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Original Citation

De Luca, Damian, Taylor, Ruth and Prigmore, Martyn (2013) Models for Academic Entrepreneurship Canalside Studios case study. In: University-Industry Interaction Conference, 28-29 May 2013, Amsterdam, The Netherlands.

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Models for Academic Entrepreneurship

Canalside Studios case study

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Abstract:

In 2005 the University of Huddersfield launched an in-house computer games studio, Canalside Studios. Funded by the University, the Studio was created to provide work placement opportunities for students studying computer games (programming and design). The Studio team is made up of undergraduate students and is supported by members of academic staff. Having had no prior experience of commercial game development the academic staff team recognised their own need for new learning and development around business awareness and industry issues to match the needs of a commercial studio. This process included the development of the staff through MBA and Enterprise Fellowship programs, industry guidance and practical project and team management by the academic staff of the Studio team. This on the job training provided an effective “Enterprise Apprenticeship” for the academics involved which has influenced a change in approach and practice and subsequently led to greater success in enterprise activity and industry engagement.

This paper provides a case study exploring the academic staff’s own development and increased understanding of industry partnerships and issues. It then presents models of academic enterprise developed through the Studio and discusses this as a distinct enterprise ecosystem.

The study reveals diversity in academic approaches to enterprise and commercial engagement within the institution and novel responses by academic staff to undertake personal development and training and define new models of working to support activities on the academic/industry boundary.

Although the study shows that there are many models for academic enterprise and entrepreneurship we conclude that academic entrepreneurs seek to take advantage of perceived opportunities and will persevere and adopt personally effective modes of work that may be outside the institutional norm.

Keywords: academic, entrepreneurship, enterprise, industry engagement, personal development.

I. INTRODUCTION

The overarching mission of Universities is the generation and transfer of knowledge - in principle knowledge creation through research and knowledge propagation through publication and teaching. The academic community generate this knowledge through the foundation of Mode 1 and Mode 2 research (Gibbons, 1994) generating outputs ranging from new concepts and theories to new methods of implantation of technologies. Studies tend to be lab or experiment based,

rigorous, theoretical or experimental in nature. The traditional output is through journal publication and the embodiment of the knowledge into the relevant curriculum.

The role universities play in economic development has been emphasised in recent years with university research and enterprise leading the way in the development of enterprising academics within the Higher Education Institutions (HEIs)(Cable & Willetts, 2011; Cox, 2005; Lambert, 2003; Wilson, 2012). “Academic Entrepreneurship” refers to the endeavours undertaken by universities and industry partners in the commercialization of their work (Wood, 2011). In the UK this has been led by government policy and appropriate funding priorities (Brennan *et al.*, 2005) and in recent years the global financial crisis, the state of public finances and the shift in government funding priorities have given academic entrepreneurship and enterprise an increased impetus. Scholars argue the appropriateness of academics managing commercial activities while engaging in an academic mission of knowledge production and transference (Lacetera, 2009). Academics approach to commercialisation of research differs in its priorities to industry’s, with peer review and publication being high in the list of priorities, this may have led to additional non-commercial activities or less effective methods being employed. Lacetera (2009) that academics can be more selective in which projects they participate in or bring to commercialisation, making it worthwhile to disrupt their traditional activities holds true in research. The creative enterprise activities are more inline with industry, where ideas need to be commercialised within cost and on time. Some scholars view Academic entrepreneurship as an area where the scarcity of research highlights the divide between entrepreneurs known to the institution and latent entrepreneurs who are unsure whether their research is entrepreneurial and concerned over who has ownership and how to protect or use it. (Tidd *et al.*, 2005)

The case study presents a non-traditional approach by two academics to build a commercial computer game studio (enterprise) within a university (non profit enterprise) to both educate and develop within their institution. This case study presents what the academics phrase an “Enterprise Apprenticeship” as with all apprenticeships there is a theory and practical application.

The study uses a qualitative, sense making methodology based on a single case study and empirical evidence from within the institution. The main study is based on interviews with the core staff undertaking the enterprise pursuit and an open forum of eight academic staff. The interviews are used to profile the academic entrepreneurs approach to self-development and their insight into working with both industry partners and academic colleagues on multiple projects and the open forum on embedding enterprise. The authors recognise the limitations of a single case study and further studies will involve multiple parties from across academia and industry, to verify models and best practice.

II. CASE STUDY

In 2003 the University of Huddersfield in the Department of Informatics validated two new degrees in the applied field of computer games. The degrees were based around the three pillars of games development, programming (technical), design and art. As a response to the needs of undergraduate degrees within the University to offer a sandwich year the department set up an in-house computer games studio, Canalside Studios. Five academic staff from the course teams were tasked, though subsequently only two members of the team took the studio through to fruition and publication of their games.

The two academics had no enterprise or commercial computer games development experience. They had no Ph.D., no traditional research and no knowledge of enterprise. The studio was initially seen as an alternative to the traditional research led activities within the University, however the University had no formal mechanism for training and developing of academic staff who wished to engage in enterprise activities. The academics involved are self-taught and knowledgeable in software and art asset development for computer games.

Working relationships between academia and industry had to be developed and initially games companies were only willing to contribute to the curriculum. The ‘Industry’ perception of the Studio was that it was a foolhardy endeavour with limited chances of success for such an inexperienced team,

they reasserted that institutions could teach the theory; yet there is no substitute to making a game and hands-on experience. Interactions between industry and the University took the form of informal meetings where mainly curriculum was discussed, industry were invited into the newly formed studio to hear the students ideas. Spillover from these events allowed both the students and staff to make more informed decisions. In the early days of the Studio, the students presented and developed short ideas for prototyping; several of the ideas were then developed. The increased confidence of the undergraduates led to the success when a game prototype was entered into Microsoft Dream Build Play competition in 2005. The competition attracted over 3400 entries from HEIs through to individual and independent developers, the entry came 2nd and the reward was a development contract with Microsoft to release an arcade game on the Xbox platform. The University was content with what was seen as useful publicity and recruitment, the students were ecstatic, the staff were content for all parties but concerned at the implications. It was clear that the staff would need developing, the Studio would need developing and industry help and guidance would be required to ensure that the arcade game development project succeeded.

1) *Staff Development Journey*

a) *Staff member 1*

This member of academic staff had been with the University for 5 years. With an engineering background and first-degree, his experience was in software development and teaching. As an engineer he was trained in problem solving and had undertaken a placement year during his studies and believed in the value of industrial experience. The challenge the Studio offered was an attractive alternative to the traditional academic apprenticeship of research and Ph.D. Having had no managerial or business experience, the academic decided to commence with an MBA as an alternative to staff development. Colleagues saw the MBA as a route to strong management and business skills. MBAs as Mintzberg (Mintzberg, 2005) argues do not necessarily make good managers, managers require experience insight and analysis. The modern MBA program is designed for people with little experience or craft to draw on. The MBA

develops the student in a broad context and is summarised in the table 1.

Marketing
Ethics
Accounting
Organisational behaviour
Quantitative analysis
Finance
Operations
Economics
Strategy

Table 1 MBA Specialities

The MBA being broad did not enable the academic to fully grasp the games production cycle and the creative side to the enterprise, it did however allow the academic member of staff to seek promotion coupled with the newly formed Studio. The MBA built confidence and appreciation of business opportunities for greater insight into management and was useful in providing direction and leadership within the Studio. Upon successful completion, the MBA opened new doors with direct synergies to the Studio and the University strategy of growing research. He made a successful bid for a ‘Yorkshire Fellowship in Enterprise’; each fellow received a budget of £10000 to support their research, a tailored training programme and business mentor for the duration of the fellowship. The business mentors were academics who had successfully commercialised their research. In this instance the business mentor was a specialist in medical simulations and serious games. Fellowships were awarded on the criteria of, quality, novelty and commercial value together with the fellow’s drive and enthusiasm. Quarterly review meetings were held with the mentors.

The University required a strong research output from the Studio although the Studio’s function is to design and implement games, currently for Xbox, with little potential to spin off academic research. Therefore the Studio had to look at alternative approaches the fellowship provided. The project was in the form of a serious game, a simulator to train podiatrists. The system would use a haptic device to simulate the use of a bone saw that would allow the surgeon to implement virtual operations. This research led to Masters of Research (MRes) qualifications for the two students involved. A

paper was presented at conference that detailed our different approaches to cutting of a 3-D mesh and the re-formation of the polygons within that mesh (Boothroyd *et al.*, 2012). The fellowship fulfilled the task of aligning the Studio output with the University strategy of a stronger research focus.

The fellowship provided the formal training required to translate academic research into commercially viable opportunities and the strategic funding to stimulate entrepreneurship within the academic environment. The fellowship gave the academic a strong understanding in the following areas, table 2.

Markets
Intellectual Property (IP)
Funding streams
Management
Business methods
Entrepreneurial skills

Table 2 YEF Specialities

The staff member followed this training with a more structured management-training programme organized by the University the Academic Leadership Programme (ALP). The course introduced skills in the following areas, table 3.

ALP - Change Management
ALP - Managing Challenging Behaviour
ALP - Negotiating and Influencing Skills

Table 3 ALP Specialities

b) Staff Member 2

Staff member 2 had an MA in Art and Design and an MSc in Digital Media. With experience of working in the Arts and as a freelance designer prior to teaching in Higher Education (HE) she brought a creative skillset and experience of interdisciplinary working to the Studio project. With teaching specialisms in concept development, design and 3D she was tasked with providing direction to the creative members of the Canalside student team.

As a member of staff without a PhD access to resources and facilities to support early stage research were limited and the Studio provided an

opportunity to engage in creative practice with a committed student team and dedicated resources and with a high degree of autonomy. The benefits of involvement in the Studio were that it would be potentially career enhancing, since it could show evidence of higher level practice than would be possible in the normal teaching environment and industry engagement and give personal satisfaction through the creative contribution.

Having both creative and technical qualifications the staff member identified the need for further development in business and leadership skills and undertook University training through the Academic Leadership Programme (ALP) and an MBA (as a part time student).

Some difficulties were experienced in managing work with the student team in the first stages of the Studio development, as the transition from teacher to manager was not easy. As a teacher used to encouraging and developing students and with an informal style there were problems in projecting authority. It became evident that the approach of asking a student to do work was not sufficient since this could be construed as merely giving advice or making suggestions that in the classroom situation students could choose to ignore. In order to overcome this it was necessary for the staff member to adopt a more aloof position and to be very direct when giving instructions and setting out expectations. Although the structured development of the ALP and MBA programmes were useful in providing insight into the broader context of business processes and work, the more subtle skills of learning to manage a team and confidently instruct and direct work were acquired more slowly by experience and through informal observation of other managers to understand both good and bad practice and the personal testing that determines a comfortable personal style that works.

Having recognised the required development table 4 highlights the routes taken on their formal training or academic enterprise apprenticeship.

Skill / Capability	Development Route
Project Management	MBA / YEF / Practice
Business Knowledge	MBA / YEF / Microsoft
Leadership	MBA / Academic Leadership Programme (ALP)

Game Development Cycle	Microsoft / Industry Colleagues
Client Management	MBA / Practice / Reflection
Enterprise Development	Reflection / Practice / Industry Colleagues
External Presence	MBA / Networking / Social Capital
Research Supervision	MRes / PGCert HEP / Published Work
Marketing and Sales	Marketing and Sales

Table 4 Academic Enterprise Apprenticeship (Skills & Capabilities)

2) What is entrepreneurship?

In Gibb's (1988) *The Enterprise Culture: Threat or Opportunity?* He defines Entrepreneurship as

"The exercise of enterprise attributes in any task or environmental context"

and an entrepreneur as

"Someone who demonstrates a marked use of enterprising attributes, usually in commerce or business"

Enterprise Attributes
Initiative
Strong persuasive powers
Moderate rather than high risk-taking ability
Flexibility
Creativity
Independence/autonomy
Problem-solving ability
Need for achievement
Imagination
High belief in control of one's own destiny
Leadership
Hard work

Table 5 Gibb's Enterprise Attributes

There are many definitions of entrepreneurialism a contemporary view of Professor Howard Stevenson of Harvard Business School in 1975 defined entrepreneurialism as

"Entrepreneurship is the pursuit of opportunity without regard to resources currently controlled" — a widely regarded definition Harvard Business School professor Howard Stevenson, D.B.A., first coined in 1975

Clark provides a different view of entrepreneurialism in the context of HE.

Clark (Clark, 1998) "An entrepreneurial University, on its own, actively seeks to innovate how it goes about its business. It seeks to work out a substantial shift in organizational character so as to arrive at a more promising posture for the future. Entrepreneurial universities seek to become 'stand-up' universities that are significant actors on their own terms"

The two definitions have quite a different character. Stevenson emphasises the risk-taking aspect and Clark the innovation aspect.

From Gibb's and the above definitions it could be argued that the business and commerce of Higher Education is Education, Research and Enterprise. Etzkowitz and Leydesdorff (1997) explore the knowledge economy and university-industry-government relations and their required contributions for success. They further discuss the development of new technology and knowledge transfer and use the notion of a triple helix of government, academia and industry to drive innovation they argue that the triple helix provides a model for both knowledge creation and transfer (2000). According to Steve Fuller (Fuller, 1999) the first example of a triple helix institution was the Kaiser Wilhelm Institute in Germany in 1911 funded jointly by the state, international industry and universities.

B. Industry Engagement.

It was recognised that industry engagement would be critical to the development of an enterprising environment within Canalside Studios. This was achieved through the use of industry gurus and a commercial producer-publisher relationship with Microsoft. What did Industry Guru bring to the Studio? He brought tacit knowledge having worked for twenty years in the industry and on major titles. His career had culminated in a directorship at a major developer and publisher. He was a very strange character to get on with yet he had the knowledge of how to make computer games. He would challenge the publisher's requests. He had the knowledge and reputation to question publishers, where the academics with no knowledge

of games development were anxious about the relationship with the publishers and initially believed the publisher must lead the development. Industry guru disagreed and opted to leave the project 75% through the development, the main disagreement was the requirement for the game to have a single player mode, this was not the core of the game and the guru felt did not add to the game play. Microsoft disagreed and insisted on implementation, a clash of titans.

What did Microsoft publishing bring, Microsoft brought compliance, industry specific business practice, coupled to the academics own development quality assurance, localisation, planning, art styles and art bibles, technical guides, technical requirements, testing and working practices to the Studio.

Both parties brought knowledge to the Studio one corporate (Microsoft) and one independent and practical (Industry guru). Given the gaps in knowledge and a need for the Studio to innovate and add value and complete the product to a professional standard, tacit knowledge needed to be transferred. Quinn *et al.*(1996) propose how knowledge growth is exponential when shared and can be of greater benefit to companies that learn from outsiders - especially from customers (Microsoft), suppliers, and specialists (industry guru).

1) Working practice

Students, when questioned, normally only work about 20 hours a week on average here we were asking the students to work 35 hours a week. Industry colleagues suggested that the student should actually work weekends to ensure that the game was delivered on time and milestones were met. Industry colleagues were clear that if the Studio was to replicate a real game studio and be a valid experience then the workload and hours present should be comparable. For example the Studio experimented with flexitime, and open casual office, this did not work. There was a lack of dependability and trustworthiness between the Studio team.

The students needed clear management; working in a commercial studio within a University environment required a cultural shift, and greater maturity, from the students. Asking for help when

required and checking on colleague's progress was a key skill. For example one of the team tasked with the games network design was left unchecked for 6 months, when crunch came the game network did not perform, which led to retrofitting the network to the game engine. A good line of communications and meetings build trust and respect within the team and prevent future problems.

2) Trustworthiness and dependability

Colleagues need to be taken at their word and reputation to ensure the job is done. Trustworthiness exists when two or more parties sign a formal agreement or contract, even if this means that your partners may have to back you when things go wrong. Microsoft offered to assist with additional artists to finish the assets in time to make sure that the studio hit their Alpha.

3) Teamwork

Studios function on their teams. A good team is where all employees want to work together and want to problem-solve and find solutions. Under certain circumstances teams need to break down behavioural barriers, for example a member of the team with poor work ethic. Participation is crucial, everybody participates, we win as a team, or fail as a team.

Due to the studio being staffed by third-year undergraduates on their placement not all the training and education had been fulfilled therefore the students also needed an independent yet managed approach to training.

4) How did industry perceive the studio?

Industry was very supportive of the studio from the outset with a view that to understand games one must make a game. Textbooks can take you through the process but cannot take you through the pain. Practitioners talk about, going through the test, about hitting technical requirements, and dealing with publisher asking you to redo items. Even though there is a design plan, the document is fluid in its nature; the way it treats the game changes as the game itself develops. This is expected and can have planning and resource implications. Hence, Microsoft offered additional support to the Studio to complete their Alpha on schedule.

One of the problems with dealing with Microsoft was a timing issue. Microsoft UK did not have the Xbox division, Microsoft US did; an 8-hour time difference between the two locations. A standing telephone call or appointment was made weekly with Microsoft. The Studio would go through the progress of the game, any complications with the game anything that may lead to delay and any support that Microsoft could offer an initial handholding procedure until the Studio had the necessary knowledge. For example the University is a not-for-profit organisation and does not have liability insurance to cover for example an epilepsy attack caused by the game \$1 million per case, required.

The Studio needed to be secure, this didn't just mean a physical lock, this meant from all possible forms of attack Microsoft made an investment into the game studio and would be placing their development kits with a nominal value of \$10,000 at our disposal. These kits allowed access to all other games that were under development for Xbox Arcade at that time. This is sharing best practice and requires a high level of trust between all participants; the Studio needed to prove its trustworthiness or risk souring this important relationship.

Part of establishing trust was entering into a non-disclosure agreement (NDA). The University signed an NDA initially with Microsoft so we could discuss our ideas. An NDA allows parties to communicate openly. Few NDAs are assigned in academic research where publication entails information disclosure. Where industry collaboration and involvement is required or needed then an NDA must be negotiated.

The University wants a strong research output from Canalside Studios, while the Studio's job is to design and implement games. One approach taken was in the form of serious games. The 1st attempt was a tool to train podiatric surgeons. The system would use a haptic device similar to a bone-saw that would allow the podiatrist to implement virtual operations. A serious game is not formal training and would not be counted as additional work for the podiatrist. This research led to 2 masters of research qualifications for the students involved. A paper was presented at a conference that detailed our

different approaches to cutting of a 3-D mesh and the re-formation of the polygons within that mesh utilising a translational research approach (Boothroyd, *et al.*, 2012; De Luca & Taylor, 2012a)

The University provided the initial seed funding to establish the Studio, this was followed by collaborative venture funds with numerous partners and EU funding for researchers night. So long as the Studio made independent games and did not try and take business from the local companies, no conflicts would exist. The regional trade organisation (Game Republic) insisted that a contract be signed to establish Canalside Studios as non-locally-competitive. Making games does not come within the normal remit of the senior lecturers role within the University, yet it is similar to the publication of research, with commercial potential through game sales and reputation. Also, members of academic staff are full-time employees with responsibilities and commitments to the School and University. To manage this issue the University itself signed the commercial deals and the NDA's. This also ensured that the University was happy that academic staff could abide by its policies and employment practices while fulfilling their commercial obligations.

An interesting potential conflict-of-interest in intellectual property generation emerged from the status of the students working in the Studio. The students are not employees of the University but are awarded a bursary for placement study to cover living costs. Under the university's IP regulations undergraduates own their work. An exception to the usual IP regulations was made here ensuring Canalside Studios was clearly mentioned as owning all IP unless the idea had been signed away to a partner organisation.

C. Enterprise ecosystem

Since the initial success the Studio has explored various interactive media value chains through a range of projects including: - interactive books, health promotion and an European Union funded International Researchers game, with the brief of explaining to 7 to 15 year olds that a university does not just engage in teaching. The Studio has worked with a varied selection of partners from the Royal Armouries through to the Fire Service.

Whilst the Studio's main focus is on academic entrepreneurship, enterprise and commercial experience for the entire team it has a unique position within the University. The Studio has been providing an effective interface facilitating three-way knowledge exchange between students, academic staff and the games industry partners. This exchange facilitated the aforementioned projects and the translational approach of cross-disciplinary research feeding through to product. It could be argued that Canalside Studios creates an environment with an increase in entrepreneurial spirit, skill and support or an enterprise ecosystem in its own right, a community of interacting scholars and practitioners with a shared resource environment dependant on each other's success. The ecosystem has benefited industry colleagues and academic colleagues from across campus and beyond. The evolving ecosystem has led to the integration of entrepreneurship and innovative pedagogies, alumni entrepreneurs and spin out enterprises.

Stakeholders bring different perspectives to a project; universities and industry can learn from each other, knowledge transfer facilitates the development of innovative new products, processes and services, the dissemination of ideas, and the stimulation of engagement between the wider society and the research and enterprise communities. Knowledge transfer may be a two-way exchange however both parties must realise that this is not always an equal exchange. To ensure all parties benefit, as a simple rule motivation and reward mechanisms must be in place and processes must be managed and evaluated in a timely fashion, then trust, and therefore bridge building, will develop. Entrepreneurial academics do not require complete academic change, it is possible for them to maintain their research and teaching activities and in the best cases the enterprise, research, and teaching form a natural synergy.

D. Models of enterprise and entrepreneurship

The Canalside Studios case study led to the development of the 'Enterprise Apprenticeship' model shown in figure 1. A non-traditional approach to enterprise and research through an environment facilitating knowledge generation and transfer at all levels. The academic recognised a

shortfall in skills and knowledge and through a combination of both formal and informal development filled any shortfalls.

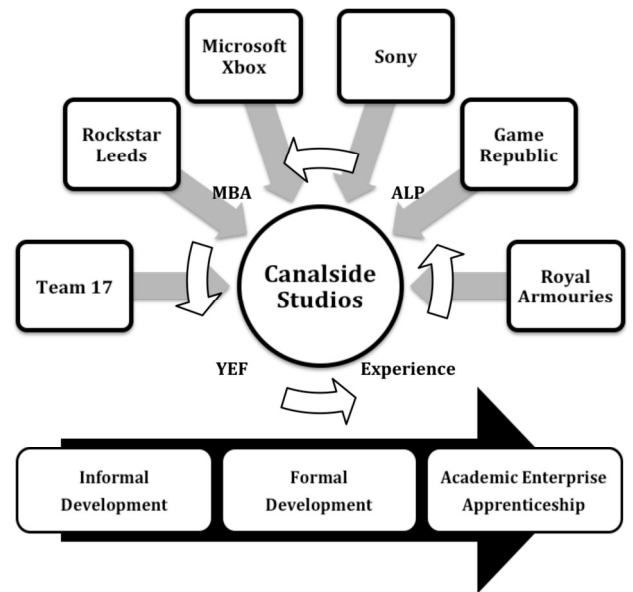


Figure 1 The Canalside model

These academics fall into the 'Academic entrepreneurialism' zone as shown in figure 2 adapting their behaviour and skill set.

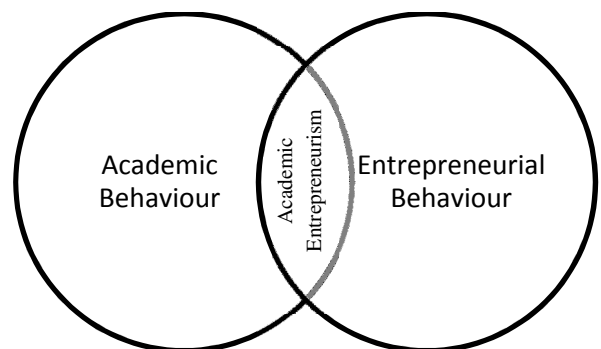


Figure 2 Academic versus Entrepreneurial Behaviour

A generic version of the above case study model of the enterprise apprenticeship is shown in figure 3. The informal development is drawn from both academic and industry experiences and social capital. A continuous improvement methodology to formal development is required leading to enterprise outputs through a suitable vehicle, i.e. studio, laboratory and or research groups. It is the intention of the authors to further investigate and validate the models presented in this paper.

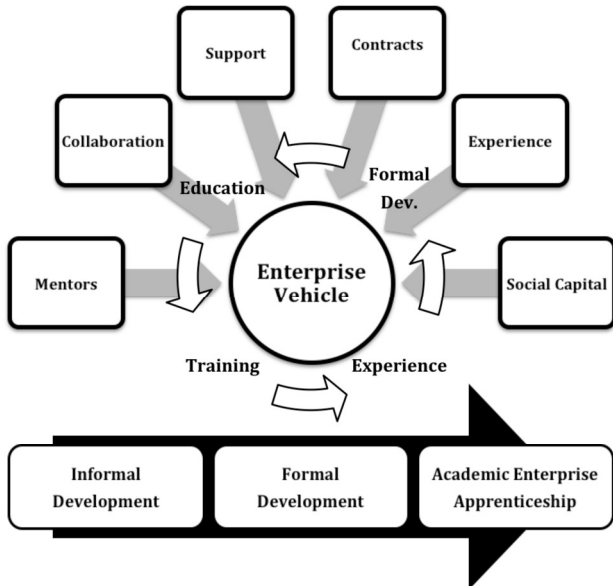


Figure 3 Academic Enterprise Apprenticeship model

Given the definition of entrepreneurship and academic entrepreneurship and the arguments presented, academics at the pinnacle of their field it could be argued are already entrepreneurial and need institutional support and persuasion to commercialise this experience. Hay *et al.* (2002) suggest the difference between academic and entrepreneurial behaviour are not so distinct, a key difference being attitudes to risk-taking. The traditional academic being generally more risk averse and therefore the nature of the work environment may be significant. Etzkowitz (2003) states that in research universities, research groups function in a firm-like way and share many of the qualities of a start-up company so the transition from academic to enterprise culture is less difficult and this may support spin out activities. From the literature presented and empirical evidence within the University unauthenticated models of enterprise have been recognised (De Luca & Taylor, 2012a, 2012b). The most traditional model in figure 4 shows the traditional academic approach of research council grant and publication, no enterprise consideration.

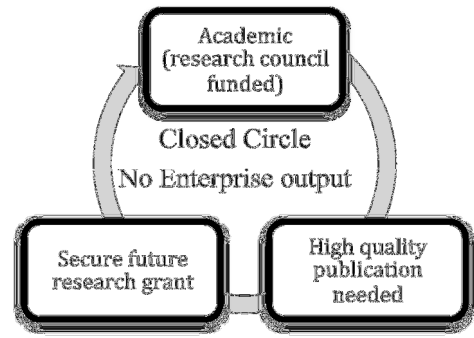


Figure 4 Traditional Research model

Academics or teams are funded through research council grants. The predominant result is publication, peer review and prestige. It should be noted that certain research calls and grants require collaboration and a commercial partner and output as shown in figure 5.

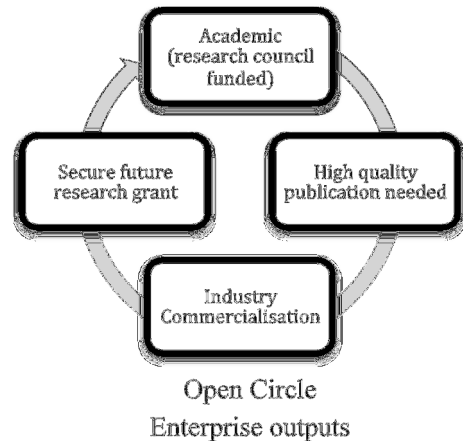


Figure 5 Collaborative Research model

Variations on the industry collaborations provide a triple helix approach to research where industry, government and the university partner in funding and collaboration, figure 6.

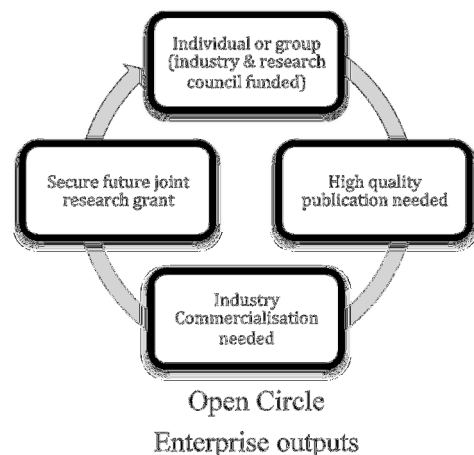


Figure 6 Triple Helix Research model

A more entrepreneurial academic may seek to exploit IP arising from their academic research. Here the commercial partner may be found independently of the research council funding. The academic is not only interested in prestige; they are interested in commercialisation, figure 7.

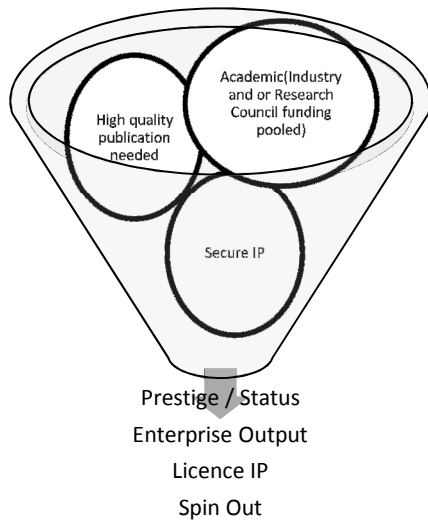


Figure 7 IP / Patent Enterprise Income model

A fifth model identified academics or teams who prefer non-government support for their research. Discussions with these academics found they referred to this type of enterprise activity as ‘real world research’ solving industry problem, figure 8.

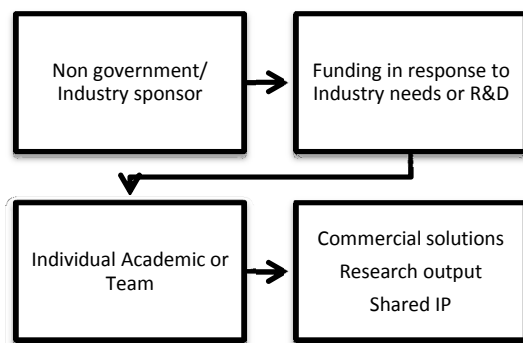


Figure 8 Industry Sponsored Research model

Figure 9 shows the domain of these academic entrepreneurs adapted from Brennan *et al.* (2005) as staff, business and enterprise awareness increases the classroom and studio environment becomes more open/permeable to business and enterprise opportunities, ideas and ways of working. Scholars suggest that there are tensions within higher education between academics who see themselves as protecting traditional academic values and an organisations changing mission to contribute to

economic growth through increased enterprise activities, paid for research or spin out activities (Philpott *et al.*, 2010; Rinne & Koivula, 2005; Williams, 2002) In certain areas of academia it is clear that entrepreneurial activity is more prevalent for example biosciences, engineering and technology subjects and where collaborative partnerships with industry or external partners are more likely (Belcher & Trowler, 2001; D’Este & Fontana, 2007; Martinelli *et al.*, 2008).

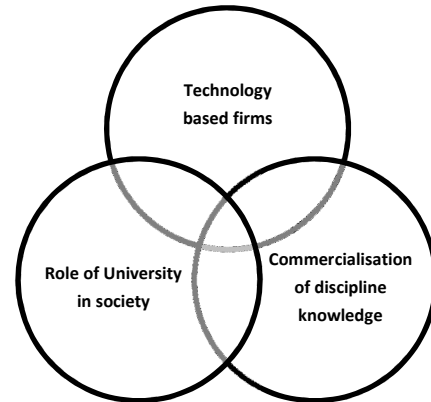


Figure 9 The Domain of Academic Entrepreneurship

Within the domain of Academic Entrepreneurship it has been recognised that both one-time and habitual entrepreneurs reside. Habitual academic entrepreneurs are either serial, single venture at any one time or portfolio, many ventures simultaneously (Ucbasaran *et al.*, 2006), it could be argued that the majority of professors who lead research groups share similar attributes and characteristics and fall into this category of academic entrepreneur. These academics identify opportunity and have the necessary human and equipment resources to ensure performance and subsequently move onto the next or parallel venture.

Brennan *et al.* (2005) recognises four clear types of academic entrepreneur from a selection of nine academics across different disciplines. In this paper a further type has been identified of the ‘Enterprise Academic Apprentice’ – a highly social non traditional academic with a strong focus on inter-disciplinary knowledge applied to problem solving, a strong focus on self improvement and continuous development, with a thirst for creativity. Willing to work with both internal and external networks without regard for formal structures within the University and a flexible approach to current resource control, this type of academic generates

discipline and enterprise knowledge and propagates this through enterprise, research and teaching.

III. CONCLUSIONS

The current and future roles universities play in the nation's economic health is being made clearer through government policy and funding. The role of universities in knowledge production and dissemination requires a shift from traditional teaching and learning to a triple pronged approach of Enterprise-Research-Teaching. Government and industry need to ensure that the future funding requires full collaboration to ensure success. To this end the authors believe that industry engagement and a triple helix approach to collaboration is essential. Academic Entrepreneurs can help led this industry engagement and are capable of operating at the boundaries of academia and industry through specialised studios or research facilities.

Modern universities need to ensure that their enterprise-enabled staff are supported and developed. New courses and staff training need to be introduced and senior managers need to support their entrepreneurial staff. A cultural change from a fully research led university to a research and enterprise university needs to prioritise and suitable strategies to enable staff and remove barriers.

Institutions need to enable working relationships between industry, government and the institution that go beyond curriculum design and one-off research and foster long term working relationships that enable a two-way transfer of knowledge and working practices.

We have presented models of enterprise and entrepreneurship recognised throughout the University and proposed an addition to Brennan *et al.*(2005) work on Academic Entrepreneurs and introduced the 'Enterprise Apprenticeship' and self-development model. These academic are prepared to adapt and adopt differing modes of working.

The case study has highlighted the need for a training or mentoring approach to staff development that can be coupled with more traditional methods and education. Many academics show entrepreneurial characteristics and many will

be latent or covert entrepreneurs. It is essential that these academics be nurtured.

Institutions can approach this new paradigm in Higher Education and have the capability in-house to do so. A shared experience has brought new working practices and developed working relationships leading to innovation and enterprise outputs; all parties benefit from the journey. The Studio has introduced opportunities that would normally only be afforded to competent experienced staff.

In response to this case the researchers intend to: -

- Fully access the extent of enterprise activities undertaken within their institution and develop models to support the various approaches taken.
- Validate these models with external colleagues across the HE sphere.
- Explore the nature of academic entrepreneurship and the extent that the academic entrepreneur is supported.
- The authors hope that by recognising different models of enterprise and entrepreneurship, the transition from a teaching and research university to a more commercially minded university will be more straightforward and rewards reaped earlier.

A. References

- Belcher, T., & Trowler, P. R. (2001). *Academic Tribes and Territories: Intellectual Enquiry and the Cultures of Disciplines* (2 ed.): Open University Press.
- Boothroyd, A., Gledhill, D., & De Luca, D. (2012). *Mesh cutting algorithm for use in an orthopaedic surgery simulator*. Paper presented at the IADIS International Conference Computer Graphics, Visualization, Computer Vision and Image Processing Lisbon, Portugal.
- Brennan, M. C., Wall, A. P., & McGowan, P. (2005). Academic entrepreneurship: Assessing preferences in nascent entrepreneurs. *Journal of Small Business and Enterprise Development*, 12(3), 307-322.
- Cable, T. R. H. D. V., & Willetts, T. R. H. D. (2011). *Higher Education: Students at the Heart of the System*.

- Clark, B. R. (1998). *Creating entrepreneurial universities: organizational pathways of transformation*. Oxford: Pergamon.
- Cox, G. (2005). *The Cox Review of Creativity in Business: building on the UK's strengths*.
- D'Este, P., & Fontana, R. (2007). What drives the emergence of entrepreneurial academics? A study on collaborative research partnerships in the UK. *Research Evaluation*, 16(4), 257-270.
- De Luca, D., & Taylor, R. (2012a). *A case study of the development of a 3D virtual object handler and digital interactives for museums by Canalside Studios (University of Huddersfield)*. Paper presented at the Digital Humanities Symposium - Virtualisation and Heritage, York University.
- De Luca, D., & Taylor, R. (2012b). *iEntAcademic Models and Lenses for Entrepreneurial Academics and Enterprise Educators*. Paper presented at the IEEC 2012, Plymouth University.
- Etzkowitz, H. (2003). Research groups as 'quasi-firms': the invention of the entrepreneurial university. *Research Policy*, 32(1), 109-121.
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy*, 29, 109-123.
- Etzkowitz, H., & Leydesdorff, L. A. (1997). *Universities and the global knowledge economy: a triple helix of university-industry-government relations*: Thomson Learning.
- Fuller, S. (1999). *The governance of science: ideology and the future of the open society*. Buckingham: Open University Press.
- Gibb, A. (1988). The Enterprise Culture: Threat or Opportunity? *Management Decision*, 26(4), 5.
- Gibbons, M. (1994). *The new production of knowledge*. London: Sage.
- Hay, D. B., F. Butt, & Kirby, D. A. (2002). Academics as Entrepreneurs in a UK University. In G. Williams (Ed.), *The Enterprising University: Reform, Excellence and Equity*: The Society for Research into Higher Education and Open University Press.
- Lacetera, N. (2009). Academic entrepreneurship. 30(7), 443-464
- Lambert, R. (2003). *Lambert Review of Business-University Collaboration*.
- Martinelli, A., Meyer, M., & von Tunzelmann, N. (2008). Becoming an entrepreneurial university? A case study of knowledge exchange relationships and faculty attitudes in a medium-sized, research-oriented university. *The Journal of Technology Transfer*, 33(3), 259-283-283.
- Mintzberg, H. (2005). *Managers not MBAs: a hard look at the soft practice of managing and management development*. San Francisco: Berrett-Koehler Publishers.
- Philpott, K., Dooley, L., O'Reilly, C., & Lupton, G. (2010). The entrepreneurial university: Examining the underlying academic tensions Kevin Philpott a, Lawrence Dooley a,n, Caroline O'Reilly b, Gary Lupton. *Technovation*, 31 161-170.
- Quinn, J. B., Anderson, P., & Finkelstein, S. (1996). Managing professional intellect: making the most of the best. *Harvard Business Review*, 74(2), 71.
- Rinne, R., & Koivula, J. (2005). The Changing Place of the University and a Clash of Values1 The Entrepreneurial University in the European Knowledge Society A Review of the Literature. *Higher Education Management and Policy*, 17(3), 91-123.
- Tidd, J., Bessant, J., & Pavitt, K. (2005). *Managing innovation: integrating technological, market and organizational change*. Chichester: John Wiley.
- Ucbasaran, D., Westhead, P., & Wright, M. (2006). *Habitual entrepreneurs*. Cheltenham: Edward Elgar.
- Williams, G. (2002). *The Enterprising University: Reform, Excellence and Equity*: The Society for Research into Higher Education and Open University Press.
- Wilson, T. (2012). A review of business-university collaboration, Department for Business. *Innovation & Skills, London*.
- Wood, M. S. (2011). A process model of academic entrepreneurship. *Business Horizons*, 54(2), 153-161.