainage.com/Supertrencher-560.html>

**Shelton Sportsturf Supertrencher**





# Shelton Supertrencher

<http://www.sheltonsdrainage.com/drainage-machinery.html#trenchers>

Client Shelton Sportstuff Drainage

Source of funding MAS Design Pilot Scheme

Date to market January 2012

Patent number NA Principal Researcher: Peter Ford



## **Aim:**

To develop a Supertrencher that can be used in wet weather, therefore all year round.

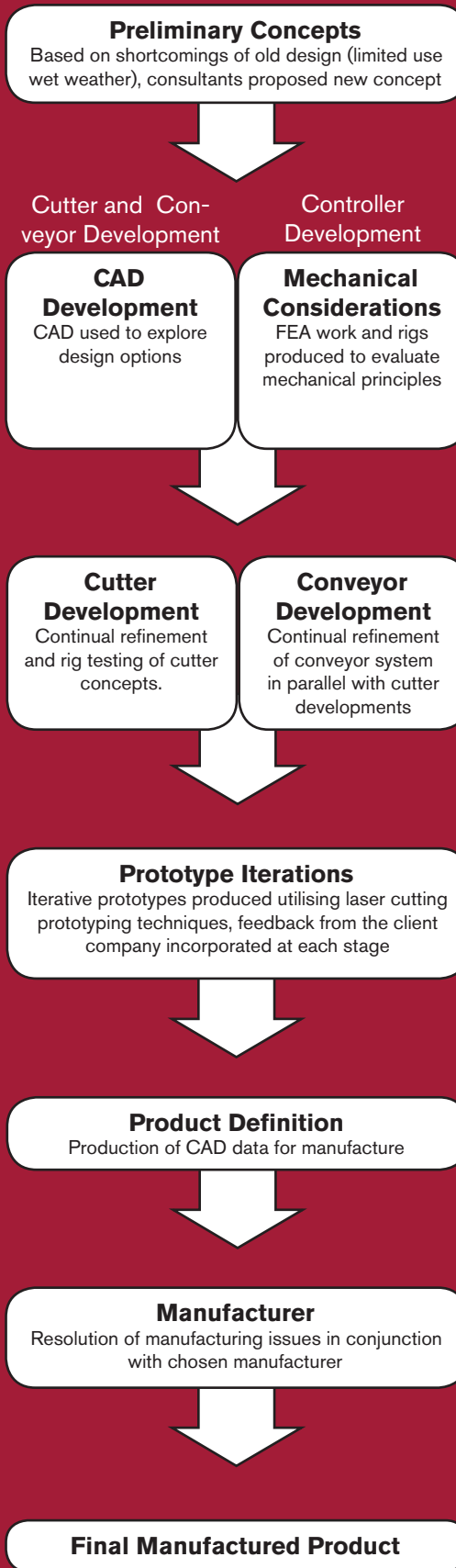
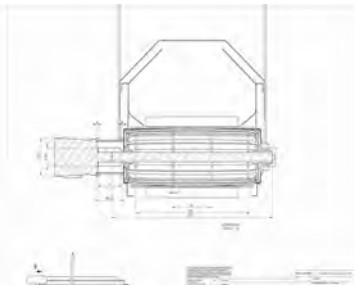
## **Innovation:**

A trench cutting device that self clears while depositing earth onto an integrated conveyor that can compensate automatically for dry or wet soil and or environments.

## **Key Research Questions:**

- How can soil be removed from the trenching cutter and placed onto the conveyor without slowing the cut.
- How can the associated conveyor be integrated in such a way so as to assist in soil removal
- How can the cutter be made stable in use on soft ground
- How can the conveyor be made stowable (in transit) without impacting on performance

# Research Methods



Concept Development  
(Law and Canard Design)

Concept / prototype evaluation and iterative development (Client, DMU Consultants and Company)

Final definition and product manufacture (Consultants, Client Company and Manufacturer)

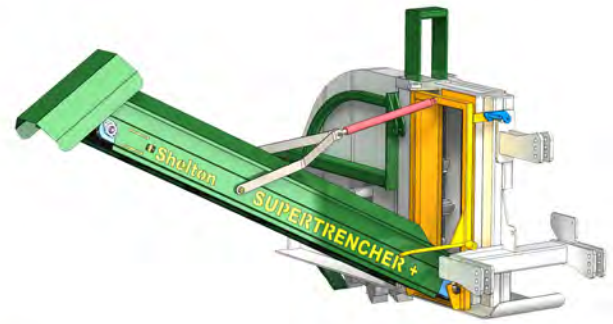
## Significance & Originality:

The method whereby they conveyer and its feed mechanism works alongside the trench cutter to extract material from the cutter when the ground is wet or dry is unique to Shelton Sportsturf. This combined with the trenchers support system to prevent the trench collapsing inward collapsing has led to a product that can be used throughout the year (wet and dry) opening up new market potential for Shelton

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## Rigour:

Extensive use of 3D CAD and analysis (Finite Element Analysis) alongside a chronology of physical mock-ups and prototypes to both theoretically and empirically validate design.



SuperTrencher - Conveyor redesign - iss2 1

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## Impact:

A unique product into the market place making it possible to undertake ground work in areas such a golf courses all year round.

£250,000 of increased sales to Sheltonsportsturf from January 2012 to June 2013, securing 3 jobs and creating one job at Shelton.



**Design Supporting Business**

**Output Highlights – MAS Design Pilot Scheme**



**Clean Surface – Neutral Pressure Shuttle Valve**



# Neutral Pressure Valve

Client	Clean Surface Ltd		
Source of funding	Manufacturing Advisory Service DMU Design Pilot Scheme		
Date to market		TBC	
Patent number		TBC	Principal Researcher: Peter Ford



## **Aim:**

To investigate reliable and safe methods of feeding a variety of products (typically solid CO<sub>2</sub>) into a pressurised system.

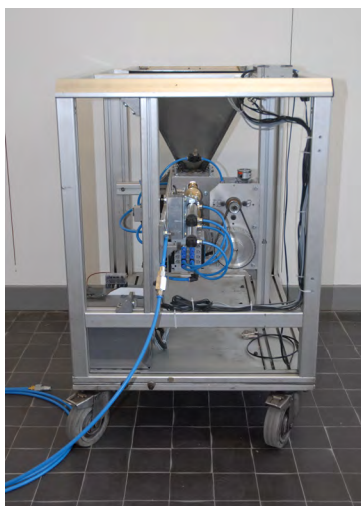
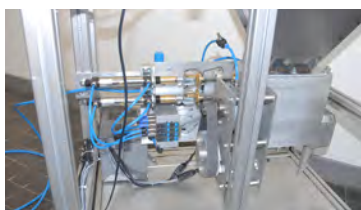
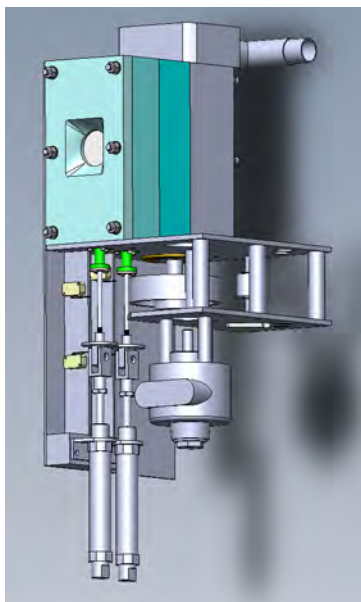
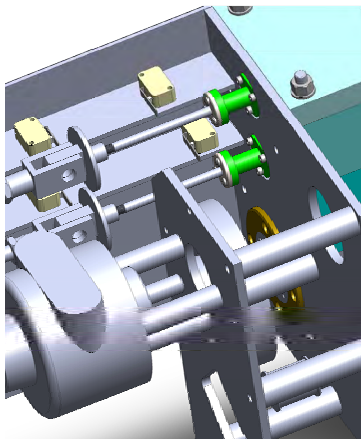
## **Innovation:**

The development of a two chamber, two shutter system that provides a route through for product, alternating between atmospheric and operational pressures thus eliminating friction in the system. This has enabled the development of a product that does not require a heavily engineered approach to overcome the friction normally associated with this kind of device.

## **Key Research Questions:**

Q1: Is it possible to introduce material into a pressurised system in a manner that does not place significant mechanical demands on that system?

# Research Methods



**Identified Market Need**  
Client company identified need to combine the benefits of two different systems within a single unit.



**Brainstorming Consultation**  
Event organised to identify potential issues and challenges with the client company and external consultants. Possible solution approaches discussed.



**Selected Proposed Concept**  
The isolation chamber concept was selected based upon specification and potential issues.



**CAD Development**  
Concept approach was developed using computer aided design.



**Production of Prototype Rig & Testing**  
Prototype mechanical rig was produced to allow concept testing. The rig was tested in-house to identify any issues.



**Issue Resolution & Prototype Development**  
Solutions were developed to address identified issues. Rig was refined to include required changes.



**Continued Testing and Development**  
Prototype rig was presented to client company for continued testing and development

Concept definition  
(DMU, Client Company and External Consultants)

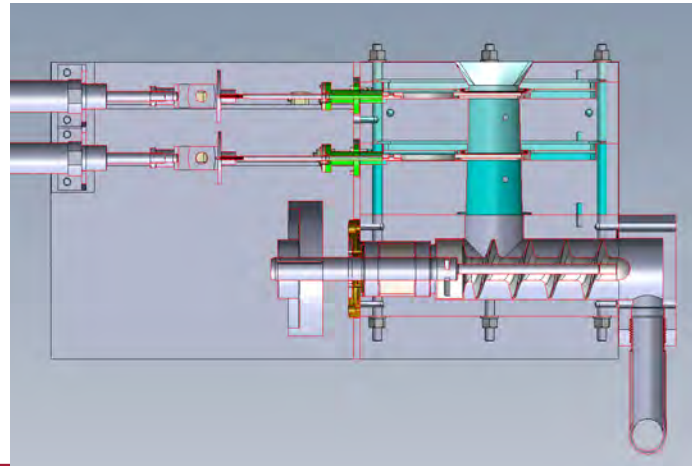
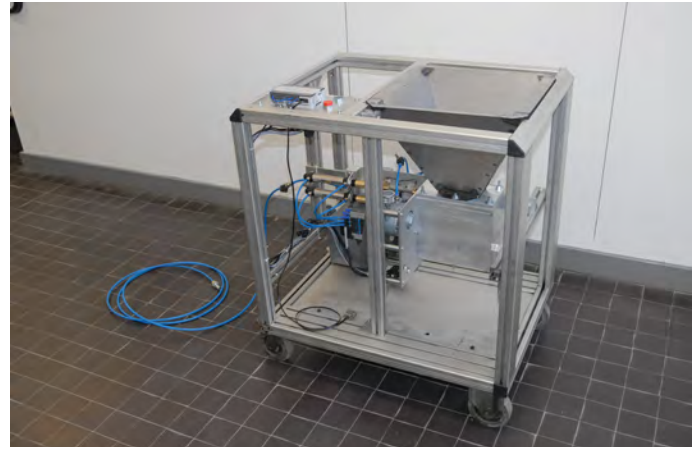
Concept Development (DMU)

Continued development  
(Client Company)

## Originality & Significance:

Originality centres on using neutral pressure to avoid the friction traditionally associated with pressurised systems. This unique approach therefore makes it possible to introduce material into a pressurised system without the need for heavy engineering to counteract this friction. The system comprises of two chambers and two shutters which operate in a defined sequence. Each chamber is either at atmospheric or at operational pressure. When the first shutter is open solid CO<sub>2</sub> can drop into the first chamber at atmospheric pressure. The second shutter is sealed due to the higher pressure in the second chamber. The first shutter closes enabling the first chamber to be pressurised to the operational pressure of the system sealing the first shutter. With the first chamber at the same pressure as the second, the second shutter is now free to open dispensing the CO<sub>2</sub> into the pressurised flow.

Significance centres on the potential to revolutionise the transfer of materials into pressurised systems with minimal friction in that system.



## Rigour:

Research was undertaken via an iterative optimisation methodology to define the working parameters, leading to the development of a unique shutter/chamber arrangement and the means for controlling the pressure in each chamber thus operating at neutral pressure.

A high quality, complete working prototype was produced and used as a development tool. The final iteration is currently undergoing evaluation and further development by Clean Surface Ltd.



## Impact:

- Increased sales, therefore GVA for Clean Surface Ltd
- Jobs created within Clean Surface and therefore growth
- Increase New knowledge relating to a way of feeding product into a pressurised system via a frictionless system



<http://www.albertmedicaldevices.com/>

**Albert Medical Devices – Melio Leg Bag**

**albert medical devices**  
Technology to advance self care



# Albert Leg Bag (Melio)

<http://www.albertmedicaldevices.com/>

Client Albert UK Ltd

Source of funding — MAS Design Pilot Scheme

Date to market Mid 2012

Patent number 02796922.9

Principal Researcher: Peter Ford



## **Aim:**

To enable a user controlled, cost effective, pumped leg bag system.

## **Innovation:**

First product on market which includes indication for the user when the system needs to be emptied and provides a discreet method of disposal.

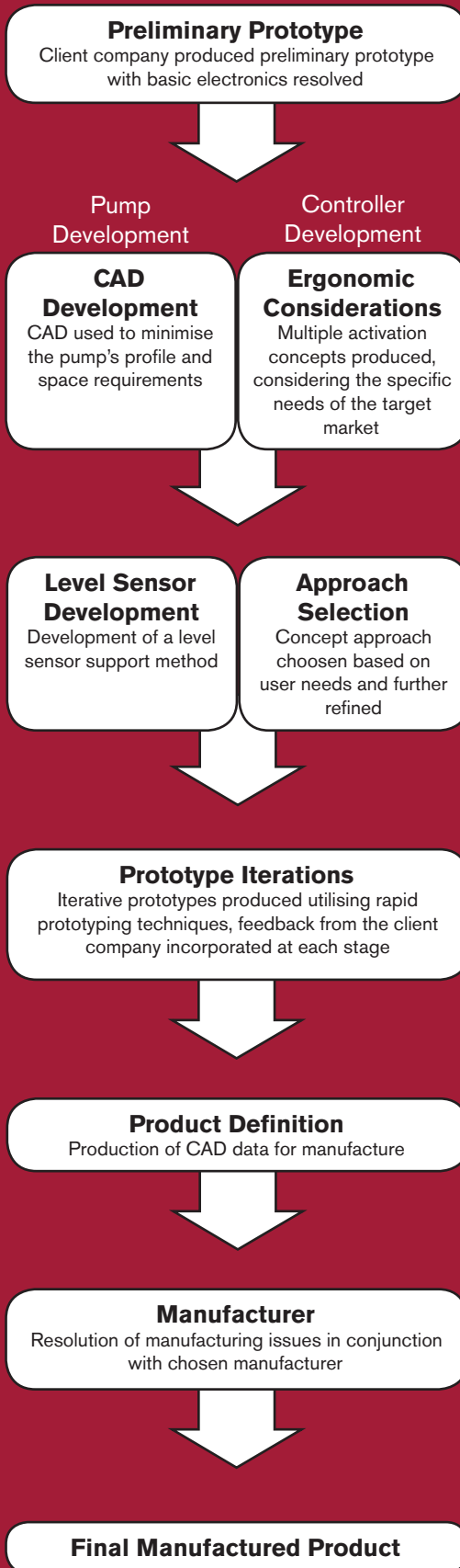
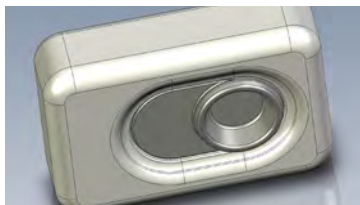
## **Key Research Questions:**

Q1: How can a fluid management system be incorporated within a flexible collection bag?

Q2: How can effective user feedback and controls be achieved within the system?

Q3: What manufacturing routes can be utilised to enable a cost effective product without compromising usability?

# Research Methods



Concept Development (DMU)

Concept / prototype evaluation and iterative development (Client Company)

Final definition and product manufacture (DMU, Client Company and Manufacturer)

## Significance & Originality:

An increased understanding of how to manage structural rigidity within a flexible system.

An innovative method of providing structural support for conductive cables within a flexible fluid filled bag. The integration of a proprietary pump to enable the cost effective manufacture of a disposable, melio leg bag system.

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## Rigour:

A series of initial basic prototypes were produced and evaluations undertaken leading to an understanding of possible configurations and constructions. This was followed by the development of a series of more advanced prototypes using additive manufacturing and related technologies used in initial trials undertaken by Albert Medical devices. Results and feedback from these experiments informed the development of pre-production prototypes utilising injection moulding technologies. These prototypes were used for field trials undertaken by Albert Medical devices.

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## Impact:

- Greater control and improved quality of life
- Increased confidence through self-management and independence
- Better fluid intake management (ease of emptying bag means patient doesn't have to regulate fluid intake)
- Reduced infection rates.
- This product will be marketed internationally



"It's an amazing product. It made me feel better and in control. Before I had all the reasons to stay home and that has really depressed me. I feel better now because I am able to live and act as a normal person."

## ERDF SME Design Support, Three Example Case Studies

### CASE STUDY 1

***Spectrum Healthcare Ergo Kneeler*** – A product to help nurses and podiatrists (typically) kneel correctly thus reducing fatigue.

### CASE STUDY 2

***Inspiration Healthcare Xenon Re Breathing System*** – A system used to minimise brain damage in extremely premature babies by enabling the capture and re use of exhaled Xenon gas (which is extremely expensive), now making it possible to use Xenon gas cost effectively. The use of Xenon gas with neonates has been proven to help damaged brain tissue heal.

### CASE STUDY 3

***Illuma Lighting Rotaspot*** – An award winning LED spot light system that uses the latest in fan cooled led lighting luminaries coupled to a unique heat dissipation system



<http://www.spectrumhealthcare.co.uk/products/ergokneeler/>

**Spectrum Healthcare – Ergo Kneeler**



# ErgoKneeler

<http://www.spectrumhealthcare.co.uk/products/ergokneeler/>

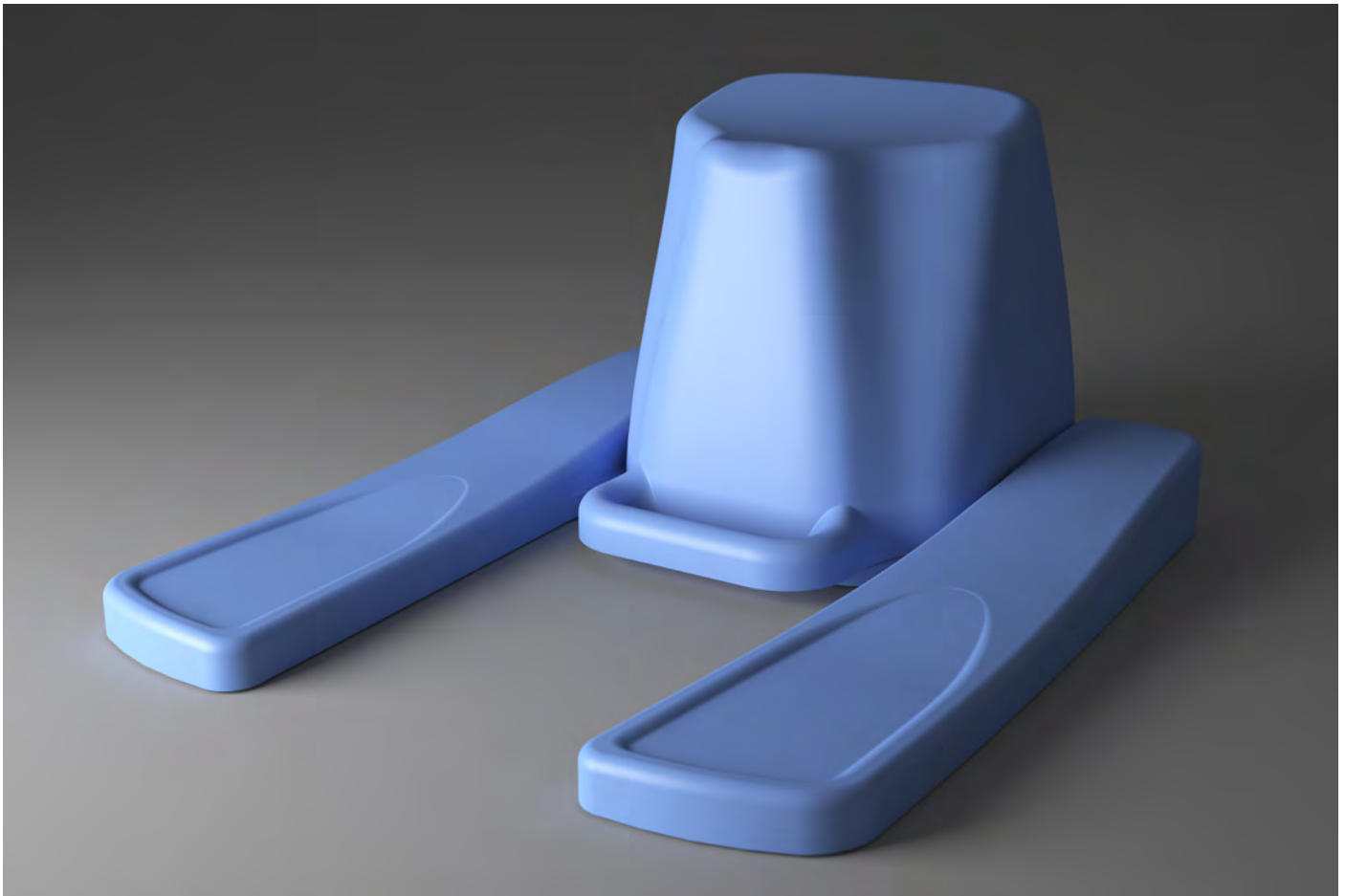
Client Spectrum Healthcare

Source of funding European Regional Development Fund

Date to market Late 2011

Registered Design number 001615311-0001

Principal Researcher: Peter Ford



## **Aim:**

Apply current knowledge to the intergration of leg and posterior support into a singular product, minimising acute and chronic physical issues associated with kneeling tasks.

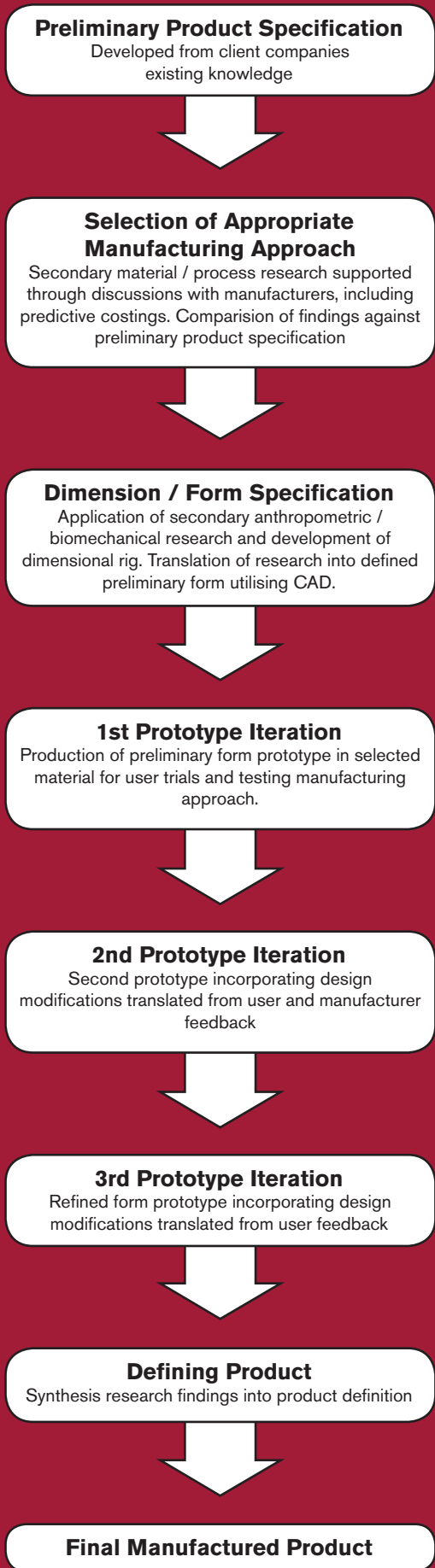
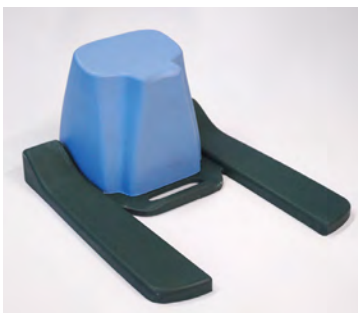
## **Innovation:**

First on market to accomodate the range of physical support into one integral product suitable for a clinical setting.

## **Key Research Questions:**

- Q1: Which manufacturings approaches provide feasible options in terms of functionality and cost?
- Q2: How can current knowledge in biomechanics be exploited to improve the functionality of the product? and What is the best approach to accommodate the range of anthropometric ratios within the user population?
- Q3: How can user feedback be best addressed in the development process?

# Research Methods



Design research and initial product definition (DMU)

Prototype evaluation and iterative development (DMU)

Prototype evaluation and iterative development (Client Company)

Final definition and product manufacture (DMU, Client Company and Manufacturer)

## Significance:

Provides an integrated solution for users who are required to spend a significant amount of time in a kneeling position to accomplish a task (initial target market is medical practitioners but principles apply to a large number of markets i.e. horticulture). Reduces the musculoskeletal stresses and postural discomfort associated with prolonged kneeling, whilst also promoting good spinal posture when undertaking tasks at low working heights



## Originality:

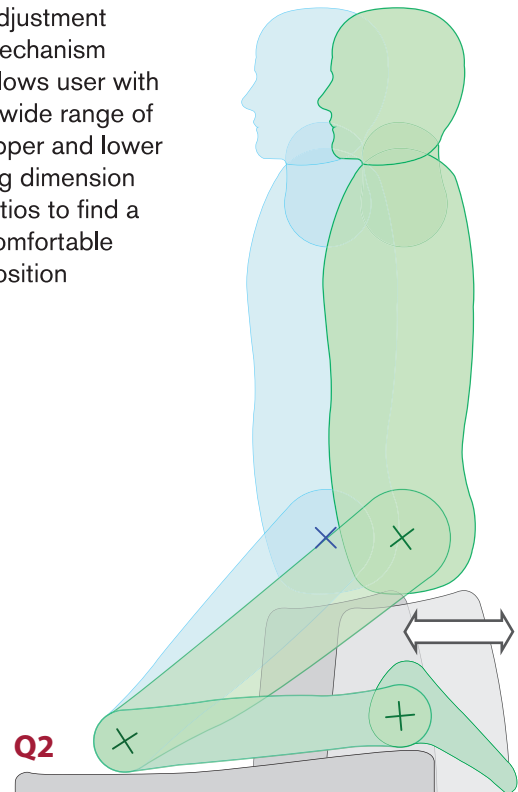
Currently no product available on the market which incorporates all the features into one integrated product. Encompasses an adjustment mechanism to accommodate the range of anthropometric measurement ratios within the user population.

**This product is being sold internationally**

## Rigour:

Is evidenced in the design research methodologies in the development of the product in parallel with the extensive use of foam moulding techniques in the initial and developmental prototyping of the product. Information from user trials, conducted at key development stages, and existing research were utilised to support design decisions through multiple iterations.

Adjustment mechanism allows user with a wide range of upper and lower leg dimension ratios to find a comfortable position



## Impact:

- Enable people who kneel statically for prolonged periods to kneel more comfortably with improved spinal posture, reduced static muscle tension and decreased compression forces
- Help reduce the risk of acute and cumulative damage, promoting the longer term musculoskeletal health of many nurses, midwives, podiatrists, therapists, school/nursery staff, carers and others
- Facilitates frequent changes in position, such as half kneeling, to reduce time spent in a single static kneeling position
- Enable some who have difficulty in kneeling to kneel more easily and comfortably
- Support staff morale, efficiency and client care
- Assist organisations in meeting their Health & Safety responsibilities towards staff

“we have all found it to be very versatile and very useful. It has come in handy on all sorts of occasions when caring for my daughter, for example I use it in the mornings when I give my daughter her chest physio...I have had very positive feedback from everyone”





Inspiration Healthcare – Xenon Re-Breather for Neonates



# Xenon Re-Breather

Client Inspiration Healthcare Ltd

Source of funding European Regional Development Fund

Date to market TBC

Patent number TBC

Principal Researcher: Peter Ford



## **Aim:**

To research into and establish a process for cost effectively developing and manufacturing a Xenon gas mixing chamber, thereby making the re-breathing system viable.

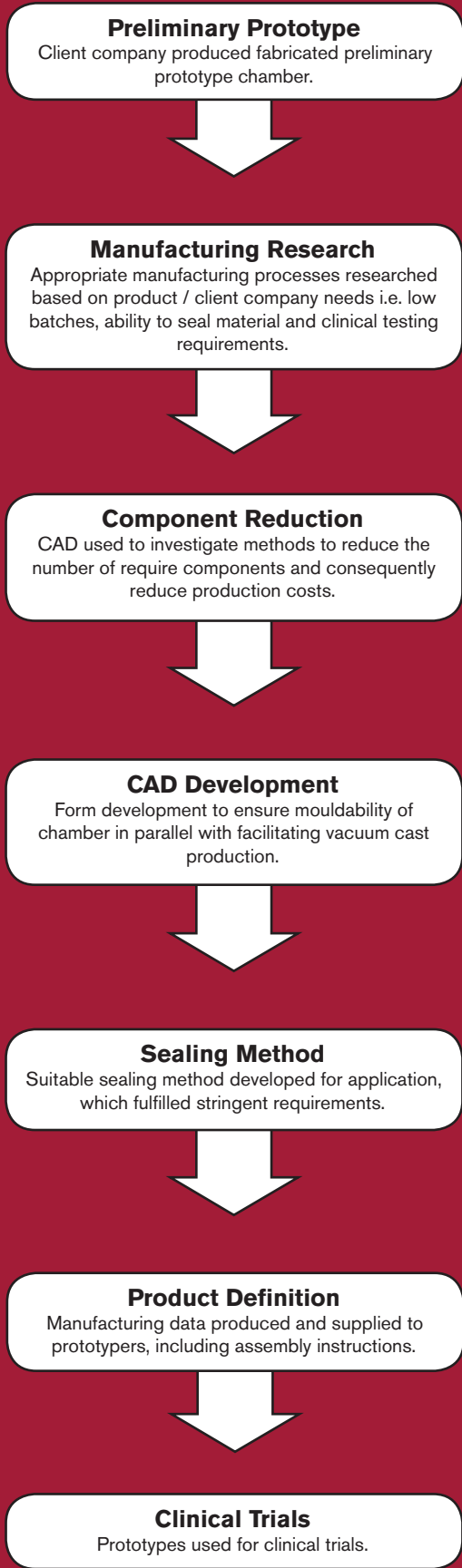
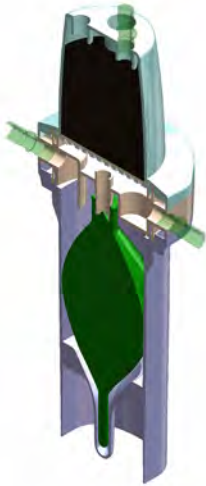
## **Innovation:**

The development of a process for simultaneously conceiving phase 1, 2, 3 prototypes, and production devices in order to undergo clinical product evaluations once. This innovation has made the production of the full xenon system commercially viable.

## **Key Research Questions:**

Q1: Can a sequence of prototyping and manufacturing methods be developed that enables Phase 1, Phase 2, Phase 3 and pre production evaluations (clinical trials) of a class 2 medical device which produce (generically) the same result and which conform to the same medical standards?

# Research Methods



Manufacturing research and concept development (DMU)

Manufacturing definition (DMU)

Clinical Trials (Client Company)

## Significance & Originality:

The successful development of an approach to prototyping medical devices at a number of different levels which conforms to medical standards eliminating the need for cost prohibitive re evaluations.

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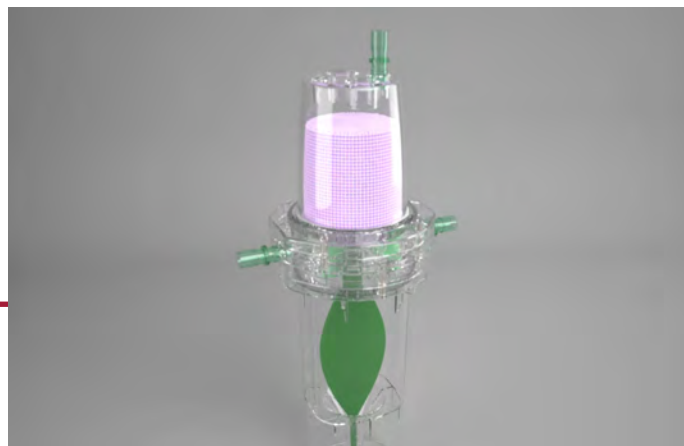
## Rigour:

Exhaustive research was undertaken into appropriate materials for use in rapid prototyped parts (that conformed to the appropriate standards), this addressed core materials, release agents and adhesives and which would produce parts identical in geometry to injection moulded, styrenic pre production items and yet be functional in their own right.

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## Impact:

- Enabling enhanced patient care (premature infants) at a viable cost
- Product to be distributed internationally
- Increase in business for Inspiration Healthcare Ltd (sales and increased revenue) and therefore, potentially, in the number of jobs created and / or secured





<http://www.illumina.co.uk/details.aspx?prodname=Rotaspot>

**Illuma – Rotaspot LED Lighting**



# Illuma Rotaspot

<http://www.illumina.co.uk/details.aspx?prodname=Rotaspot>

Client Illuma

Source of funding European Regional Development Fund

Date to market 2013

Registered Design number ?



Principal Researcher: Peter Ford



## **Aim:**

Redesign the Roataspot model to accommodate the latest Fortimo SLM LED module from Philips, and build in the ability to cope with the necessary heat dissipation

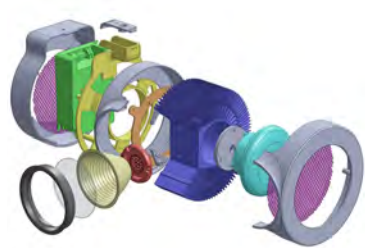
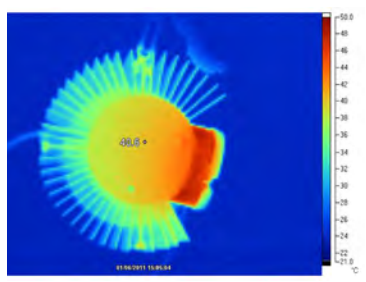
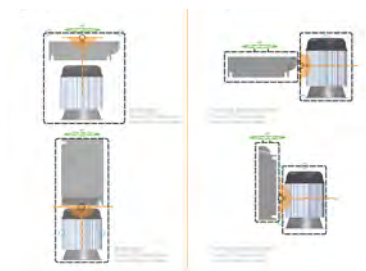
## **Innovation:**

Use of a custom heatsink design coupled with an oscillatory fan to provide optimum cooling for the LED module.

## **Key Research Questions:**

Q1: Is it possible to integrate a modern fan cooled LED based luminaire with an extruded aluminium heat dissipation component?

Q2: Is it possible to produce a cost effective, yet still visually and commercially attractive product?



**Preliminary Product Specification**  
Developed from client companies existing knowledge



**Configuration Exploration**  
Preliminary work to establish which configurations were achievable with the known components



**Stage 1 Concept Development**  
Production of multiple concepts using the different configurations. Presented to the client to establish a preferred aesthetic and functional route.



**Stage 2 Concept Development**  
Expanding on the preferred concepts and looking in more detail at the assembly of the inner components



**Heat Sink Development**  
Research into the best way to keep the LED module within operational temperature limits. Passive and active cooling explored and tested using a thermal camera, backed up by Finite Element Analysis.



**Detail Development**  
Specification of all parts and their method of assembly. CAD data produced for prototyping.



**Prototyping**  
Fully working prototype produced for product testing



**Final Manufactured Product**

Design research and initial product definition (DMU)

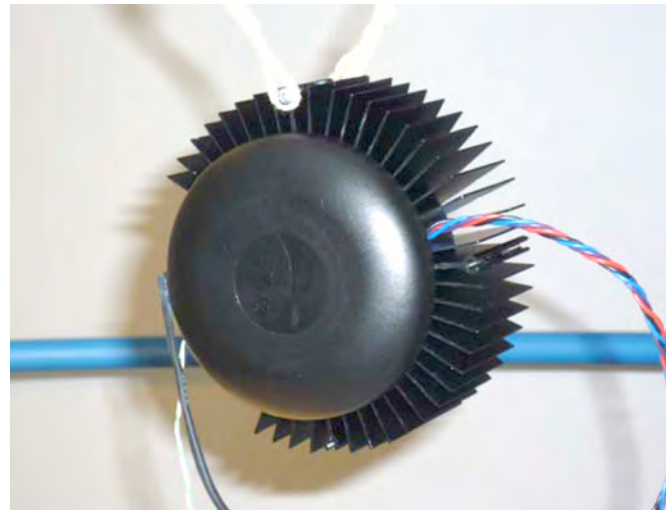
Concept pruning and iterative development (DMU)

Development and testing of internal components (Client Company)

Final definition, prototyping and product manufacture (DMU, Client Company and Manufacturer)

## Significance:

Allows the use of an LED module that is powerful enough to match a traditional bulbed light fitting. The active cooling solution is energy efficient, quiet and long lasting given that there are no mechanically moving parts. This ensures that the luminaire is ideal for long life installations with minimum maintenance required.



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## Originality:

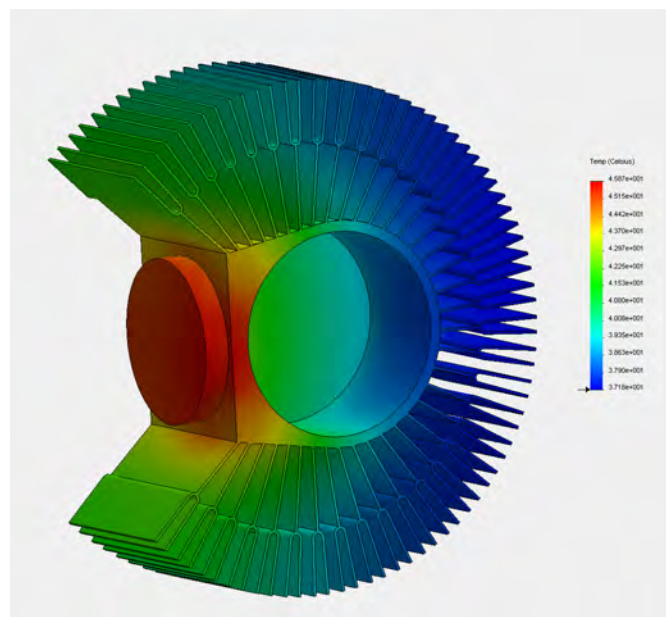
This is a brand new product for illuma and the first to use the more powerful Philips Fortimo LED modules.

**This product is being sold internationally**

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## Rigour:

Is evidenced in the design research methodologies in the development of the product in parallel with the testing of the internal cooling system. The luminaire has been designed from scratch to incorporate the Philips LED module, and indications show that the cooling system works sufficiently well to utilise the next generation of even more powerful LED modules.



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## Impact:

- Has provided Illuma with an innovative luminaire that broadens their product range and has created £100 000 worth of sales to date.
- Has created two positions at Illuma.
- Use of LED technology increases the bulb lifespan by nearly five-fold, decreasing the frequency of maintenance and the resources that this requires.
- Has given Illuma new knowledge on cooling configurations which can be re-used in future luminaires.



## **Private Sector, Large Enterprise, Design Research Commissions, 2 Example Case Studies (for context)**

### CASE STUDY 1

***G4S Victim Tracking Unit*** – A device that works alongside the prisoner tagging system but is used (typically) by victims of abuse. The product accommodates every kind of telecommunications technology to enable communication virtually anywhere in the world. Simply it enable the system to communicate discretely to the victim that the abuser (who will be tagged) is approaching or coming within the designated restriction area.

### CASE STUDY 2

***Oxford Instruments Pulsar Nuclear Magnetic Resonance Device*** – A desk top based NMR device the development of which explored the use of selective laser sintering in the prototyping of large casework components.



**G4 Security – Victim Tracking Unit**



# Victim Tracking Unit



Client G4 Security Ltd

Source of funding G4 Security Ltd

Date to market TBC

Registered Design number TBC

Principal Researcher: Peter Ford



## **Aim:**

To develop a product that communicates with a victim of abuse that the abuser is approaching the restricted zone.

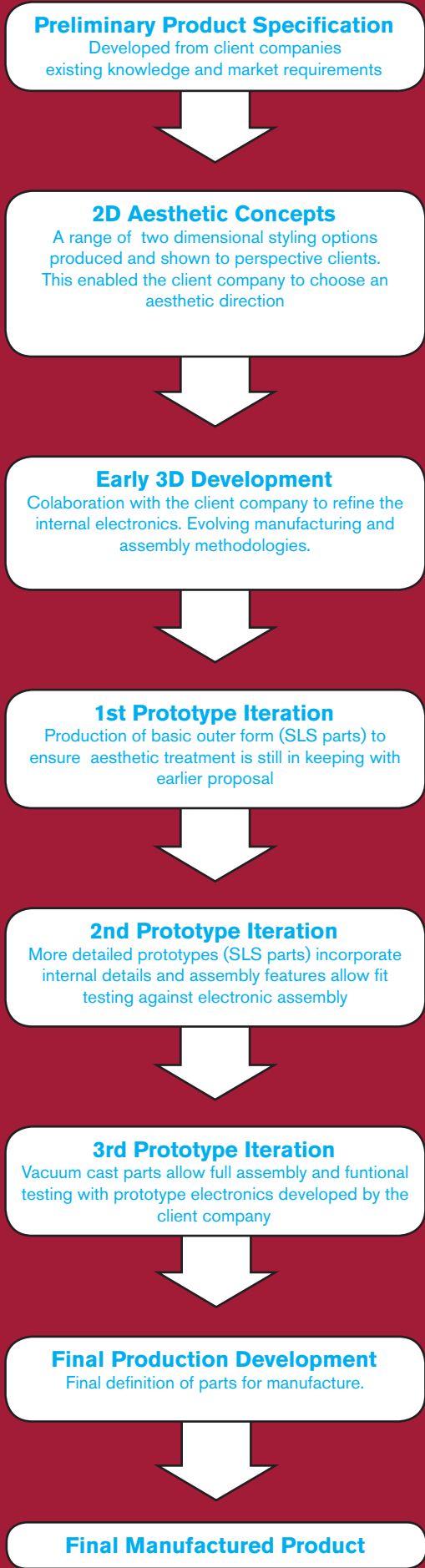
## **Innovation:**

The development of a discrete, durable and waterproof product that can accommodate a wide range of communication technology and the related power supply.

## **Key Research Question:**

Q1: Given the wireless communication demands of the VTU (Bluetooth, WiFi, GPS, etc) and the enhanced range requirements needed, can this technology (more powerful transmission and aerial reception) demanding larger re chargeable battery support, be incorporated into a hand held device small enough to be used conveniently and discretely by those under the threat of abuse?

# Research Methods



Design research and initial product definition (DMU)

Prototype evaluation and iterative development (DMU)

Prototype evaluation and iterative development (Client Company)

Final definition and product manufacture (DMU, Client Company and Manufacturer)

## Originality & Significance:

The approach to construction and internal configuration of components leading to a small yet powerful communication device, making it possible to provide the abused with an effective, discrete, safety and security device.

This is the first product of its type to provide real support to victims of serious crime, helping to prevent intentional or unintentional meetings with an abuser.

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## Impact:

The VTU provides vital support and reassurance to the often overlooked victims of crime. It has the potential to prevent incidence of re-offence, reducing crime rates and at a human level protecting people from the trauma of crime.

VTU has also allowed G4S to access a new section of the monitoring technologies market and allowed them to secure a larger contract in the world's single largest market – France.

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## Rigour:

Extensive empirical design research based on CAD and the iterative use of rapid prototyping techniques was used to develop a product which is very compact enabling it to be carried and used discreetly. Construction was developed in such a way so as not to impede transmission and reception functionality, yet robust enough to withstand exhaustive impact testing while remaining water tight. User testing was undertaken to ensure simplicity of use as the VTU must be operated simply in times of extreme stress.





<http://www.oxford-instruments.com/businesses/industrial-products/industrial-analysis/campaigns/something-is-missing/pulsar-delivering-nmr-to-your-benchtopy>

## Oxford Instruments – Pulsar Desk Top NMR System



# Oxford Instruments - Pulsar

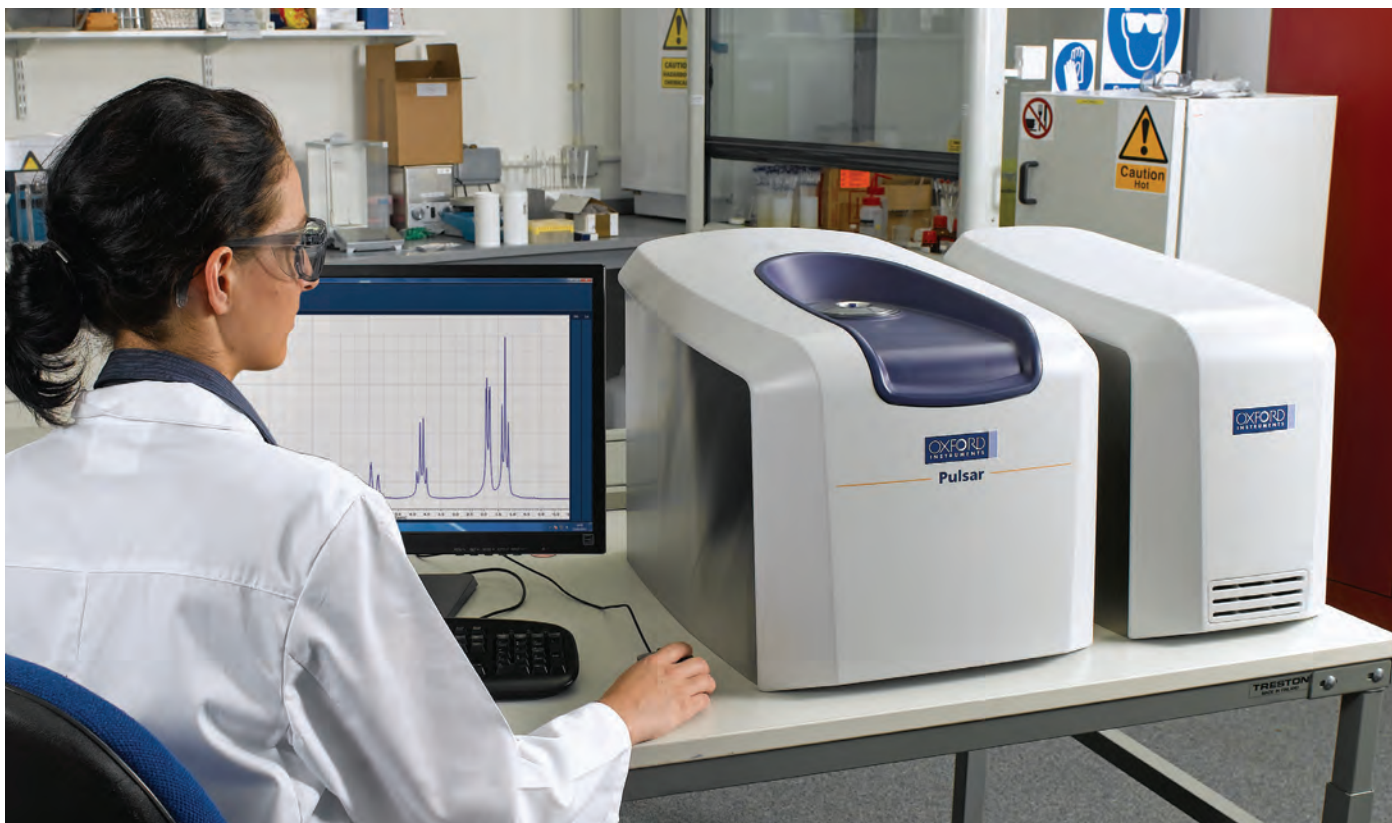
<http://www.oxford-instruments.com>

Client Oxford Instruments

Source of funding Commercial Project

Date to market Mid. 2013

Registered Design Number N/A Principal Researcher: Peter Ford



## **Aim:**

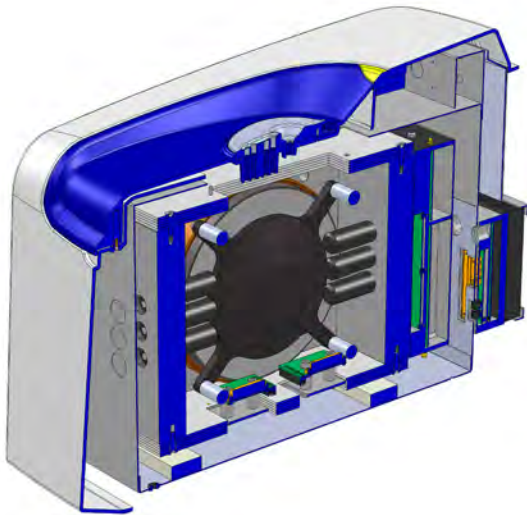
To utilise CAD systems and large scale rapid prototyping techniques to develop the new Pulsar product over a very short time frame, necessary to satisfy commercial pressures.

## **Innovation:**

The Pulsar device is an affordable bench-top, cryogen-free NMR spectrometer that offers convenience without the special requirements and cost associated with superconducting magnets. The use of rapid prototyping to emulate the final RIM cast parts facilitated the rapid development of the product, allowing it to be brought to market more quickly than would usually be possible.

## **Key Research Question:**

How can large scale rapid prototyping techniques be used to speed up and improve the efficiency of the design development process.



**Preliminary Product Specification**

Developed from client companies existing knowledge



**2D and 3D Concept Generation**

A range of 2D and 3D styling options were generated and reviewed by the client company, who chose to proceed with a combination of designs.



**Concept Development**

Taking feedback from the client, the concept was further developed with the level of detail increasing. Working closely with OI engineers to implement necessary changes to the interior components.



**Aesthetic Prototype**

Production of a full sized aesthetic block model for the client company to review and photograph for their promotional literature.



**Detailed Design Development**

Responding to feedback from the aesthetic model and some further technical demands.



**SLS Prototype**

Extensive fit and function tests carried out with the assistance of a full sized SLS prototype. The SLS accurately reproduced all details of the proposed production parts allowing for very thorough checks.



**Defining Product**

Synthesis research findings into product definition



**Final Manufactured Product**

Design research and initial product definition (DMU)

Prototype evaluation and iterative development (DMU)

Prototype evaluation and iterative development (Client Company)

Final definition and product manufacture (DMU, Client Company and Manufacturer)



### **Originality & Significance:**

The approach to product development, with its use of CAD systems and large scale rapid prototyping, has allowed the quick and efficient realisation of a new and commercially important piece of equipment for Oxford Instruments.

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### **Rigour:**

Extensive empirical design research based on CAD and the iterative use of rapid prototyping techniques allowed the development of this new product

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### **Impact:**

With its relatively low selling cost and negligible running costs, Pulsar is ideal for virtually any chemistry laboratory and ideal for teaching NMR to undergraduates

The Pulsar system as a whole has allowed Oxford Instruments to pursue a new area of the NMR Analysis market. Contributing in part to their continued success as a UK manufacturer and employer.



## **MAS Design Pilot Scheme Report**

(Introductory summary only, the full report can be provided if required).

## EAST MIDLAND MAS DESIGN PILOT SCHEME

## PROJECT REPORT

30<sup>th</sup> September 2009

## Summary of findings and observations

The East Midlands MAS Design Pilot scheme has been very well received by all who have taken part in it.

The 5 regional events have had positive feedback from all 130 attendees with 94% stating the event achieved their primary objectives for attending, 100% stating the event was relevant to their business and 76% stating the event would alter their business approach.

All 13 projects have been completed and are developing toward manufacture. Indications so far are predicting, when full production has been achieved, an increase in yearly turn over in excess of £5 million, but perhaps more importantly the generation or securing of over 50 jobs, more than double outcome requirements for the project.

The project has received a many of favourable comments, the following are a few examples:

*“The quality and professionalism of your final design drawings has made it easy for companies to provide quotations for tooling costs without having to ask further questions..... We believe that we now have a quality product to go to market with. In the UK alone there are 6 million purchases of existing leg bags alone, with the rest of Europe, sales potential is considerable. Albert UK has already had considerable sales enquiries from Germany and Saudi Arabia.....This significant increase in revenue will have a dramatic impact on Albert UK with the creation of a number of jobs”*

Trevor Wills, Managing Director, Albert UK Ltd

*“The team at DMU were able to assist us in accessing partnership funding for the project, introduce us to a design company whose skill set interfaced well with Carbolite’s own and yet still took us an incremental step forward in employing new design methodologies, new manufacturing technologies and new manufacturing materials. The end result is a new Carbolite SAFEAIR, that really looks as though it was designed and built in the 21<sup>st</sup> Century and that we are confident will be a strong seller in the modern design conscious dental industry of today”*

Alan Street, Product Manager, Carbolite Ltd

*“Finding out about the MAS funding programme was of particular interest to East Coast on a number of levels. Firstly the opportunity to work with a recognised institute such as the Design faculty of DMU and utilise their skills and experience in the design process could only benefit us in achieving our goals; secondly working in conjunction with DMU and a third party commercial product design consultant would enable us to benefit from ideas and new thinking from outside our industry, as well as hopefully allowing us to achieve our objectives more quickly; finally, in the current economic climate any assistance in product design and development is most welcome to a business, both in terms of financial and intellectual assistance”*

Dave Burley, Marketing Manager, East Coast Fittings Ltd

*“The initial meeting with Peter Ford, Canard and Brian Law were very positive and we felt that from day one they had a grasp of our requirements. Time was of the essence so with Peter Ford’s input he was able to co-ordinate the two companies so that work on the project could start almost immediately.....  
The 1<sup>st</sup> production machine is underway and early results are very favourable.  
This was the first time we have engaged in an outside design project, as we had always been nervous about the costs and results from an outside design house. Involvement in this project has been very productive, giving us confidence to adopt this route on future projects”*

Michael Claxton, Technical Manager, Shelton Sportsturf Drainage Solutions Ltd.

*“I am pleased to confirm that the whole project has gone very well from our point of view. To begin with the application and award process was quite straightforward. More importantly for our project, the involvement with MAS and particularly DMU has been very helpful. It has enabled us to put together a small group of organisations to undertake the widely differing aspects of our project”*

Mike Griffiths, Managing Director, Sound Products Ltd

*“The work undertaken by the De Montfort University Design Unit as part of the East Midland MAS Design Pilot scheme has been essential in helping Sure Technology develop a range of domestic and commercial security products that will exploit the ‘Spyral’ synthetic DNA technology currently being developed by Sure and their collaborators.  
We are delighted with the standard of work and professionalism delivered to date which is now approaching being production ready”*

Graham Marshall, Managing Director, Sure Technology Ltd

A significant factor in the success of this pilot scheme has been the unique blend of support capability offered by differing but complimentary groups; the understanding of manufacturing needs within the region and regional support systems of the MAS, the cultural understanding of design implementation and knowledge base of a large, design orientated university and the capabilities of a highly proficient commercial design sector.

In addition the scheme has provided support for a number of projects that have arisen from iNet contacts, in particular the medical sector. A good example of how different schemes can be made to work together, where design can become the innovation enabler for creative thinking and new ideas.

This combination has delivered effective 'awareness raising' of the value of design within manufacturing, critical funding of the design process itself and the mentoring and monitoring of events, follow ups and projects throughout the exercise.

It can be seen from this exercise that the development of products is not a quick one; the actual design element may only be a few months but economic climate, availability of funding for capital investment and the time to manufacture all serve to make for quite lengthy timescales. It can be seen from the project data that many of these products will not be 'on the market' until late 2010.

In this context and with hindsight it may have been better to have conducted all the regional events before the end of July 2008.

However, this alone is a significant element of 'learning' to be extracted from the project. All the 13 funded projects are products, no graphic, packaging or web site design was undertaken in fact no design exercises that could have survived with a 'light touch' design approach. The design and manufacturing of products usually requires significant investment, capital, marketing and manufacturing; the product specification and design definition has to be right so as not to squander this investment, this takes time.

The combination of the EM MAS, De Montfort University and the commercial design sector has proven to provide very effective support in this context. Typically DMU with access to its additional HEFCE funding to support innovation activities will enable the design team at DMU to 'stay with' these projects and the client companies through to completion.

The EM MAS Design Pilot Scheme has provided an intensive and comprehensive support and funding structure tailored to meet the differing needs of a wide range of product manufacturers within the EM. It is difficult see how the only possible alternative the Design Councils 'Designing Demand' scheme can compete with this level of support in the context of designing products.

Designing Demand is essentially a mentoring scheme without any direct funding of the design activity itself. The workshops, the Generate, the Innovate and Immerse programmes all follow this model; the Designing Demand document states:

*"The service is currently free, as it is supported by your Regional Development Agency. The **only cost is the design fees** related to your design project"*

Although the Designing Demand document does suggest that regions may provide a subsidy. As it stands, Designing Demand would appear to provide a worthwhile offer for those companies that can benefit from the more 'light touch' design intervention.

The deepest level of design intervention defined in the Designing Demand offer is 'Immerse' which offers up to 18 months of mentoring support; it can be seen from this EM MAS Pilot Scheme that an effective product design intervention can take over 24 months.

The EM MAS Design Pilot scheme has once again clearly demonstrated that carefully managed and directed design interventions can play a significant role in generating and safeguarding jobs within the East Midlands; it has clearly demonstrated that it is possible to effectively utilise public and private sector funding to achieve these results and in so doing provide valuable, long lasting benefit to the manufacturing and design sectors within the East Midlands.

## SECTION 1 - The Pilot Scheme

### Background

The East Midlands Development Agency (EMDA) has for some time been considering the best way to support Design within the East Midlands, commissioning a number of studies in recent years, typically the COMEDIA report of 2002/2003, the TRENDS report on design in Leicestershire 2004/2005 and more recently the PACEC report of 2008.

It is quite clear that the East Midlands (EM) is well supplied with design capability, it being the largest design sector outside of London and the South, with 8 % (4,358) of design businesses being situated in the East Midlands Region (The Business of Design: Design Industry Research, undertaken by The Design Council in association with the DBA in 2005).

In addition the EM hosts a large variety of industries both small and large prompting EMDA to develop 4 areas of distinct innovation support (iNet's) within the Region, these being:

Food and drink  
Transport  
Healthcare and bioscience  
Building and construction

Design can and will play a pivotal supporting/enabling tool to the iNets but as yet there does not appear to be a clear mechanism as to how 'design' can best provide this support within their structure and indeed provide support to the multitude of other businesses with the EM that fall outside the scope of the iNets.

It is believed EMDA will adopt an element of the Design Councils 'Designing Demand' scheme, possibly to be administered by Business Link during 2010.

The East Midlands Manufacturing Advisory Service (EM MAS) Design Pilot Scheme was intended to investigate if the MAS business support model could also be adapted to provide effective design support within the EM.

### EM MAS Design Pilot Scheme Aims and Objectives

The aims and objectives for this pilot scheme were quite simple, this was to determine if the MAS business support model could be adapted to provide the following:



- ❖ To raise the awareness of the importance of and value of design in New Product Development and in particular:
  - *Demonstrate and promote the value of good design for business performance*
  - *Demonstrate the commercial realisation of innovation*
  - *Identify potential high impact design support projects with SME's*
  - *Establish an integrated support package for SME companies*
  
- ❖ To provide an effective mechanism to both mentor and fund the delivery of a number of targeted design interventions across the EM and in so doing:
  - *Developing new or more effective products or processes*
  - *Routes to manufacture.*
  - *Identifying new markets and customers.*
  - *Reducing costs and improving resource efficiency.*
  - *Introducing lean manufacturing and best practice.*

The above was undertaken in 3 stages:

- 5 Regional awareness and stimulation events
- A series of 2 day design 'clinics'
- The undertaking of 12 design intervention projects

### **The Collaboration**

The EM MAS Design Pilot Scheme was delivered as a collaborative effort between PERA (EM MAS) and De Montfort University (DMU).

As deliverers of the current MAS manufacturing support scheme within the East Midlands, PERA have a clear understanding of the state of manufacturing within the EM and its needs and difficulties within the current economic climate. Via their business support networks and extensive data base of companies, PERA has ready access to manufacturers and new product developers within the EM.

In parallel with this DMU has considerable experience in the transfer of knowledge in the context of design between manufacturers, academia and design consultancies and in particular with the management and delivery of design projects for industry within the EM and beyond.

The combination of EM MAS and DMU made for a unique level of design support for business; EM MAS being in a position to address the practical needs of British manufacturers by delivering hands on advice and assistance in a wide range of manufacturing disciplines and DMU providing specific cultural input on design implementation and on networking with the design community within the EM.

As the EM MAS Design Pilot Scheme progressed, the network expanded to embrace experts on IP and IP management, funding investment and environmental issues and eventually with a number of design consultants on the delivery of the projects themselves.

### **Overall Project Scope, Target Output and Outcome Requirements**

A wide range of manufacturers and new product developers across the EM were invited to the 1 day events, the events themselves being relatively general in appeal. The intention was to tailor the design support to the specific needs of the companies wishing to engage the scheme; generally speaking however the majority of attendees were interested in the development of products and artefacts. As such the design support provided was within this context with projects ranging from drainage digging machines to plastic tableware.

## Summary of Results to Date

Actual for the 5, 1 day events:

<b>MAS Design events 2008</b>				
Event Location	Event Date	Total no. of People in attendance	Number of SMEs attended	No. of people from SMEs attended
Leicester	19-Jun-08	34	16	21
Nottingham	24-Jun-08	20	13	15
Northampton	18-Sep-08	18	6	6
Lincoln	23-Sep-08	18	4	6
Castle Donnington	25-Sep-08	41	19	22
<b>TOTAL ATTENDEES</b>		<b>131</b>	<b>58</b>	<b>70</b>

Projected for the Project Interventions

Company	Projected launch date	Projected increased revenue yr 1	Projected increased revenue yr2	Projected jobs created/ safeguarded yr 1	Projected jobs created/ safeguarded yr 2
<i>Agentdraw Ltd</i>	End 2010	£75,000	£150,000	1	1
<i>Albert UK Ltd</i>	End 2010	£750,000	£1,500,000	3	2
<i>Carbolite Ltd</i>	Mid 2010	£100,000	£240,000	1	1
<i>Clean Surface Ltd</i>	End 2010	£150,000	£350,000	4	2
<i>East Coast Fittings Ltd</i>	End 2010	£200,000	£400,000	1	1
<i>Guidance Ltd</i>	Mid 2010	£250,000	£250,000	2	0
<i>KoKo GB Ltd</i>	End 2010	£100,000	£150,000	1	1
<i>Protean Ltd</i>	End 2010	£100,000	£150,000	1	1
<i>Shelton Sportsturf Ltd</i>	End 2009	£150,000	£315,000	2	1
<i>Sure Technology Ltd</i>	End 2010	£1,000,000	£1,000,000	15	5
<i>Sound Products Ltd</i>	Mid 2010	£500,000	£500,000	2	1
<i>VeriVide Ltd</i>	Early 2010	£125,000	£206,000	2	0
<i>Wright Plastics Ltd</i>	End 2010	£150,000	£250,000	1	1
<b>Totals</b>		<b>£3,650,000</b>	<b>£5,461,000</b>	<b>36</b>	<b>17</b>
				<b>53</b>	

**ERDF SME Design Support Impact Report (Summary only)**

ERDF Regional Design  
Support EMX05513  
for  
De Montfort University  
Project Review

Report  
by

**JEMBRO**

## **1. Introduction and Background**

De Montfort University's (DMU) Faculty of Art and Design is known as one of the leading institutions in the UK for product design, with an emphasis on new product development (NPD). Over the last 10 years, the faculty has been awarded a broad spectrum of funding initiatives to develop new and innovative ways of NPD by designing and developing leading edge products for the East Midland Region's SMEs. Such funding initiatives include Improving Business by Design, Resource Efficient Design (RED) and Deep RED amongst others.

It is with this background of successful deployment of funding resources by developing innovative support systems for SME's in NPD that DMU were awarded this ERDF funding. The objective of the funding was to offer the design expertise and resource of the Faculty of Art and Design to the region's SMEs who have products which are either i) at the idea stage or ii) in their infancy. The funding pays typically for a minimum of two days of design support work by DMU's product design team, so permitting access by the SMEs to such resource which would normally be outside their knowledge and indeed their ability to finance.

This report seeks to assess as to whether the ERDF funding has achieved viable outcomes in terms of new products developed, an increase or potential increase in GVA, possible jobs safeguarded and new jobs created.

During this round of ERDF funding, a total of 110 SMEs from the region were assisted in the design and development of their products. From these, 24 have been approached to obtain detailed information relating to the above.

## 2. Summary

Over a period of four months, a survey was undertaken with a sample of 24 SMEs from 110 businesses which had received the benefit of ERDF funded new product design from DMU.

The outcome of the survey forms the backbone of this report. The report seeks to assess as to whether the ERDF funding has achieved viable outcomes in terms of if new products that have been developed have been commercialised and thus providing an increase or potential increase in GVA, possible jobs safeguarded and new jobs created.

Eight out of the 24 companies completed the Output and Results Recording Forms and it is from these forms and the information provided that clear results in terms of GVA increase and employment increase can be seen.

The GVA increase is a mix of actual GVA increase and potential GVA. The reason for the mix is explained in the report. The results of the eight companies show average increases in GVA over a three year period of £157,533. If this is extrapolated across the 18 businesses that have been funded for new product design and who have commercialised their product, the total GVA increase is £2,835,594.

There is an encouraging level of employment resulting directly from the funding. Two jobs have been safeguarded whilst 15 have been created of which 14 are full time.

The deployment of ERDF funding to DMU and their application of such towards new product design can be deemed to be an effective use of funding resource for the benefit of the region's SMEs.

Throughout the survey, it can be noted that not one of the businesses contacted was negative in respect of the assistance, advice and resource applied by DMU to the development of their new product.

### **3. Methodology and Approach to This Report**

The methodology applied to obtaining responses to the request for completion of the Output and Result Recording Forms was to initially approach all 24 SMEs in two phases with an email to request completion of the two forms along with an explanation as to why the information is needed (see sample email on following page). From the first phase of emails, a very limited response was received; it was assumed this was largely down to the time lag between the time in which the intervention was undertaken and the date to market for the product (in some cases, almost three years). The second phase of emails followed. These two phases were followed up within 7-10 days by two phases of telephoning each of the businesses and attempting to speak to the relevant person who had either commissioned the work or was the main point of contact whilst the work was undertaken. This initial telephone engagement elicited only a handful of responses in respect of form completion and submission.

Further rounds of calls were undertaken to follow up those who i) had said that they would return the completed forms ii) were not initially available in the first round of calls but would call back and iii) had passed the responsibility onto a colleague within their business.

Two further phases of emails followed the calls to attempt to elicit further responses from those who had shown some indication of willingness to co-operate.

The final round of phone calls to the SMEs was undertaken with those where a rapport had been established and it was felt that there was a very strong possibility, with prompting, that they would respond as requested.

Finally, a last round of emails was sent to 'mop up' any possible respondents.

The outcome of the approach is that only eight SMEs completed the Output and Result Recording Forms; 33% of those that were approached for information. Whilst this is not a large percentage, it has to be noted that some of the businesses were funded some three and a half years ago and largely it would appear to be due to the time needed to complete the forms for busy companies. The methodology and approach of four email phases and an average of three telephone calls to each business will or will not achieve co-operation for the purpose of this report in eliciting a response to complete the forms.

A schedule of the emails and telephone calls can be found in 'Email and Phone Call Schedule'.



SME	Address	Postcode	Contact Name	Number	Replies	Project Success Actual	Project Not Progressing	Project Success Ongoing	Project Success - Don't Know	GVA Increase Actual To Date	Jobs Created Actual To Date	Jobs Safeguarded Actual To Date	GVA Increase Potential Year 2	Jobs Created Potential Year 2	Jobs Safeguarded Potential Year 2	GVA Increase Potential Year 3	Jobs Created Potential Year 3	Jobs Safeguarded Potential Year 3	GVA Increase Potential Year 4	Jobs Created Potential Year 4	Jobs Safeguarded Potential Year 4
Albert UK	213 Langer Lane, Chesterfield	S40 2JW	Trevor Willis	01246 540089	Y	Y					3	1									
Andrewson Designs Ltd	Hawthorn Cottage, Walcotby Folkingham, Sleaford, Lincs	NG34 0SU	David Anderson	01529 497151 / 07718083228	N	Y															
Blue Frog	195t Margarets Street, Leicester	LE1 3EB	Chris Samuel	0116 253 0612	N				?												
Carbolite	Parsons Lane, Hope, Hope Valley	S33 6RB	Paul Haight	01433 620011	Y	Y				£ 50,268.00	1										
Clean Surface Ltd	Prototyping	14 Highmere Road, Leicester,	LE4 9LZ	Nigel Chapman	Y	Y				£ 25,000.00	1										
Clements Retail	115 Pakar Drive, Leicester,	LE4 0JP	Vince Steventon	07850 602761	N		N														
Flextraction Ltd	10 Digby Drive, Leicester Road Ind Est, Melton Mowbray	LE13 0RQ	Walter Gilder	01664 410 641	N	Y															
Guidance	4 Dominus Way, Meridian Business Park, Leicester,	LE19 1RP	Malcolm Roberts	0116 225 2600	Y	Y							£ 40,000.00	3	2	£ 40,000.00			£ 40,000.00		
Iluma Lighting	Silks Road, Willow Farm Business Park, Castle Donington, Derbyshire	DE74 2US	Daniel Hamburger	01332 818 200 / 07775 778 741	Y	Y							£ 30,000.00	2		£ 30,000.00			£ 30,000.00		
Its Design	Atherstone House, Merry Lees Industrial Estate, Desford, Leicestershire	LE9 9FE	David Godfrey	0845 217 9951	N	Y															
Inspiration Healthcare Ltd	Gildor House, West Street, Earl Shilton, Leicester	LE9 7EJ	Neil Campbell	01455 840 555 / 07812 976247	Y	Y							£ 25,000.00	2		£ 160,000.00			£ 380,000.00		
Kubek Pine Ltd	47-55 Northgate St, Leicester	LE3 5BZ	Matthew Leach	0116 251 9551	N	Y															
LED Wise	2 Oadby Hill Drive, Oadby, Leicester	LE2 5GF	Iain McIntosh	0116 272 0145	N	Y															

SME	Address	Postcode	Contact Name	Number	Replies	Project Success Actual	Project Not Progressing	Project Success Ongoing	Project Success - Don't Know	GVA Increase Actual To Date	Jobs Created Actual To Date	Jobs Safeguarded Actual To Date	GVA Increase Potential Year 2	Jobs Created Potential Year 2	Jobs Safeguarded Potential Year 2	GVA Increase Potential Year 3	Jobs Created Potential Year 3	Jobs Safeguarded Potential Year 3	GVA Increase Potential Year 4	Jobs Created Potential Year 4	Jobs Safeguarded Potential Year 4	
MCD-Medical Composite Development LLP	1 Blandford Road, Chilwell, Nottingham	NG9 4GY	Robert Tetrault	07882 978224	N				?													
Mogo (Newstarto Ltd)	180 Church Gate, Loughborough, Leicestershire,	LE11 1UD	David Hughes	01509 215833	N	Y																
Pluswipes Ltd	Powell Road, Willowbrook East Industrial Estate, Corby, Northants	NN17 5KJ	Tanya Teasdale Brown	01536 406085	N		OG															
Protean	The Bell Tower, 12 High Street, Brackley, Northants	NN13 7DT	Colin Hibbs	01280 706060	N	Y																
RS	BioCity, Pennyfoot Street, Nottingham	NG1 1GF	Jim Coghill	0115 912 4412	N	Y																
Sci-Sports	5 Frog Island, Leicester, Leicestershire	LE3 5AG	Sean Gayless	0116 262 7280	N	Y																
Shelton	Baumber House, Baumber, Horncastle, Lincs,	LN9 5NF	Michael Claxton	01507 578288 / 07811 549896	N	Y																
Sound Products	Unit 16, Stewell Business Centre, Heage Road Ind Est, Ripley, Derbyshire,	DE3 3GH	Mike Griffiths	01773 570161	N		OG															
Spectrum Healthcare (UK) Ltd	1 Kingsfield Close, Dallington, Northampton,	NN5 7QS	Stephen Clark	01604 586501	Y	Y				£ 25,000.00	1		£ 25,000.00			£ 25,000.00			£ 25,000.00			
Sure	2 Moorbridge Court, Bingham, Notts,	NG13 8GG	Graham Marshall	01949 836990	Y	Y				£ 10,000.00	3	1	£ 125,000.00			£ 200,000.00						
Venvide	Quartz Close, Warrens Business Park, Enderby, Leicester,	LE19 4SG	John Dakin	0116 284 7790	N		OG															
					8	18	1	3	2	£ 75,268.00	5		£ 130,000.00			£ 360,000.00			£ 675,000.00			£ 1,260,268.00
																						15
																						2

## *Observations of the results from responses*

### **GVA**

There is one business who in relation to GVA skews the figures in the table to a degree because of both their size and potential growth. It is for this reason that there are two sets of observations including and excluding Inspiration Healthcare.

The combined actual and potential increase in GVA for the eight businesses over the three years required on the forms £ 1,260,268

Average increase in GVA per business over the three years £ 157,533

If the average increase in GVA is aggregated across the 18 businesses who have commercialised their products, the total increase in GVA across all businesses for the three years is £ 2,835,594

This total increase in GVA across the 18 businesses is deemed more than acceptable.

### *Employment*

#### **Jobs Safeguarded**

The actual jobs that are safeguarded as part of this intervention are two. Whilst this is not considered to be substantial, these are jobs that could have been lost should the intervention and new product development have not taken place.

#### **New Jobs**

The number of new jobs generated through the intervention and products developed is 15. Considering the number of responses, this averages out to 1.87 new jobs per business. If only the 18 businesses that are known to have their product in the market are considered, this still equates to 33 new jobs created and can be considered to be a successful deployment of ERDF funding.



# LEADING INNOVATION THROUGH DESIGN

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Peter Ford and James Woudhuysen (2013). The fuzzy front end of product design projects: how universities can manage knowledge transfer and creation. XX – XX

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## THE FUZZY FRONT END OF PRODUCT DESIGN PROJECTS: HOW UNIVERSITIES CAN MANAGE KNOWLEDGE TRANSFER AND CREATION

Peter FORD<sup>\*a</sup> and James WOULDHUYSEN<sup>b</sup>

<sup>a</sup>De Montfort University; <sup>b</sup>De Montfort University

Over 20 years, the Design Unit at De Montfort University, Leicester, has undertaken research projects for both large firms and small or medium-sized enterprises. Many projects have been fully funded by private sector clients; but in those projects assisted by public funds, the Unit's research has brought together manufacturers, sub-contractors, design consultancies, market researchers, intellectual property specialists, funding bodies and other higher education institutions. Using these experiences, the paper focuses on the dynamics of knowledge acquisition during the 'fuzzy front end' of product design projects. We suggest that, through a novel management and integration of different players in new product development, higher education institutions can help small firms, in particular, get existing knowledge transferred to them, develop new knowledge, lower uncertainty through prototypes, and so make the most of design.

*Keywords: Innovation; uncertainty; prototypes*

### METHODOLOGY

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The paper first reviews some of the literature that relates to knowledge transfer and the process of design in the early stages of new product development (NPD). It then considers the Design Unit's experience, since 1992, in design-based innovation in manufacturing in the UK's East Midlands region. The experience covers both commissions that were fully funded by private sector clients, and commissions that were partly or wholly funded by three schemes of state support for design. The paper analyses data from this work, and contrasts two projects funded by international companies with two state-supported projects for local firms. The paper concludes by proposing scenarios for the management and integration of knowledge around NPD.

### LITERATURE REVIEW

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#### KNOWLEDGE AND ITS TRANSFER

The impact of knowledge on general economic life first gained systematic recognition 50 years ago (Machlup, 1962). In the same era, too, there emerged an emphasis on the *communication* of ideas in society, rather than on their production (McLuhan, 1962; Fiore & McLuhan, 1967). In management literature, however, the subtleties of both the transfer of

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knowledge and its creation were captured in a much later landmark book, *The Knowledge-Creating Company* (Nonaka & Takeuchi, 1995). That book remains relevant today. One reason: more recent studies of product design in UK government-funded Knowledge Transfer Partnerships (KTPs), while useful about its commercial benefits, don't always clearly define the nature of the knowledge transfers (Ford & Davies, 2012).

For Nonaka and Takeuchi there are two kinds of knowledge: informal, subjective, intuitive and *tacit* knowledge held by individuals, and formal, *explicit* knowledge. For them, knowledge is primarily tacit, consisting of technical knowhow at the fingertips of professionals, as well as mental schemata, beliefs, ideals, values and emotions. However, when tacit knowledge is converted into the explicit sort, and vice versa, firms can, through such a 'knowledge spiral', acquire 'organizational' knowledge.

What circumstances prompt the kinds of knowledge conversion outlined by Nonaka and Takeuchi? Several authors contend that information from *sources outside the firm* is critical to innovation (Drucker, 1999; Van den Bosch, Volberda, & De Boer, 1999; Reid & de Brentani, 2004). Drucker (1999:114,115) maintained that such information comes not just from suppliers, rivals, and customers, but also from direct personal observation, volunteering for non-profit work, and continuing education. Indeed, what Drucker wrote about continuing education hinted at a useful role that higher education institutions (HEIs) could play with companies. Others too have seen real possibilities in the tension between academic and corporate environments (Rynes, Bertunek, & Daft, 2001), and in the general interplay between these two milieux (Schaber & Thomas, 2008).

After Nonaka and Takeuchi published, the rise of the Internet gave new weight not so much to the creation of knowledge as to its communication. While the concept of the network society gained a mass audience (Castells, 1996), management literature veered toward the need for 'open' innovation, both in products and in services (Chesbrough, 2003, 2011). In this framework, large, vertically integrated firms manage information in a comforting 'landscape of abundant knowledge' (Chesbrough, 2003:XXV). Thus while Chesbrough concedes that innovation includes *knowledge generation*, he prefers to highlight *moving knowledge around* – getting it from customers, other companies, suppliers, universities, national laboratories, industrial consortia, consultants and start-up firms (Chesbrough, 2003:40, 52).

Clearly knowledge management is essential to product design, and designers need a 'know-what, know-who, know-why, and know-how' framework (Qiu, Chui, & Helander, 2006: 52). However, rather than just the diffusion of information, *intense interaction between both information sender and information receiver has to take place over time* if a true transfer of knowledge is to occur, (Thompson, Jensen & DeTienne, 2009:331,333). Also, true transfer can only take place if the knowledge acquired is *acted upon*, so that it creates *new* knowledge and is assimilated as experience. Open innovation, termed by its boosters as an 'established and mainstream engine of economic growth' (Harwood & Simoes-Brown, 2012:143), tends to downplay this creation of new knowledge and therefore, if anything, tends to impede growth (Woudhuysen, 2010).

#### THE 'FUZZY FRONT END' OF NPD PROJECTS

The question of creating new knowledge, and even of acquiring knowledge that already exists, assumes particular force at the inception of an NPD exercise. Here, different participants encounter what has become known as the 'fuzzy front end' (FFE) of such exercises – circumstances that ensure that not all the knowledge necessary for any particular project is yet available to those working on it. Here, it's worth looking at the work done on the car industry by Kim Clark and Takahiro Fujimoto (Clark & Fujimoto, 1990, 1991).

In their original article, Clark and Fujimoto (1990) made names for themselves around the ideas of 'product integrity' and the 'heavyweight product manager'. 'Internal' product integrity in cars meant 'consistency between a product's function and its structure: the parts fit smoothly, the components match and work well together, the layout maximizes the available space' (Clark & Fujimoto, 1990:108). 'External' product integrity, by contrast, meant 'integrating a clear sense of customer expectations into the work of the product development organization as a whole' (Clark & Fujimoto, 1990:108). The work of leading both kinds of integrity fell to heavyweight product managers, automotive engineers who first were 'deeply involved in creating a strong product concept', and then, as the concept's 'guardians', were out to 'keep the concept alive and infuse it into every aspect of the new product's design' (Clark & Fujimoto, 1990:114). In this first excursion, it should be noted, Clark and Fujimoto made several references to the importance of *prototypes* in *early-stage* NPD. For example, they wrote:

*Production people built high-quality prototypes that tested the design against the realities of commercial production early in the game and so eliminated expensive delays and rework later on.* (Clark & Fujimoto, 1990:119)

By contrast, Clark and Fujimoto made, at this moment, no reference to *uncertainty* in NPD.

By the time of their book, however, Clark and Fujimoto (1991) made several – though only several – mentions of uncertainty in early-stage NPD. Their emphasis remained on product integrity and skilled management. Interestingly, too, in both article and book, the authors emphasized how the heavyweight product manager had to ensure and personify effective communications, but laid much more stress on the person *pushing ideas forward*. The heavyweight had to go about 'developing an integrated product concept' (Clark & Fujimoto, 1990:110). Engaged in 'integrated problem solving', they were 'responsible not only for internal coordination, but also for product planning and concept development' (Clark & Fujimoto, 1991:128, 255).

In the same year that Clark and Fujimoto's book was published, two other authors popularized the FFE (Smith & Reinertsen, 1991). Interestingly enough, their book argued that the FFE is 'an area of extraordinary opportunity' (Smith & Reinertsen, 1991:50). The period between recognition of an opportunity and the moment at which a full development team starts working on it can often be 'roughly half the time to market' (Smith & Reinertsen, 1991:50). In turn, buying time in that period is very much cheaper than doing the same later. Altogether, Smith and Reinertsen concluded,

*The true cost of the Fuzzy Front End is much higher than managers suspect. The most important component of its cost is the cost of delay, not the cost of the people assigned to the project.* (Smith & Reinertsen, 1991:53)

However, reflecting the broader, cultural zeitgeist of uncertainty about the future that came into its own after the end of the Cold War, the literature of innovation and NPD soon lost Smith and Reinertsen's 'can-do' attitude. Indeed, it went on to make a big issue of the unknown. In 1992, a group of four authors from northern Europe and the US wrote up a study of communication between R&D and marketing departments at the FFE: when published in full in 1995, it contained no fewer than 96 mentions of the string 'uncertain' (Moenaert, De Meyer, Souder & Deschoolmeester, 1995). Defining uncertainty as the *gap between required and possessed information about user needs, technology, competition, and the required resources*, the study proclaimed that '[I]nnovation patterns can be viewed as uncertainty reduction activities, as is shown by the vast majority of scholars in the field' (Moenaert et al, 1995:244).

Again in 1995, Nathan Rosenberg, one of America's leading experts on innovation, made a similar point. He wrote:

*Uncertainty pervades not only basic research, where it is generally recognized, but also product design and new product development. This means that any early commitment to a specific large-scale project [in innovation] – as opposed to a more limited, exploratory approach, is likely to be risky. (Rosenberg, 1995)*

What Rosenberg wrote was not new, so much as a formal setting out of the idea that innovation – especially in large products – is an activity saturated with risk. Indeed, since 1986 and the first publication, in German, of Ulrich Beck's *Risk society* (Beck, 1992) the doctrine has grown that innovation itself is a source of risk.

If the open innovation framework is complacently satisfied with the world's existing knowledge, those who highlight uncertainty seem plagued by doubts. But there are ways out of this dilemma. First, uncertainty can be a positive thing in a sense broader than that specified by Smith and Reinertsen: it can be a *spur to the creation, through action, of new knowledge*. Second, it is possible that uncertainty at the FFE may be greatest for 'discontinuous' as opposed to 'incremental' innovations (Reid & Brentani, 2004:172). However, *prototypes* – early, and perhaps rapid, or virtual – can lower uncertainty in the FFE, across both incremental and discontinuous innovations. The evidence comes from Japanese manufacturers, making largely industrial products around which customer requirements were well understood, but for whom prototypes therefore lowered uncertainties of a technical nature (Verworn, Herstatt, & Nagahira, 2008:12,13). Nevertheless, it is suggestive.

## RESEARCH QUESTIONS

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Is knowledge transfer bound up with the production of new knowledge, not just the communication of the existing sort?

Can a commercially experienced academic environment support innovation, in ways that design consultancies and government agencies cannot?

Is uncertainty at the FFE something to be relaxed about, particularly if prototypes are undertaken?

## CONTEXT – THE DESIGN UNIT

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The Design Unit established itself in 1992 in response to demand from local industry for a style of design research and innovation that could probably only be met by a University with broad expertise and resources in NPD. For more than 10 years, the Unit designed products ranging from consumer goods, through transport equipment, to retail fixtures and fittings. It did this both for international companies, and for small and medium enterprises (SMEs): in each case, commissions were fully funded by the client. It should be noted here that in Britain, the 2006 Companies Act defines SMEs as firms that have two of three characteristics – an annual turnover of less than £25m (nearly \$40m), gross assets of less than £12.5m (nearly \$20m), or fewer than 250 employees.

As the Unit gained a name for its collaborative outlook and effective designs, so most projects came about through recommendation and repeat business. In all, more than two thirds of the concepts developed by the Unit reached production, with more than 22 products or product ranges being successfully launched to market over the period 1992-2001. In a significant majority of cases, the Design Unit engaged in a high level of collaboration with a number of players, and so assisted in the transfer of important knowledge. But there was something else, too: in a number of cases, *the level of innovation achieved depended on the*



*creation of new knowledge – and was reflected both in patents, and in the winning of public awards.*

A few years after the election of a Labour government in 1997, the Design Unit's direct work for private sector clients began to be complemented by projects that, in whole or in part, enjoyed the support of the state. With the Regional Development Agencies Act of 1998, the government established Regional Development Agencies (RDAs) throughout the UK. Part of each RDA's job was to support (SMEs). In 2003, therefore, the Design Unit suggested to Leicestershire Economic Partnership, a body backed by money from the East Midlands RDA, that it fund a pilot scheme – Improving Business by Design – aimed at SMEs in the Leicestershire sub-region of the East Midlands (Ford and Marsden, 2005). Thereafter, the Design Unit suggested another initiative, known as the Design Pilot Scheme, to the government's Manufacturing Advisory Service. Today, while the Unit continues with work that is fully funded by private sector clients, it also gains assistance from the European Union, in the shape of the third venture it has put forward: a Regional SME Design Support Scheme, financed by the Union's European Regional Development Fund.

In fact, the Design Unit not only proposed but also managed and implemented each of these three schemes. That gave it the freedom to engage not just SMEs, but also manufacturers, sub-contractors, design consultancies, market researchers, intellectual property specialists, funding bodies and other higher education institutions (HEIs). From 2003 until today, these schemes have seen more than £750,000 (nearly \$1.2m) invested in the local design community alone.

Below, we summarise the Design Unit's experience with commissions that were fully funded by private sector clients, and its experience with the three schemes that involved a degree of state support.

## **COMMISSIONS FULLY FUNDED BY PRIVATE SECTOR CLIENTS, AND THE THREE SCHEMES USING STATE FUNDS**

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### COMMISSIONS FULLY FUNDED BY PRIVATE SECTOR CLIENTS, 1992-2002

The EU defines 'micro enterprises' as firms with a headcount of fewer than 10 employees, and a turnover of less than €2m (nearly \$2.5m). Predictably, then, the vast majority of the Design Unit's commissions that were fully funded by private sector clients were for firms that were larger than micro enterprises. Often through project managers, clients supplied briefs and specification: in effect, they hired the Design Unit in the way they would a design consultancy, or consultants in design research and forecasting. Clients did bring other players into the work, but this happened only occasionally.

### THE IMPROVING BUSINESS BY DESIGN SCHEME, 2003-7

This scheme began with research into those Leicestershire SMEs that might benefit from support in NPD. The Design Unit identified 52 possible projects among capable manufacturers that also had definite routes to market. Eventually, the Unit selected 16 projects for further development and funding support, and went on to write project briefs and product specifications, hire local design consultancies to act on these, and retain a role guiding design research and implementation through to production. As described earlier, money for this work originated with the East Midlands Development Agency. However, UK central government's Higher Education Innovation Fund, which helps HEIs spin out their ideas into industry, also chipped in cash. Meanwhile, clients invested their time in the design research and implementation stage; they also invested their own cash – but only once manufacturing development began.

Overall, the scheme was highly successful. More than 62 per cent of the Design Unit's interventions went through to manufacture. In central government, industry minister Lord

Sainsbury commended the Improving Business by Design scheme for showing ‘a 14:1 return on public sector investment through the development of new markets for UK design and manufacturing companies’ (Sainsbury, 2005).

#### THE MANUFACTURING ADVISORY SERVICE'S DESIGN PILOT SCHEME, 2008-10

The Manufacturing Advisory Service operates across the UK, but has no specific mandate to support design. In 2008, central government was encouraging RDAs to adopt Designing Demand (Design Council), a state run scheme. However, the East Midlands RDA wanted to consider options, and invited the Design Unit to propose how it would support local SMEs through the MAS network.

Following a number of sub-regional events, the Design Unit selected 13 projects among capable manufacturers that also had definite routes to market. The Design Pilot Scheme that emerged around these projects followed Improving Business by Design, in that clients had to fund manufacturing development; but it differed from the earlier scheme in three respects. First, funding for the design stage of each project was here split 50:50 between the Advisory Service and the client companies second, the Unit not only hired design consultants, as before, but did design research and implementation alongside them, while retaining its role in supervising each project through to production. Third, the East Midlands RDA played a role on top of basic funding for design. To local food, drink, medical, transport and construction companies, the RDA's freshly established Innovation Networks made outlays to help in the analysis of markets, the protection of intellectual property and the assembly of prototypes. That, and the way in which the Networks referred clients to the Design Unit, proved an invaluable counterpoint to its Design Pilot Scheme.

Results were remarkable. In all, 11 of the 13 projects undertaken reached production.

#### THE REGIONAL SME DESIGN SUPPORT SCHEME OF THE EUROPEAN REGIONAL DEVELOPMENT FUND, 2009-12

Since 2000, England has benefited from more than €5bn of monies from the EU's European Regional Development Fund. Here the Design Unit did not seek out client companies; rather, funds were available to any SME applying for innovation support – including manufacturers spun out from East Midlands universities other than De Montfort. In this case, all the cash for design work came from Brussels, as well as from the UK central government's Higher Education Innovation Fund. As with the Design Pilot Scheme, however, the Innovation Networks run by the East Midlands RDA assisted, and both design consultants and the Design Unit collaborated on the design work. Manufacturing development was, as in the previous two schemes, left for clients to fund.

The Design Support Scheme has turned out to be very popular. Under it, the Design Unit has taken on nearly 100 assignments to date. Strikingly, while about seven in every 10 companies employed just five or fewer staff, more than five in every 10 has so far neared or reached production.

### **QUANTITATIVE ANALYSIS OF THE DESIGN UNIT'S WORK**

The four figures below quantify the performance characteristics of the 181 design research and implementation projects so far undertaken by the Design Unit. Here, the category ‘successful completions’ refers to projects that have progressed or are progressing to manufacture, while ‘unsuccessful completions’ are projects that have not progressed or will not progress to manufacture. In our definition, small enterprises have fewer than 10 employees; medium enterprises form a rather broad category, having between 11 to 250 employees, and large enterprises are organisations with more than 250 employees.

Importantly, ‘external Management & Integration’ (M&I) refers to those projects in which the Design Unit coordinated the work of a number of players: manufacturers, sub-

contractors, design consultancies, market researchers, intellectual property specialists, funding bodies and other higher education institutions.

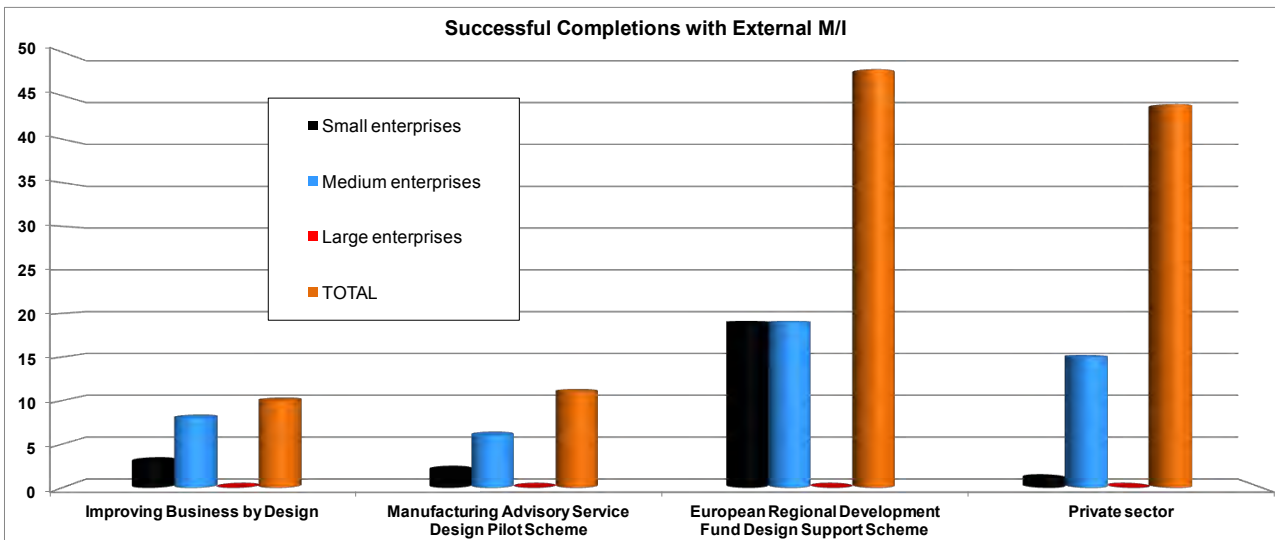


Figure 1 Number of SUCCESSFUL completions conducted WITH external Management & Integration

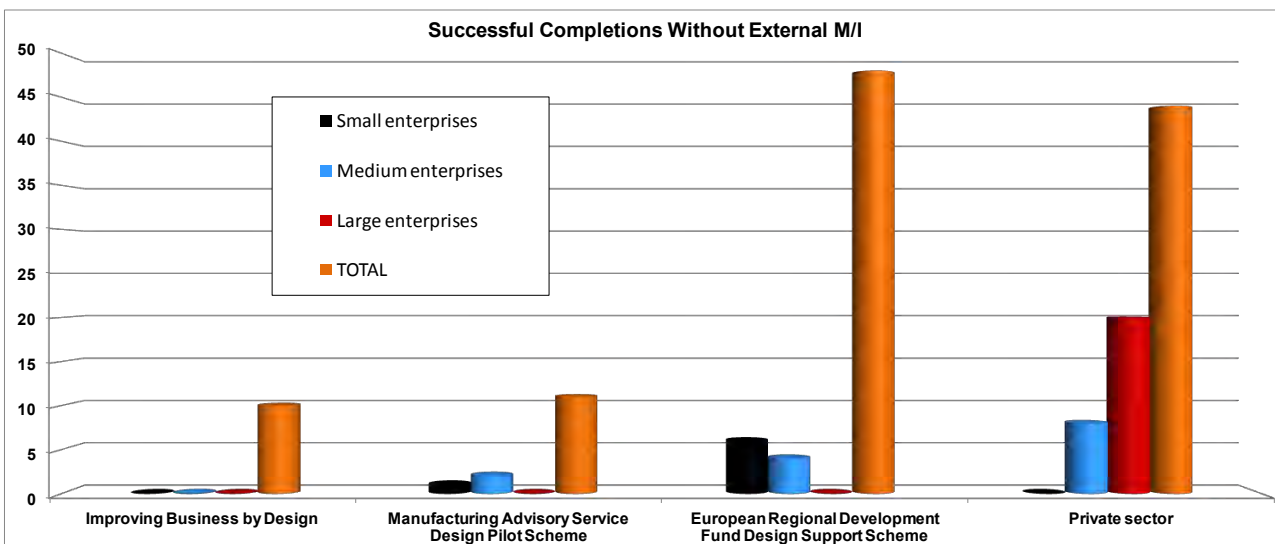


Figure 2 Number of SUCCESSFUL completions conducted WITHOUT external Management & Integration

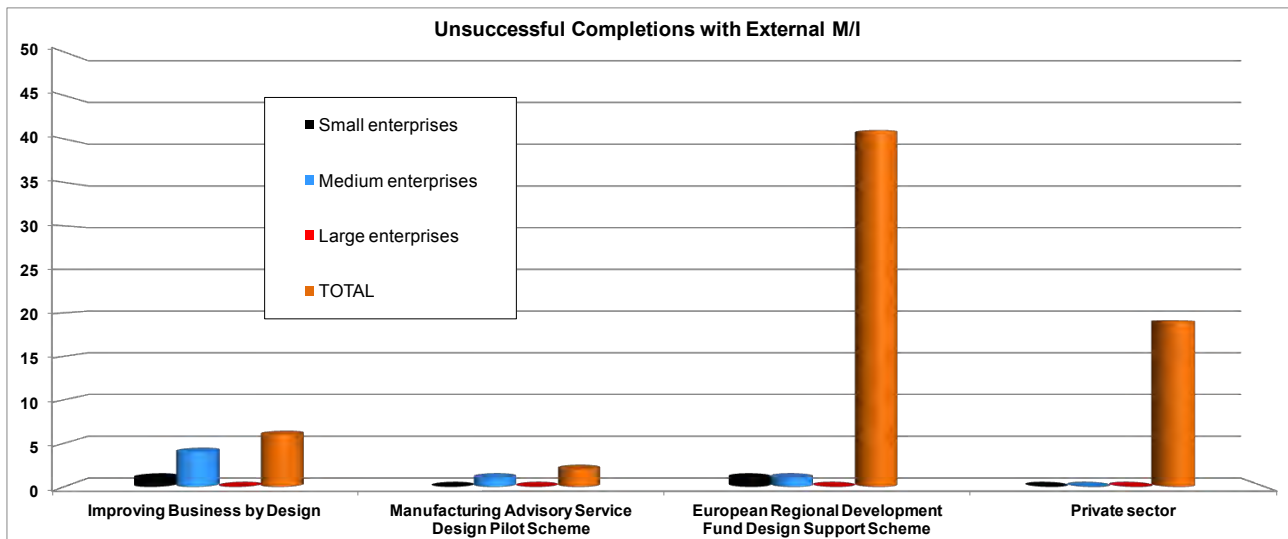


Figure 3 Number of UNSUCCESSFUL completions conducted WITH external Management & Integration

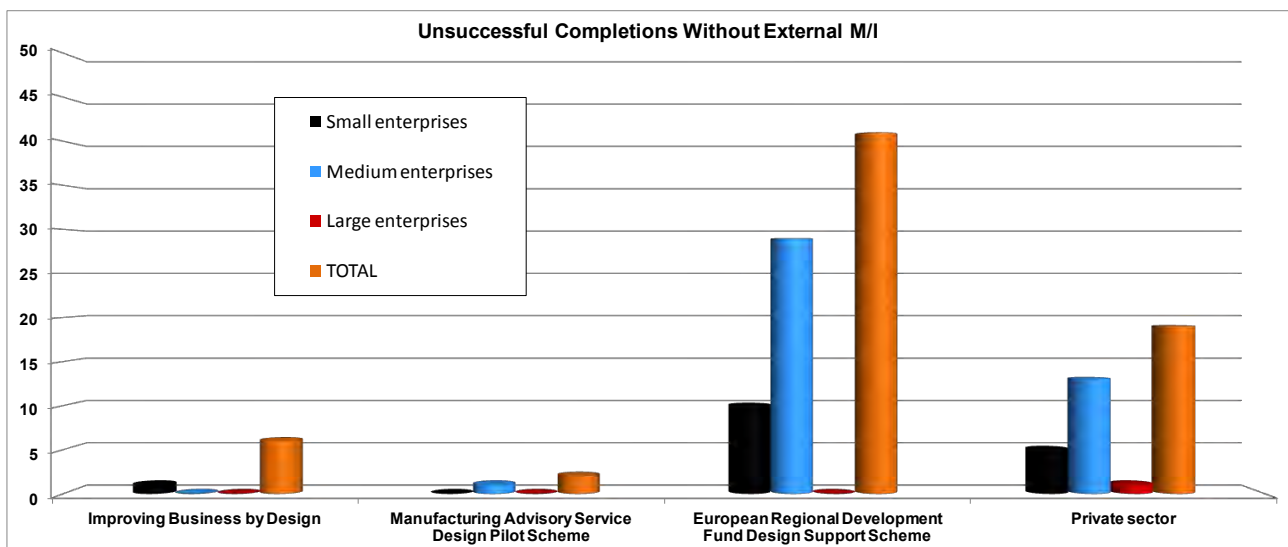


Figure 4 Number of UNSUCCESSFUL completions conducted WITHOUT external Management & Integration

Overall, the Design Unit successfully completed nearly two in every three projects. Among small and medium enterprises, there was a strong correlation between successful completions and external M&I: nearly four in every five of such projects met with success. Conversely, where small and medium enterprises enjoyed no external M&I, nearly nine out of 10 projects failed to complete successfully.

Large enterprises fared differently. With them, very few projects failed to complete – whether they were conducted with external M&I, or without it. Clearly, and not unexpectedly, it was small and medium enterprises that drew the most tangible benefits from external M&I.

We now examine four case studies of the Design Unit’s work in the light of our quantitative analysis.

#### FOUR CASE STUDIES OF THE DESIGN UNIT’S APPROACH

The case studies below span small, medium and large enterprises. Two were fully funded by private sector research contracts; two relate to the publicly funded schemes we have discussed. All four bring out the way in which, if information acquired is acted upon and worked up in the form of prototypes, new knowledge is created.

#### CASE STUDY 1 – COMPANY SE, MAKERS OF HAND-HELD SCIENTIFIC EQUIPMENT

SE, a large producer of scientific equipment, runs manufacturing centres in the UK, the US and Scandinavia. Among other products, it makes hand-held devices that determine the composition of a variety of metals. In this product domain, SE's existing model had the reputation of being difficult and costly to manufacture, as well as unreliable to use: as a result, the product was losing market share. The Design Unit's job was to develop a replacement product that avoided these problems, boasted equivalent or higher functionality, and was more comfortable to use. The new product also had to display a whole number of warnings about use to those who handled it, in accordance with ever-tightening regulations. Above all, the new product had to be developed quickly to stem loss of market share. Indeed, the division of SE responsible for the new product knew that its future rested on the outcome of a development programme that, in all, cost £2m (more than \$3m).

A key feature of the new design concerned how to manage the dissipation of heat from the product's internal components. The original device had two small heat dissipation panels which, although adequate from a thermal perspective, were very hard to assemble, and very hard, too, to seal inside the product. Eventually, a major innovation was made: a single large extruded aluminium panel was substituted for the two panels. In fact this component came to comprise the bulk of the upper part of the product: it proved to have structural and cosmetic merits, was comparatively easy to assemble, and avoided all the sealing issues of the previous design.

SE gave a dedicated manager responsibility for overall project management, and involved almost all the interested parties in initial concept development, so as to minimise uncertainties. At its conclusion, the project resulted in all the new product's commercial targets achieved and securing the future of the division in charge of it. However the product was late to market – something that inspires three observations.

#### OBSERVATION 1

While the old product was tricky to manufacture and seal, and had design details that were poorly resolved, it was at least in continuous manufacture. The new design was radically innovative in its configuration, but introducing it promised to disrupt production schedules quite dramatically. Nevertheless it was accepted, because it was 'not like the old model'. Given the disruption caused, there might have been wisdom in simply ironing out the worst features of the old model, and staying with the production routines that accompanied that. However, there was great prejudice against staying with the status quo in any way.

We find this turn of events absorbing. After all, irrational *management prejudice* never figures in the literature on the FFE in NPD.

#### OBSERVATION 2

A full two months after a first prototype of the new model was built, tests by SE found that the large new single panel within it didn't dissipate heat as well as the two smaller panels in the original model. In this respect, the product lacked what, as we have seen, Clark and Fujimoto (1990:108) termed 'internal' product integrity. Then it emerged that a member of SE's technical team, who had worked on the original design, had suspected all along that heat dissipation would be weak, but had elected to stay silent. Fortunately, *rapid prototyping techniques provided new knowledge*, relatively quickly, about how best to amend the new design.

The two months testing and subsequent design iterations caused delay – and that, combined with other delays (in further design development, the procurement of parts and the commissioning of production tools) had a significant impact on the project's end-date. Altogether, the remarks made by Smith and Reinertsen (1991) about delays at the FFE were strongly confirmed. Still, the use of rapid manufacturing techniques reduced the effect of

these delays, and allowed 80 vacuum-cast pre-production models to be sold to and tested by impatient customers. Eventually, fully finished, injection-moulded products succeeded these models.

The lesson here is that *while powerful knowledge may already exist within a development team, corporate 'politics' may prevent such tacit knowledge from becoming explicit*. Again, one doesn't encounter such a turn of events in the literature on the FFE, even if the categories 'tacit' and 'explicit', pioneered by Nonaka and Takeuchi (1995), are all too relevant here.

#### OBSERVATION 3

In their book, Clark and Fujimoto (1991:255) write that heavyweight product managers have broad 'responsibility and clout', that they are 'usually senior within the organization, often at the same or higher rank' as the heads of its functional units, that they 'exercise strong direct and indirect influence across all functions and activities in the project'. The SE person in charge had no authority like this. Indeed throughout the project, all SE employees involved, and especially the person in charge of it, proved excessively cautious. Covering their backs, they unnecessarily prolonged their evaluation of design details (the heat dissipation feature, for example), and so cramped the ability of the Design Unit to assist SE.

Overall, *company habits and a lightweight product manager impeded swift decision-making*. Thankfully, however, the sheer size and financial resources of SE ensured market success. Still, there can be no doubt that SE staff suffered from a *blame culture*, which in turn led to an exaggerated and somewhat congenital *aversion to taking risks*. *Here uncertainty in the FFE was not a gap in information that needed to be closed, but a way of life*.

These facts, which are only too familiar, once again seem to elude the literature on the FFE.

#### CASE STUDY 2 – COMPANY SF, MAKERS OF LIGHTWEIGHT SPORTS FOOTWEAR

SF forms a part of a large multinational brand-orientated group, which is highly regarded for its design and manufacture of quality outdoor leisure products. At the time of the Design Unit's involvement with SF, it was encountering rivals who were growing in confidence – while its own product range was in danger of becoming dated. Following an aggressive recruitment campaign, new product managers in both footwear and apparel began to inject a new dynamic into the company.

The Design Unit was commissioned to work alongside the new manager for footwear on a brand new range of high performance, off-road running shoes. The shoes had to be light, provide good support to the wearer, grip the ground very well, and repel all water. Above all, they had to be put on the market within nine months, ready for the start of the winter season.

The new manager was highly experienced and motivated, and integrated the Design Unit very well into the team at SF. Entirely confirming the thesis of Smith and Reinertsen (1991) about *avoiding delays* at the FFE, members of both SF and the Design Unit visited manufacturers in China *before* beginning significant concept work – and when they eventually found one with the skills to handle the project within the required timescales, the tight deadline for the project no longer looked insurmountable.

Innovation here centered on the development of the shoes' upper construction, which was based on volume mesh fabrics on to which polyurethane was flow moulded to provide impact resistance in critical areas. Until this moment, flow moulding at this level of precision had not been achieved on footwear, but the need to cut down weight and use materials that did not absorb water made the innovation essential. Significantly, the approach adopted eschewed all use of leather, since regulations enacted by Brussels ensured that any and all import of this material from China to the European Union would be subject to tax.

A second innovation was the development of a triangular lug on the sole of the shoe; this provides a wedge-shaped grip, with the two triangular arms of each lug giving a buttress-like support for each lug. Again, this was an unprecedented feature for footwear of this type. The final result was the lightest footwear on the market for off-road running, with highly effective grip and protection for the foot, and with a system that would repel water.

SF and the Design Unit undertook a considerable amount of both concept and detail development at the factory in China. The project required a large investment in tooling for sole units, and in particular the development of this unique grip system; but timescales did not allow for much in the way of theoretical analysis or even prototype development in the UK. Ironically, much of the progress achieved was based on the development of 2D data, which the Chinese manufacturer interpreted – at incredible speed – into 3D. Nevertheless, a number of rapid prototypes of the triangular lug system and the sole unit were produced in the UK, while the Chinese manufacturer was able to make prototypes of the upper units by hand, at extraordinary speed. This intimate, close relationship between SF, the Design Unit and the manufacturer, along with iterative development in China, led straight into production development, and was a key factor in the success of the project.

#### OBSERVATION

In direct contrast to SE, at SF *the project leader had the skill, experience and gravitas to act as a heavyweight product manager*. He fully integrated the Design Unit into the NPD process, giving the freedom to operate fully on behalf of SF as an external consultant. This resulted in a unique and innovative range of footwear, one that bolstered SF's position as a leading innovator in sports footwear. In this case, Clark and Fujimoto's heavyweight product manager framework accurately describes what was a successful instance of NPD.

#### CASE STUDY 3 – COMPANY WT, MAKERS OF WOUND TREATMENT DEVICES

With 150 staff, WT is a medium enterprise. The East Midlands biosciences Innovation Network introduced it to the Design Unit under the Design Support Scheme of the European Regional Development Fund. The project was to develop what is called a negative pressure wound treatment device – that is, a powered means of lowering air pressure on wounds – which could be worn discreetly by the individual receiving treatment.

The product's primary requirements were to accommodate a power source, and to manage the tubing to and from the wound area – tubing that allow fluids safely to be extracted from the wound. The Design Unit undertook research, while WT was to develop the electronics and associated software.

The project was initiated and managed by WT's managing director, who was a dominant presence within the firm. Because he was also busy, the project moved at a slow pace: those working for the MD on the electronics and software would not make decisions without his approval.

Prototypes were eventually produced for evaluation with target end-users. However, it was discovered not long after, that a very similar product to that envisaged had already been introduced on to the market. That blow to the project proved terminal.

#### OBSERVATION

Given WT's appreciable size, and the obvious potential of the new product, both the Innovation Network and the Design Unit had assumed – wrongly – that WT had done due diligence on the project before it took advantage of state support. Clearly the MD's management style was a negative influence here, too. The result was that, though knowledge was acquired on the project as far as it went, it was not possible to generate new knowledge, because the project had to be cut short.

What this project encountered was an *over-heavy but absentee product manager*. This is a kind of professional who is probably quite common – but rarely, if ever, treated in books or journal articles about the FFE. The case study confirms the critical remarks made by Thompson et al (2009), for while information was in some ways *diffused* between the MD and other parties, *an intense interaction over time* was lacking.

#### CASE STUDY 4 – COMPANY KD, MAKERS OF A DEVICE FOR ALLOWING HEALTHCARE PROFESSIONALS TO KNEEL PROPERLY WHILE TREATING PATIENTS

KD, a small enterprise with fewer than 10 employees, specialises in equipment for evacuating hospitals and schools and moving people around them. It identified a need to develop a kneeling system that would allow healthcare professionals – typically, midwives and podiatrists – to undertake a range of near-to-floor tasks in comfort, with proper support, and with full ease of movement. Owing to poor posture while kneeling, many such professionals suffer damage to knees, backs and hips. As with case study 3, the East Midlands biosciences Innovation Network introduced KD to the Design Unit under the Design Support Scheme of the European Regional Development Fund.

The device had both to provide comfort for knees and ankles, and to support the professional's buttocks in such a way as minimise pressure on and fatigue in the lower back and hips. The product also had to be durable, given the way it would likely be handled; adjustable, to accommodate different sizes of user; affordable, and as light as possible. Naturally, too, it had to conform to a number of medical regulations and furniture standards.

To put users in exactly the right position was something that had never been achieved on a product of this type before, and involved iterative theoretical and practical investigations. The iterative use of a range of prototypes, from the basic to those produced with 3D rapid prototyping techniques, eventually led to a unique product – one that supports the knees and the front aspect of ankles in a manner that prevents the blood flowing through joints from being constricted. Buttocks are supported on a saddle that can be moved backward and forward to accommodate different leg lengths. The height of this saddle is critical, for in kneeling it dictates the position of the back and hips, and therefore determines the level of comfort achieved.

Though it had limited experience in NPD, KD had fielded products that had enjoyed consistent sales in the healthcare market. The East Midlands biosciences Innovation Network was able to commission initial research into intellectual property around the new product, perform due diligence exercises on it, and later introduce KD to organisations that could validate its conformance to relevant medical regulations. As for the Design Unit, its usual tasks of research, design development, prototyping and human factors evaluation were supplemented by locating institutions qualified to assess whether the product met relevant furniture standards. Around NPD in this arena, regulation has a special salience.

The Design Unit also found an appropriate manufacturer – a vital task, given the originality of the product and the unknown size of its market. The balance of capital investment to product cost, and the ability to meet a range of potential production volumes was enough of a challenge for it to be required that the manufacturer become part of the development team, rather than act just as a contractor.

Given KD's relative inexperience in NPD, the Design Unit initially took responsibility for establishing the configuration of the product concept and, from then on, for its development; the Unit also managed and integrated of the various players in the project through to the production of initial prototypes. Following this, KD started to develop a stronger role in project management through to the device's final production, all the while continuing to enjoy support from both the Design Unit and the Innovation Network.

Given the innovative nature of the product, as well as uncertainty about the size of its market, the date for its launch was not fixed until pre-production prototypes had been built.



That way of doing things proved invaluable, in that it allowed adequate time for the various tasks to be undertaken. Following the evaluation of these prototypes, a launch date was agreed and, later, met. Today, sales of the product have far exceeded expectations.

#### OBSERVATION

Much of the success of this project came down to innovating a unique solution to a clearly identified market need. The process took more than two years, but the willingness of KD to let the Design Unit manage and integrate all the relevant players from concept through to production allowed the Unit to *go beyond design research and implementation by acting as a heavyweight product manager*. On top of this, KD benefited from witnessing M&I in action, so that, in the later stages of the project, it could take on M&I itself. Thus *effective knowledge transfer occurred both in the immediate process of NPD, and in KD's acquisition of skills in M&I*. Also, *the centre of gravity for heavyweight product management shifted from external consultant to client*.

#### THE FOUR CASE STUDIES SUMMED UP

The four case studies above correlate reasonably well with our earlier quantitative analysis. It appears that *large companies can have enough resources to perform successful NPD even when a project manager is weak (SE), and certainly when the relevant individual is strong (SF)*. Things are not so straightforward, though, for medium and small enterprises. *If they try to manage NPD projects themselves, but lack proper capabilities in M&I, SMEs can get into trouble (WT)*. On the other hand, *if SMEs let an external heavyweight project manager take charge of M&I, they can move ahead, and even pick up the talent to perform M&I themselves (KD)*.

#### **FOUR ARRANGEMENTS FOR MANAGING NPD PROJECTS AND TRANSFERRING KNOWLEDGE AROUND THEM**

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While Clark and Fujimoto (1990, 1991) focused on project management, Thompson et al. (2009) explain that, for true knowledge transfer to take place, it is vital to understand the identity of the senders and receivers, and where new knowledge may reside. Below, we present four heuristics through which both project and knowledge management can be better understood.

In figure 5, a large enterprise performs project management, and the main transfer of knowledge occurs between it and the other players. During the NPD process, the new knowledge created will reside largely within the design firm, though some may flow back to the client.

In figure 6, a small enterprise takes the place of the large one. Because the design firm plays a more dominant M&I role, much of the knowledge that is created and transferred ends up with it.

In figure 7 a business broker intervenes, introducing the client to the design firm, transferring knowledge about public funding possibilities to the client, as well accepting the transfer of knowledge from the client about its funding requirements.

In figure 8, finally, a body with responsibility for M&I handles transfers of knowledge for all players – sub-contractors, design firms and funders.

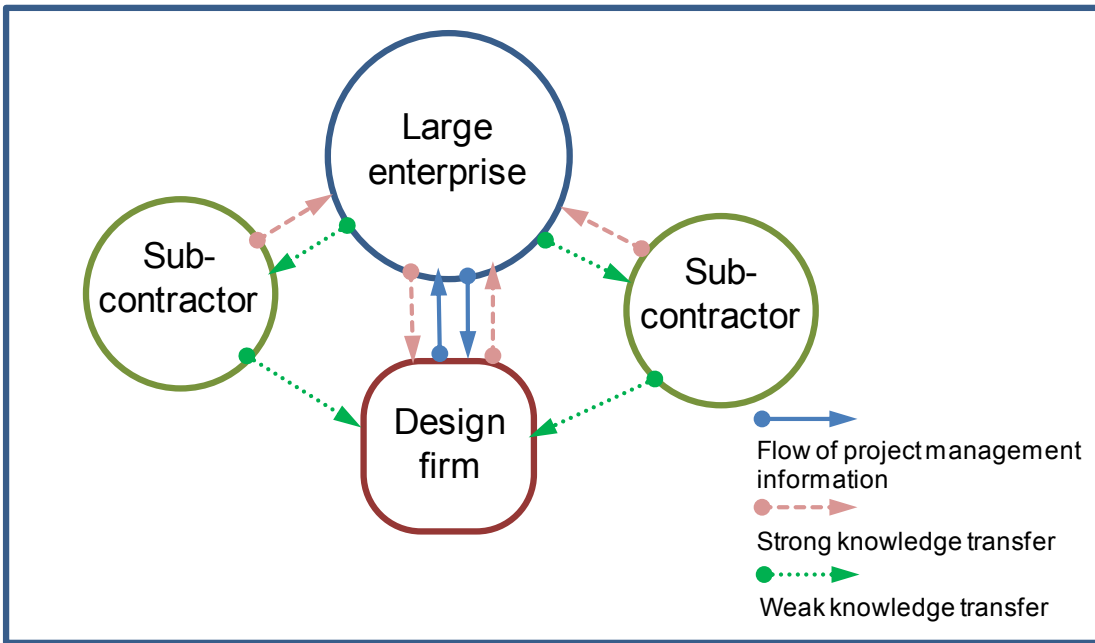


Figure 5 A large enterprise plays the dominant role in project management and knowledge transfer

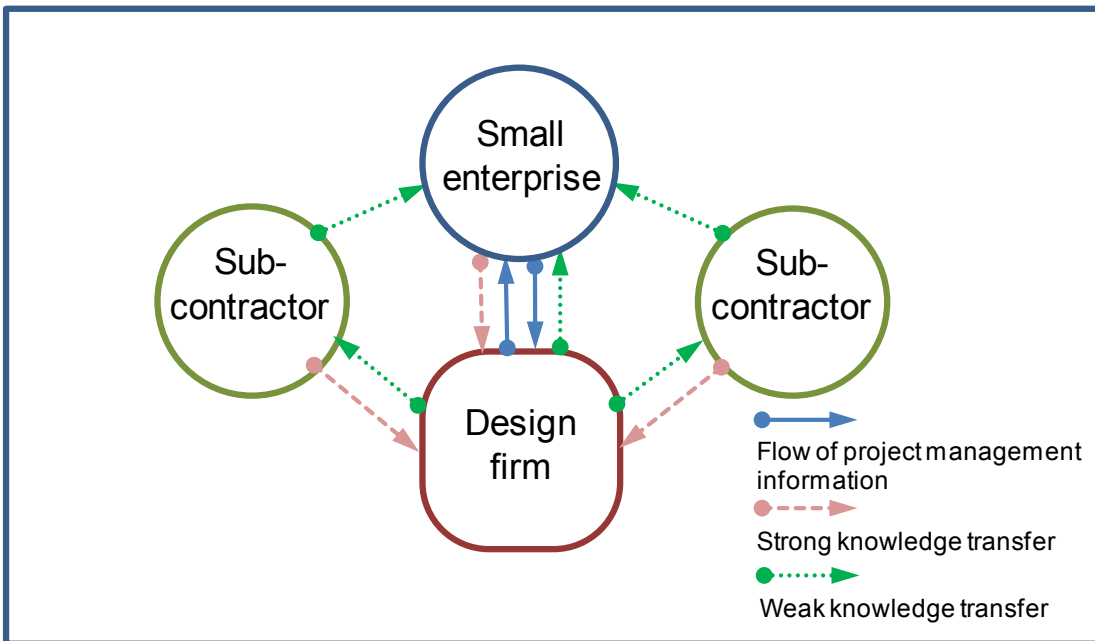


Figure 6 With a small enterprise, the design firm dominates project management and knowledge transfer

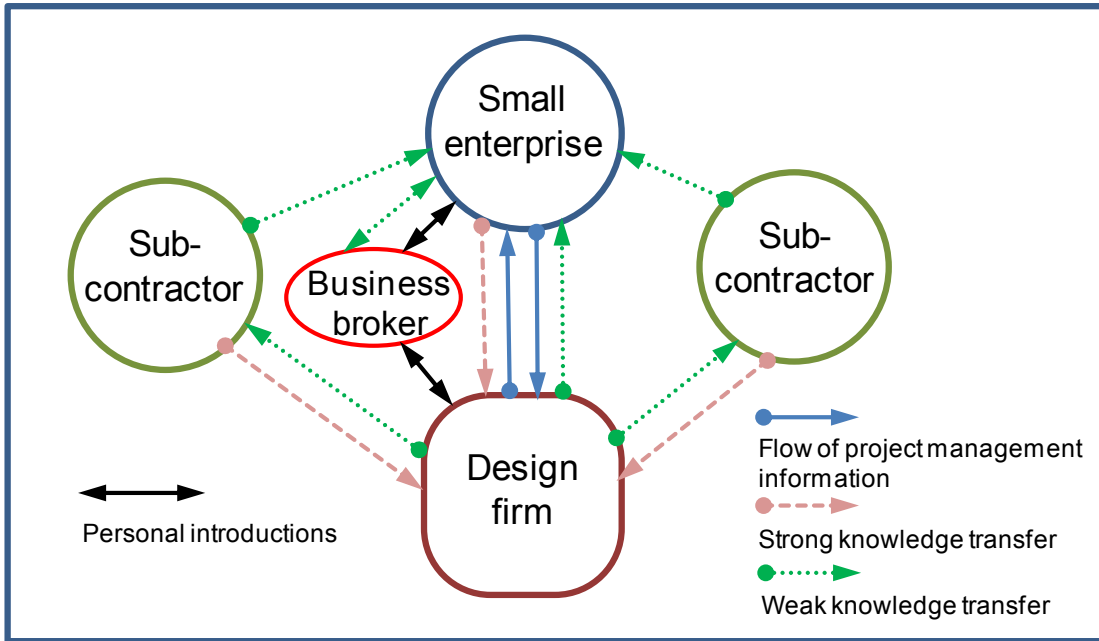


Figure 7 A business broker links the design firm to a small enterprise, and has a dialogue with the latter about funding

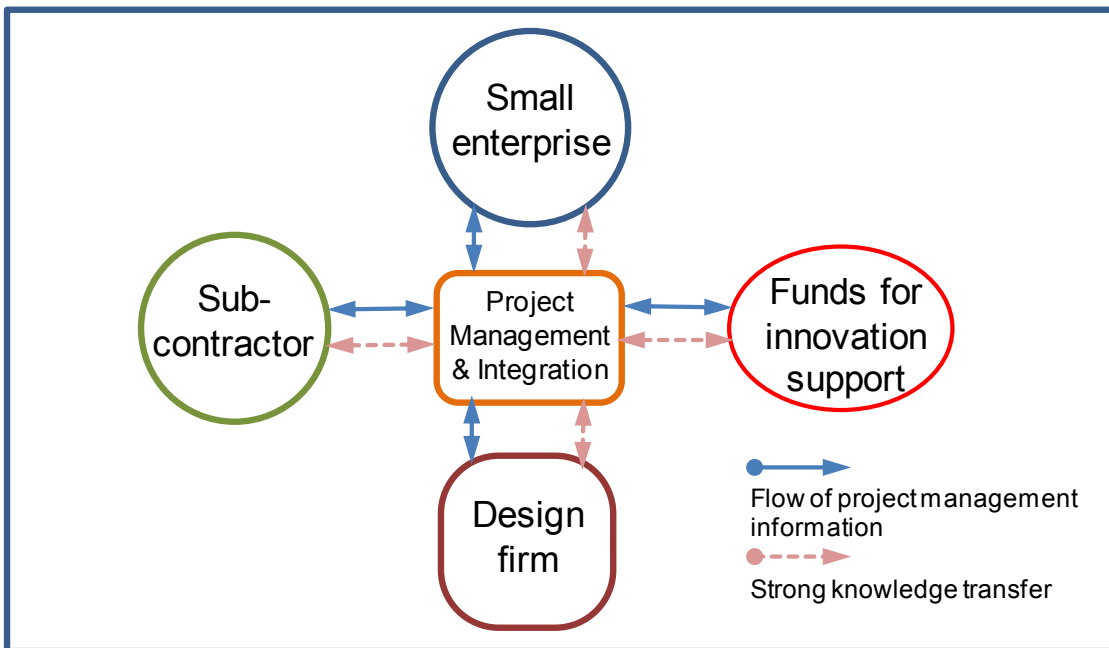


Figure 8 A body with responsibility for M&I dominates project and knowledge management

## CONCLUSIONS

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The paper brings out a number of points about the fuzzy front end of new product development.

First, *the management of knowledge in NPD is not just about knowledge being relayed from point to point, but also about it being originated*. This ought to be obvious, given that a genuinely new product design or ‘discontinuous’ innovation might well be thought to embody new thinking; but the doctrine that innovation is largely and simply a clever combination of previous developments is all too fashionable nowadays (Woudhuysen, 2010:27). The significance of prototypes here also ought to be obvious. By its nature, a prototype is meant to test out new ideas, not just embody existing ones or lash them up together.

Second, *a commercially experienced higher education institution can play the role of heavyweight product manager*. It can manage and integrate the work of varied players and, in this work, can ensure not just that lines of communication are clear, but that whole new product concepts are developed and adhered to in the face of setbacks that are inevitable. A commercially experienced HEI can have the kind of clout, objectivity and balanced, comprehensive vision that can save time and money in NPD, and that a project manager internal to a client may not be able to muster. At the same time, HEIs have goals that go beyond time and money, a fact that can work to the advantage of clients.

Third, *uncertainty at the FFE is something to be embraced, not feared*. Again it should not need saying, but *if there were no uncertainty, there would be no novelty*. With company SE (handheld scientific equipment), a simple design facelift would have involved much less uncertainty – but would have led to much lower profits.

Fourth, uncertainty may surround not just user needs, technology, competition or the required resources, but also *state regulation*. The impact of regulation on NPD has almost certainly grown a great deal over the past 20 years, and closing information gaps about it was a key part of the Design Unit’s work with company SF (sports footwear with imported components that could have been subject to EU taxes), and with company KD (kneeling devices for healthcare professionals). Indeed, had company WT’s product gone forward, medical regulation would have been pivotal there as well.

Last, despite its relative absence from the literature on the FFE, *the size of client companies matters*. In the realm of construction, the category of the novice or inexperienced client has been shown to be relevant to the FFE (Tzortzopoulos, Cooper, Chan & Kagioglou, 2006: 658). That category pretty much describes how many small firms and not a few medium ones would see themselves.

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# MANAGING EFFECTIVE INDUSTRY KNOWLEDGE TRANSFER WITHIN A HIGHER EDUCATION CONTEXT

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## ABSTRACT

Effective knowledge transfer is essential in ensuring the successful development of products, but is the role of the different actors in this process clear? During the past 20 years De Montfort University (DMU) has supported in excess of 100 companies in the design and development of new products. Case study material has been produced to support undergraduate and postgraduate teaching, placements for students have been established and a number of Knowledge Transfer Partnerships (KTP) have been initiated and completed. Activities with Small and Medium sized Enterprises (SMEs), Large Enterprises (LEs), design consultancies and KTPs, all in the Higher Education context, have provided DMU with considerable and multifaceted experiences relating to knowledge transfer in product design and new product development in both the public and private sectors. Based on these experiences this paper considers the nature of and the difficulties in ensuring effective knowledge transfer in the product design and new product development discipline, in a higher education context. This paper investigates knowledge transfer environments that support academics in gaining experience and providing design students and professionals with access to information from which to generate innovation. This paper explores the nature and importance of relationship building in the management of knowledge environments to enable effective knowledge transfer and uses a case study to illustrate this activity within the Higher Education Institution (HEI) context.

*Keywords: Knowledge Transfer, KTP, Product Design, Knowledge Creation, Knowledge Environment*

## 1 INTRODUCTION

In 2004 DMU undertook its first regional (East Midlands) design support scheme entitled Improving Business by Design (IBD), a highly successful initiative to assist SME's in making better use of product design in new product development activity. IBD was followed by a further six, regionally funded SME design support initiatives. These activities have included new product development support, the provision of rapid prototyping and manufacturing facilities and support with resource efficiency and sustainability in both new product development and design for retail. With all of these schemes an overarching requirement has been to involve the region's product design and manufacturing community in the delivery of these interventions.

On a number of occasions relationships with companies formed under these schemes have led to Knowledge Transfer Partnerships (KTP), a partnership between a company interested in developing a new product or technology with a HEI capable of supporting the venture. In most of these cases the relationship building between the HEI, the partner company, their sub-contractors and design practitioners on design exercises prior to a KTP have been invaluable in ensuring the KTPs success. Interactions between academia, manufacturing, the design profession and product design students have all made for a dynamic knowledge environment.

This paper begins with a quick review of some of the current literature relating to knowledge transfer. Three knowledge environment models are then proposed, illustrating different interaction scenarios within New Product Development (NPD) based on the experiences of the authors. The merits of the HEI distributed model are subsequently discussed with the context of a specific case study.



## **2 KNOWLEDGE TRANSFER ISSUES IN LITERATURE**

This section considers both theoretical and empirical literature and concludes by presenting questions for debate.

### **2.1 The explicit and the tacit**

An underpinning tenet of Nonaka and Takeuchi's book, 'The Knowledge-Creating Company' [1], is that the tacit and the explicit on their own are both limited in their knowledge creation capacity, but that when they interact, 'innovation emerges'. They advocate a dynamic relationship or interaction between the tacit and the explicit, which they refer to as the knowledge spiral, the conversion of knowledge created at an individual level (tacit knowledge) to generate explicit knowledge which in turn brings about the development of tacit knowledge in others; "the root of all knowledge creation is the mobilization of tacit knowledge" [2]. Thompson et al. [3] develop this further in that they acknowledge a cyclical characteristic to knowledge transfer but couch it in terms of it needing to 'stimulate action' in the receiver for it to be truly classed as knowledge transfer.

Qui et al. [4] refer to knowledge management as being essential to product design, proposing a "know-what, know-who, know-why and know-how framework for designers to obtain essential knowledge or information relating to the design task in hand". It is interesting to note that Thompson et al. [3] identify this as information diffusion and not effective knowledge transfer in itself and that interaction has to take place between both the sender and the receiver for knowledge transfer to take place. Van den Bosch et al. [5] state that outside sources of knowledge are critical to the innovation process; in particular, they refer to a company's ability to make use of this knowledge or their absorptive capacity to assimilate it and make use of it.

### **2.2 Academia and practice**

Boland et al. [6] state "it is a widespread perception that knowledge created by scholars is not used in practice". Rynes et al. [3] concur and build on this in their paper that focuses specifically on the knowledge transfer relationship between practitioners and academics; suggesting that academics and practitioners have fundamentally different frames of reference with respect to the many aspects of obtaining, using and interpreting knowledge. They make significant reference to Nonaka and Takeuchi [1] in support of this, stating that "the failure to truly integrate practitioner and academic perspectives is what causes this form of knowledge transfer (the academic or explicit with the practitioner or tacit) to be generally ineffective" [2].

Rynes et al. [2] make the point that this lack of interaction between academic and practice suggests that current academic knowledge generation processes are therefore likely to be inferior, even from an academic perspective. They urge researchers to seek and not avoid the tension inherent in interactions between the explicit approach of the academic in contrast to the tacit approach of the practitioner.

A particularly interesting point made by Thompson et al. [3] is their reference to the cycle of knowledge producing action which in turn produces greater knowledge, being referred to as experience. Crabbe [7] discusses the conundrum of design academics having opportunity to practice design, debating as to whether worthwhile knowledge of design is in itself good enough without acquiring practical skills, that without this experience, academics may not be 'best equipped' to pass on design knowledge to students.

### **2.3 Knowledge Transfer Partnerships**

Several papers discuss the benefits of product design related Knowledge Transfer Partnership (KTP) schemes. Crabbe [7] and Wormald and Evans [8] describe three successful KTP's between them; whereas Schaber and Thomas [9] describe two that had limitations in their varying degrees of success. Millward et al. [10] [11] describe a number of KTPs but in both papers they define the main obstacle to achieving successful product development is the lack of understanding of the discipline on the part of the dominant owner manager, or the impact of the owner manager operating within a resource constrained environment.

Rynes et al. [2] stress "that good social relations, mutual empathy, and some sort of common ground are prerequisites for achieving optimal outcomes in cross-boundary knowledge creation" they state that knowledge transfer is fundamentally a social process. A theme expanded by Thompson et al. [3] who state that the management of knowledge is a human phenomenon and that therefore knowledge transfer rests on behaviour and relationships.

## 2.4 Summary

As has been described, there are many facets to the issue of knowledge transfer, from the management of knowledge to the knowledge environment, to the diffusion and assimilation of information. The review highlights current thinking on the need to have interaction between the tacit and the explicit in order to enable innovation and how that the academia and practice relationship does not always make this possible.

In the majority of the examples of KTPs referred to above, emphasis is placed largely on the financial success of the activity; while important it is interesting that the nature of the actual knowledge transfer is not always clearly defined. Establishing an in-house NPD capability and the embedding of CAD and CAD related processes are consistent outputs in many KTPs. Crabbe [7] describes the benefits to the academics involved in terms of the opportunity to gain experience in practice.

While the current literature emphasises the importance of interaction between academics and practitioners, and the benefits of KTPs in the context of product design, the best knowledge environments for this to be achieved are not explored. How can HEIs manage the knowledge environment to benefit all the actors in the process?

## 3 KNOWLEDGE ENVIRONMENT MODELS

It is the opinion of this paper that the nature of any knowledge environment has a critical impact on the creation of new knowledge. The formulation of a knowledge environment not only establishes the sources of information and the mechanisms for obtaining appropriate information, but it is where the relationships for a particular new product development exercise are established. Thompson et al. [3], explains that understanding who the senders and who the receivers are, and where the new knowledge may reside in a knowledge environment is needed to stimulate true knowledge transfer.

The figures below present three simplistic knowledge environment scenarios; Figure 1 presents a knowledge environment centred on design practitioners that have been contracted to develop a product for a client company, a traditional design consultancy process without an HEI involvement. The primary information flow is from the client and potential sub contractors to the design group. During the NPD process, the new knowledge will reside largely within the design group with some new information possibly flowing back to the client company.

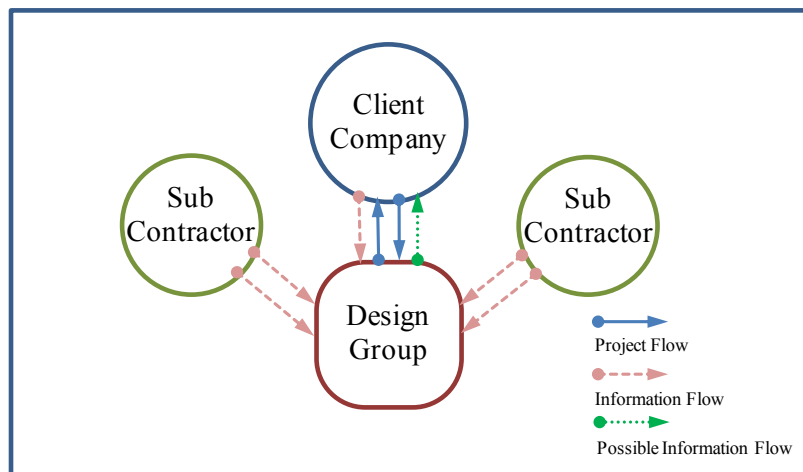


Figure 1. Consultancy model, design group centred

Figure 2 presents a typical KTP knowledge environment. With the KTP associate being placed within the partner company the information flow gravitates toward the partner company. With only weekly or fortnightly meetings, there is less opportunity for the HEI to play a fundamental role. Typically relationships with sub-contractors tend to be remote and less intimate, with new knowledge residing largely with the partner company.

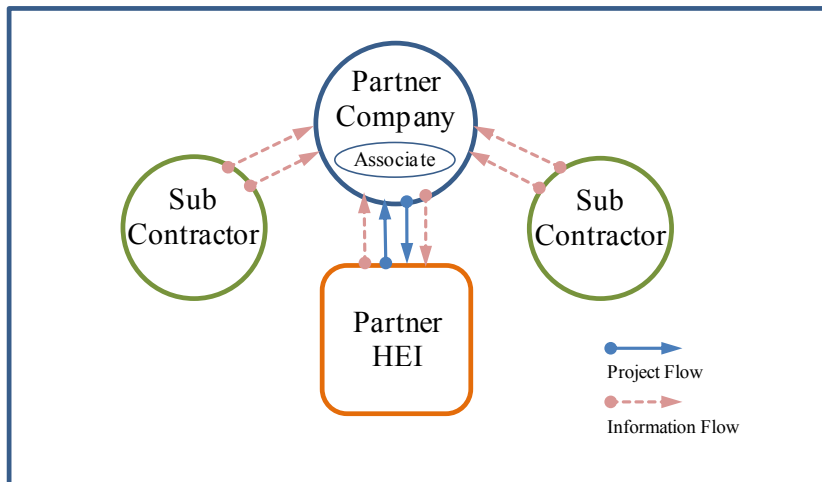


Figure 2. KTP model, partner company centred

Figure 3 presents a scenario where the partner HEI has a more fundamental and active relationship with all those involved with new product development including the identification, contracting and briefing of design practice and sub-contract support, enabling greater opportunity for explicit and tacit interaction to occur. In this model a more circular information flow provides greater opportunity for new knowledge to reside in all parties; in particular there is more potential for dissemination within the HEI environment.

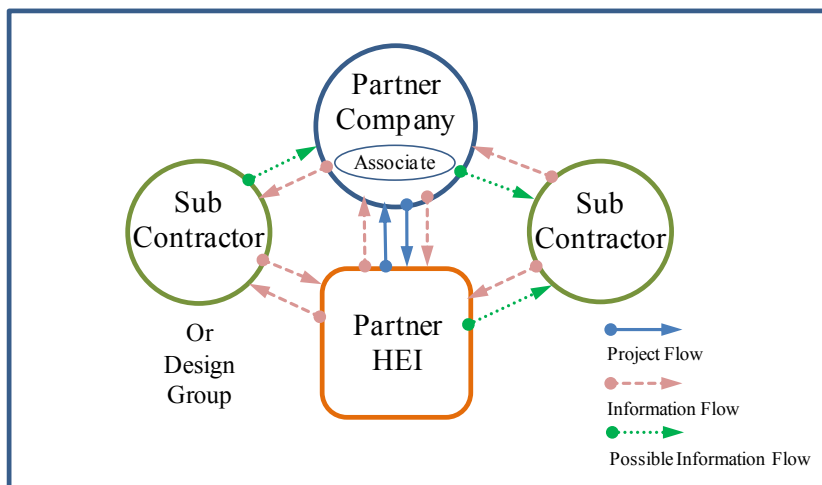


Figure 3. HEI distributed model

#### 4 CASE STUDY

This case study provides an example of the HEI distributed model, defined in figure 3. As part of the 2004 IBD support scheme, DMU established a relationship with a manufacturer and distributor of dust and fume extraction products (who will be referred to as EC). A thorough review of EC’s new product development capabilities, their products, their markets and their competitors was undertaken with a view to identifying opportunities for new product development. This resulted in a project to rationalise the number of components needed to construct their range of devices and at the same time ‘design out’ any features that would present a restriction to airflow. Overall this would have a positive impact on cost and performance, and therefore ultimately competitiveness.

This exercise required a fundamentally innovative approach to design and construction; a design practitioner was sourced and contracted to assist in the project, both DMU and the practitioner being involved in proposing concepts to EC. The results were so successful that the potential for EC was far more than they had been envisaged; as such they were sufficiently encouraged to embark on a KTP with DMU to take full advantage of this potential. A significant advantage in the set up of this KTP was that the partner company EC, was already known as was their commitment and ability to invest in the project. Again the project continued to progress well with both the design academics from DMU and the design practitioner, supporting the KTP associate in building upon the original concept.

Early in the KTP there was a change in health and safety regulations requiring dust and fume extraction equipment to monitor itself continually in terms of flow rate. This required a review of the design requirements and the contracting of an electronics consultancy (who became a sub-contractor) into the development team. DMU by this time was running another regional SME design support scheme which was able to support the enlistment of this additional contractor to develop the flow monitoring and feedback technology that would be compatible with the new design and manufacturing approaches.

Driven by the NPD experience of DMU, this knowledge environment was established over a period of time and was based on skills, experience and knowledge from an HEI (academics and KTP associate), the client company, a design consultant and an electronics consultant. However to make this possible funding was required beyond that which the KTP on its own could afford, a significant consideration for an exercise of this type.

The result has been a genuinely successful exercise with all parties benefitting from the opportunity to develop new knowledge. This success can be attributed largely to the establishment of long term relationships. As both consultancies could not provide input to the project over its duration (due to other consultancy commitments) they were brought into the project as and when needed, the common denominator being DMU acting as the manager of this knowledge environment and communication hub for all the parties concerned. This in itself proved useful experientially to the design academics involved and has indeed, in part, provided inspiration for this paper. Both consultants involved have expanded their knowledge base on design issues relating to extraction devices but more importantly with the new associated technologies.

The partner company has of course developed new, market leading products, but has in addition, been able to embed new product development frameworks within the company that extend beyond the KTP associate. There is a genuine knowledge transfer legacy within EC; as such they are not reliant on the associate having to stay with them. EC is also seeking to develop its own Masters programme in extraction and venting related issues, potentially involving DMU.

With regard to knowledge dissemination on the design courses within DMU, this has provided valuable study material, with case studies being constructed in a manner where the tacit is carefully being made explicit through anecdotal and related methods, including KTP associates presenting their experiences in lectures and contributing to tutorials on student projects.

## **5 CONCLUSIONS**

Knowledge transfer has generated much discussion; but clearly the process is inextricably linked to human activity; the interplay between all the participants and their roles within the environment. This paper has highlighted, that effective knowledge transfer has to be more than just placing a KTP student within a company. The case study demonstrates the benefits of the HEI distributed model, derived from a circular information flow between the different partners. If HEIs take the opportunity to manage the knowledge environment, engaging academics, students, design practitioners, manufacturers and sub-contractors it can bring about knowledge benefits for all. Especially new tacit and explicit knowledge relating to NPD located within the HEI, which can be disseminated to students.

This paper has been largely based on experiences of one HEI engaging in NPD, in collaboration with companies, design consultants and subcontractors; further work needs to be conducted to explore the generalisation of the finding to alternative contexts such as in-house design teams.

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### **Origin Oman – Muscat, April 2009**

Having heard of the Investigators work with SME's in the UK, he was invited by the Sultanate of Oman to undertake company design audits for 'The Nejd' and 'Sweets of Oman', 19<sup>th</sup> and 20<sup>th</sup> April 2009; this was followed by the Investigator providing one of the panel session talks on Design Innovation at Origin Oman's Product Design and Packaging Workshop, 18<sup>th</sup> April 2009.



origin Oman's

# Product Design & Packaging Workshop

18 April 2009  
Grand Hyatt Hotel, Muscat



# Packaging Origin Oman

In today's congested business world, packaging has become a critical factor; it can often make or break a product. If the packaging is right, people will buy a product without even trying it because most associate superior packaging with quality.

It's generally accepted that 70 - 80% of a consumer's purchasing decision is made at the point of sale. In supermarkets, for example, research shows shoppers spend an average of less than 10 seconds in any single product category, so decisions are made quickly and often based on what a product looks like.

The look and feel of the product, design, colour, labelling, price and the name of the product itself are all things that trigger us to stop and look at items on shelves. Most of these triggers either are, or can be influenced by packaging.

Indeed, potential consumers will touch, rate and even smell a product simply based on its packaging. With so much at stake, having a product packaged creatively will increase the likelihood of it being bought and re-bought if it lives up to its name.

However, attention to packaging is a crucial step that's often neglected in business. Ask yourself this question, would you buy a plain looking item or something excitingly packaged that makes everyone drool? Everyone knows that packaging attracts attention, provokes and communicates volumes about the product it contains and the brand. Think about a box of chocolates, would you buy one with 'Cheap Chocs' printed on the box if you were taking it as a gift - even if the contents were just as good as those at twice the price?





## Origin Oman's Product Design & Packaging Workshop

18 April 2009 – Grand Hyatt Hotel, Muscat

### Event Summary

The Origin Oman campaign will conduct a one-day product design and packaging workshop which will provide an insight into the specialist design expertise available to Oman's manufacturing industry; the importance of product design and packaging, development and innovation to manufacturing – illustrated with examples and expert guidance; and advice on how to avoid product development and packaging failures.

### Event detail and schedule:

9.00am – 9.30am: Networking + coffee

#### Session 1: 9:30am – 10:15am

**Peter Ford, Reader in Design Innovation - De Montfort University**

Approximately 50% of all new product development projects are failures. Session 1 will illustrate with examples, how to avoid the pitfalls and justify why new product development is important to Omani manufacturers. In addition, Session 1 will highlight the key drivers for a successful customer driven implementation strategy.

10:15am – 10:30am: Questions

10:30am – 10:45am: Networking + coffee

#### Session 2: 10:45am – 11:30am

**Rawan Darwish, Shaun Loftman & Stuart Jeal - Landor Associates**

Session 2 will outline the why's, how's and wherefores of design, development and innovation in product design and packaging.

11:30am – 11:45am: Questions

## **PEIE (Public Establishment for Industrial Estates) Smart Manufacturing Conference**

The Investigator later invited by the Sultanate of Oman to be a panel member for the PEIE (Public Establishment for Industrial Estates) Smart Manufacturing Conference 2009 – Bad Vibrations, Perception of Manufacturing.

# Smart Manufacturing Conference 2009

7<sup>th</sup> December 2009  
Grand Hyatt Muscat, Sultanate of Oman

## Survive & Thrive Conference Program

Under the Patronage of  
**HE Maqbool bin Ali Sultan**  
Minister of Commerce & Industry

Presented by





## Overview

Launched in 2006, PEIE's annual Smart Manufacturing Conference is designed specifically to encourage and assist manufacturers in reaching their full potential. This important event also represents an opportunity to inspire local businesses to work towards making their goals a reality. Indeed, Oman's manufacturing sector employs over 45,000 people, but this betrays the leverage industry has on national employment as each manufacturing job supports at least one service sector job.

The manufacturing sector is diverse and encompasses many disciplines. Moreover, it lies at the heart of many of today's leading business sectors. For example, it drives sustainable growth in agriculture, food processing and drink, pharmaceuticals and life sciences, automotive industry, ICT, construction and the built environment, energy industries, R&D, and cultural and creative industries. In brief, manufacturing makes a critical contribution to national wealth and quality of life.

### **The Smart Manufacturing Conference seeks to:**

- **Inform:** provide and disseminate information on what public and private sector authorities are offering by way of support and advice to manufacturers.
- **Inspire:** motivate manufacturers to broaden their outlook and further develop and grow their business.
- **Share:** float ideas and share the experiences of manufacturers and those connected to the sector.
- **Encourage:** convince young people that manufacturing is an attractive career option.



## Event Details

**Date:** 7<sup>th</sup> December 2009

**Venue:** Grand Hyatt Hotel, Sultanate of Oman

### Target Audience

Smart Manufacturing is a must for managers, executives and business owners who are shaping their organizations. The Conference is designed with the following fields in mind:

- Directors
- Consultants
- Engineers
- Bankers
- ICT & Telcos
- Venture Capitalists
- Environmentalists
- Training & HRD
- Academics
- Civil Servants
- Business Entrepreneurs
- Senior Management, Marketing Managers, Product Managers, Import & Export, Health & Safety; PR Specialists, IT, Sales & Advertising Managers.
- Senior level executives with job titles in the areas of product design, logistics, finance, investment, Internet/interactive/electronic/web/online, customer marketing or management, design, research and development, strategic initiatives and business development.





## **Why Attend?**

Smart Manufacturing is an in-depth, highly interactive and information rich event that has been designed specifically for manufacturing professionals and those associated with the sector that want to delve deeper into the various challenges facing manufacturing today. Conference participants will have plenty of access to presenters and time to network with other participants. Each of the Conference sessions will have a strong emphasis on interactivity. Indeed, it's PEIE's belief that the only way to learn is through doing, and it's through hands-on exercises and real-life case studies that Smart Manufacturing will equip you with the skills, knowledge and techniques to succeed in the ever-competitive manufacturing environment. In brief, the Conference is a must-attend for anyone who is serious about making their manufacturing business hit harder.

## **Attendee Benefits**

1. By taking just one day out of the office you will return with innovative answers to all those business questions you have so often asked.
2. Get answers to questions from leading manufacturers and those associated with the sector.
3. Review and share best practices with other business professionals.
4. Meet and exchange ideas with key manufacturing professionals.
5. Ensure you are at the bleeding-edge of the latest manufacturing developments.

Conference presenters are the best in the business, each skilled at making the most difficult topics accessible and comprehensible. You won't just hear what works at Smart Manufacturing, you'll learn how to build and apply what works.



## Event Program

### 7<sup>th</sup> December 2009

9.00am -9.15am **Welcome Address**  
Mr. Hilal Al Ahsani, CEO, PEIE

9.15am -9.45am **Keynote Address: Survive & Thrive**  
Dr. Abdullah Al Zakwani, Director, Industrial Innovation Centre

9.45am -10.00am **Networking Break**

### Track 1

10.00am -11.00am **Upskilling Manufacturing: 21<sup>st</sup> Century Style**

**Moderator:** Maryam Al Shaibani, Zubair Corp.

**Panelists:** Mark Hobbs, Shaleem Petroleum  
Matt Jabbour, AMIDEAST  
Abeer Al Jasim, Knowledge Horizon  
Dr. Ahmed Al Mashani, An-Najah Center for HR Development

The availability of skilled people and graduates with scientific and engineering degrees is in decline right across the world. For many Omani manufacturers it has been difficult to recruit people with the right capabilities in science and engineering who are willing to move into the sector and take up leadership roles. This panel will analyze and discuss the skills Oman's manufacturers need to bolster, particularly in relation to leadership, management, engineering, technology, marketing and design as well as sector specific craft skills. To facilitate this, training should be made more modular to enable employers to access skills training in more easily digestible chunks. In addition, the panel will discuss how to encourage Oman's youth to study basic science, engineering and business degrees and enter industry.

11.00am -11.15am **Networking Break**



## Track 2

### 11.15am -12.15pm **The Economic Downturn: Accessing Investment & Financial Advice**

**Moderator:** Richard Williamson, KPMG

**Panelists:** Samir bin Bashir Saied, Oman Development Bank  
Rajiv Dhar, Omar Zawawi Establishment  
Hilal Al Rashidi, SME Dept. MOCI  
Alfred Strolla, Deloitte  
Abdulnasir Al Raisi, BankMuscat

Whilst Oman has one of the strongest manufacturing bases in the Gulf it mirrors the rest of the region by under-investing when compared to international competitors. Some of this is about the ability of organizations to access finance and financial advice and some of it is to do with the willingness of organizations to invest. Given the current economic conditions Omani manufacturers should be able to access unbiased financial and business advice in order to understand their position vis-à-vis the credit crunch. This session will offer manufacturers the opportunity to gain such expert financial and business advice through a panel of leading specialists who have first-hand experience of running their own business, as well as helping companies through periods of economic uncertainty.

## Track 3

### 12.15pm -1.15pm **Bad Vibrations: Perceptions of Manufacturing**

**Moderator:** Ron Cregan, NavyBlue

**Panelists:** Clara Zawawi, Ocean Blue Oman  
Peter Ford, De Montfort University  
Alex Adams, Apex Publishing  
Kevin Hasler, Zeenah PR  
Rayan Al Kalbani, Mazoon Environmental & Technological Services

Manufacturing is not a declining industry, it is merely transforming. But as it transforms, we need to move peoples' perception of the sector away from the misleading 20th century stereotypes. Indeed, there exists a perceptual problem within Oman about manufacturing which is perpetuated by low numbers of positive manufacturing messages. This session will discuss how these perceptions affect young people and new graduates who may otherwise be attracted into the sector, as well as affecting possible investment opportunities either for Oman - in terms of foreign inward investment - or for individual businesses.

### 1.15pm -2.15pm **Lunch Break**



## Track 4

2.15pm -3.15pm

### **Entering New Markets: A Manufacturer's Guide to Exporting**

**Moderator:** S. Gopalan, Reem Batteries

**Panelists:** Shatha Abbas, The Nejd  
Ron Cregan, NavyBlue  
Peter Ford, De Montfort University  
Dr. Abdullah Al Zakwani, Industrial Innovation Centre  
Fahmy Al Hinai, Poly Products

Oman's manufacturers need to plan for growth and survival in the globalized world of business competition. Some will choose to conduct business from home taking on competitors in the safety of Oman's domestic market. Others will go international operating from both domestic and foreign markets.

Research suggests that manufacturers who export boost their business productivity by up to a third in the first year. So, why should Omani manufacturers be thinking about exporting? There are many benefits including:

- Economies of scale in production
- Increased revenue and profit
- Boosting business productivity
- Spreading the risk base
- Learning about the wider competition
- Developing new product ideas


Oman's manufacturers know they need to trade internationally to succeed. However, many feel a lack of information prevents them from entering new international markets. Attend this session and get informed about exporting and overcoming associated barriers.

## **Visit to Surabaya Indonesia**

The investigator was invited to Surabaya Indonesia by the British Council (visit hosted by Universitas Pelita Harapan – UPH), to work with UPS in developing methods by which UPS could help SME's in Eastern Java (mainly craft based) be better prepared for exporting product to Europe.

This involved an intensive week of visits to craft based SME's and culminating in the investigator provide a keynote talk at the Surabaya UPH Festival 03 on The Creative Industries in a Global Knowledge Economy



 Attachments can contain viruses that may harm your computer. Attachments may not display correctly.

**Peter Ford**

**From:** pbford@dmu.ac.uk [pbford@dmu.ac.uk] **Sent:** Thu 14/07/2011 20:35  
**To:** Peter Ford  
**Cc:** Peter Ford  
**Subject:** FW: De Montfort & Pelita Harapan University Partnership  
**Attachments:**  Offer letter UPH Surabaya.pdf(161KB)

-----Original Message-----

**From:** Scarlet, Faye (Indonesia) [mailto:Faye.Scarlet@britishcouncil.or.id];  
**Sent:** 08/06/2010 04:21:17  
**To:** Ian Kirkwood [mailto:ik@dmu.ac.uk]; Peter Ford [mailto:pbford@dmu.ac.uk];  
**CC:** MRGDivinagracia [mailto:rochelle\_divinagracia@yahoo.com]; L.A. DIVINAGRACIA [mailto:louie\_divinagracia@yahoo.com];  
**Subject:** De Montfort & Pelita Harapan University Partnership

Dear Mr. Kirkwood,

I'm writing on behalf of Prof. Dr. Maria Rochelle G. Divinagracia, Director of the Center for Creative Industries, Universitas Pelita Harapan Surabaya (UPH Surabaya).

UPH Surabaya just won Partnership Grant from the **British Council** with the amount of **£10,000** (please see attached the Offer Letter and agreement).

This partnership grant can be used to support any academic partnership between UPH and its UK Higher Education Institution Partner. In their proposal UPH stated that they would like to see the possibility to develop a **short-course on Craft-based Product Design**. We understand that De Montfort University has a strong record in a wide range of research projects that impact on many facets of industry and society, and that one of the areas of research in the Faculty of Art and Design is the Design and New Product Development, lead by Mr. Peter Ford. Hence, we think there is a big possibility for UPH and DMU to have a very good international academic link through this partnership programme.

The grant can be used for example for course development and visits to the respective partner to discuss further details about the collaborative programme delivery.

You can also see below the activities planned by UPH for the partnership programme:

Shall you have the interest in pursuing academic partnership with UPH Surabaya, you are most welcome to contact Prof. Maria Rochelle directly at [rochelle\\_divinagracia@yahoo.com](mailto:rochelle_divinagracia@yahoo.com) for further discussion. For any confirmation and inquiries regarding the British Council Partnership Grant, you can contact me at [faye.scarlet@britishcouncil.or.id](mailto:faye.scarlet@britishcouncil.or.id)

<<Offer letter\_UPH Surabaya.pdf>>

Best regards,

Faye Scarlet Ålund

Programme Officer

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 E [faye.scarlet@britishcouncil.or.id](mailto:faye.scarlet@britishcouncil.or.id) | [www.britishcouncil.or.id](http://www.britishcouncil.or.id)

**Creating Opportunity Worldwide**

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**Schedule of Activities of Professor Peter Ford's Visit to UPH-Surabaya  
9-16 August 2010**

Date	Time	Activity	Person-in-Charge
09 August (Monday)	10:30	Arrival at Juanda	Prof. Rochelle
	12:00	Lunch with Rectorate	Rectorate's secretary & Dian
	13:30	Overview of De Montfort University	Prof. Ford/ Dian
	14:00	British Council Project Briefing and Team Meeting	Prof. Rochelle/ Dian
	16:00	Check-in at Mercure Hotel, Surabaya	Dian/ Rosalinda
10 August (Tuesday)	8:30-16:00	Site Visit of Craft Enterprises at Sidoarjo (Batik, Leather)	Johan
11 August (Wednesday)	8:30-16:00	Site Visit of Craft Enterprises at Mojokerto (Miniature Boat)	Johan
12 August (Thursday)	8:30-16:00	Site Visit of Craft Enterprises at Madura (Batik)	Johan
13 August (Friday)	8:30-16:00	<ul style="list-style-type: none"> <li>• Write-Shop and Team Meeting</li> <li>• In-House Seminar on Product Design at UK's Creative Industries by Professor Peter Ford</li> </ul>	Prof. Ford/ Dian/ Gracia
14 August (Saturday)	10.00	Visit to the Creative Industry Exhibition at Juanda Airport Lunch	VP Januar Heryanto
	18.00	Dinner with VP for Academic Affairs and Members of the Center for Creative Industries	VP John Batubara/ Dian/ Rosalinda
15 August (Sunday)		Free Time	
16 August (Monday)	8:30	Procession of University Senate and Opening of the Second Year Anniversary of UPHS	Prof. Rochelle/ Dian/ Firmanto
	9:15	MOU Signing and Public Lecture of Prof. Peter Ford <ul style="list-style-type: none"> <li>• Welcome by Prof. John Batubara (Vice-President for Academic Affairs)</li> <li>• Brief Presentation on the British Council's Higher Education Partnership Program by Mr. Keith Davies (Country Director for Indonesia)</li> <li>• MOU Signing between UPHS and DMU (Rector Jonathan Parapak and Professor Peter Ford)</li> <li>• Public Lecture "<i>Creative Industries in a Global Knowledge Economy</i>"</li> </ul>	
	10:25	Short Break	
	10:31	DGS Seminar 2	
	12:00	Lunch	
	14:30	Depart for Surabaya International Airport	
	15:00	Check-in at Airport	
	17:00	Flight to UK (via Jakarta)	

OUR PARTNERS IN EDUCATION



# UPH FESTIVAL SURABAYA 03



16th-19th  
August 2010  
**Be Transformed**  
UPH FESTIVAL SURABAYA 03

## UPH Surabaya

Jl. Jend. A. Yani No. 288

Waru, Surabaya

Tel. (+62 31) 582 51 007-10

Fax. (+62 31) 582 51 020

[www.uphsurabaya.ac.id](http://www.uphsurabaya.ac.id)

email : [infochs@uphsurabaya.ac.id](mailto:infochs@uphsurabaya.ac.id)

# VISION AND MISSION OF UPH

UPH has defined its organizational vision and mission to emphasize a balanced and integrated education, encompassing the arts, science, and technology and strengthening spiritual values.

## Vision

To be a prime national educational resource for applying total transformational principles that empower future leaders to transform people in a balanced and integrated manner; to enhance knowledge and technology; to develop good character and attitude and to glorify God.

## Mission

To prepare the students in their respective fields to become academically proficient professionals who respond ethically and strategically to the challenges of the future, who are able to solve problems creatively, who can seize opportunities proactively for the benefit of their organizations and communities, and who can realize their life goals. To support academic and professional staff in their collegiate endeavors enhancing their quality of life and service to others.

# ABOUT UPH FESTIVAL

UPH Festival is a celebration welcoming new students into the vibrant campus environment through a series of stimulating academic seminars, informational department open houses, inspiring musical and art performance, and exposures to student activities. The Festival is open to the public and is presented with spirit of openness to experience the academic environment and dynamic campus.

Be Transformed at UPH Festival 03 Surabaya, the BIGGEST campus event of the years

# RECTOR'S REMARKS

## Welcome to UPH

Welcome to UPH Festival 2010

By the Grace of God, I am very pleased to present the UPH Festival Surabaya 03 to all of you as our special way to welcome the new students and introduce the UPH family.

This year, we chose "BE TRANSFORMED" as our sincere desire to make significant contribution toward global education through our vision: True Knowledge, Faith in God, and Godly Character. We believe that we all have roles in sharing the responsibility to be transformation agent to prepare the Nation's Future Leader by means of Holistic Education. But if we want to be an agent of transformation, we first must "be transformed".

Please accept my deep appreciation to the speakers, parents, faculty members, students, and committee members for your participation in UPH Festival Surabaya 03.

It is my hope that we enjoy this festival and may God be Glorified.

Soli Deo Gracia

Dr. (Hon.) Jonathan Parapak  
UPH Surabaya Rector

# EVENTS HIGHLIGHT

## GRAND OPENING

### UPH FESTIVAL 03 SURABAYA

📍 CITO HALL - MALL CITO  
🕒 Monday, 16th August 2010  
(07.30 - 09.30)

### HIGH SCHOOL COMPETITION

📍 CITO HALL - MALL CITO  
🕒 16th - 19th August 2010  
(08.00 - 16.00)

## DGS SEMINAR



Prof. Dr. Drs. Tjpta Lesmana, M.A, M.A.R.S  
🕒 Mon, 16th Aug

📍 Cito Hall - Mall Cito  
📌 Creative Communications for the Creative Economy Toward Community's Transformation



Prof. Peter Ford  
🕒 Mon, 16th Aug

📍 Cito Hall - Mall Cito  
📌 Creative Industry in a Global Knowledge Economy



Dr. Benyamin Intan  
🕒 Wed, 18th Aug

📍 UPH Surabaya  
📌 Indonesian Challenges in Facing Various Problems of Transformation



Budi Suharto  
🕒 Wed, 18th Aug

📍 UPH Surabaya  
📌 Certified Financial Planner



Mr. Martin Hatfull  
🕒 Thu, 19th Aug

📍 Cito Hall - Mall Cito  
📌 International Opportunities for Creative Industries in Developing Economies



Garry A. Miller, Ph.D  
🕒 Thu, 19th Aug

📍 Cito Hall - Mall Cito  
📌 Holistic Education for National Transformation



Prof. Dr. Sugijanto, M.S., Apt  
🕒 Thu, 19th Aug

📍 Cito Hall - Mall Cito  
📌 Higher Education Development Strategy in Indonesia: Towards World Class Educational Institutions

## DEVOTION

Dr. (Hon.) Jonathan L. Parapak, M.Eng.Sc

📍 UPH Surabaya  
📌 "The Truth Will Set You Free: Is Our Creativity Borderless?"  
Romans 6:20-23 and John 8:32

Pdt. Henry Ongkowitzo

📍 UPH Surabaya  
📌 "Our Creativity and True Worship"  
Romans 1:17, 12:1

Pdt. Irwan Pranoto

📍 Cito Hall - Mall Cito  
📌 "Sustainability of The Transformation Toward God's Perfection" Romans 12:1-2

Ev. Koentjoro Angkawidjaja

📍 UPH Surabaya  
📌 "Christian View on Creativity"  
Gen 1:26

## CLOSING CEREMONY

### Closing Ceremony & Dies Natalis 02 UPH Surabaya

🕒 Thursday, 19th August 2010  
(07.00 - 18.00)

📍 Cito Hall - Mall Cito