

**LINKING THE TRIPLE HELIX MODEL OF INNOVATION TO ENTERPRISE  
INNOVATION PROCESSES**

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## 1 INTRODUCTION

The purpose of this paper is to provide a reflection on the implications for current models of innovation arising from an on-going case study in an Irish subsidiary of a multi-national corporation (MNC). Ireland's strategy of attracting foreign direct investment (FDI) from North American MNCs is increasingly being threatened by the low cost economies of Eastern Europe, India and China. Irish enterprises rapidly need to build new sources of competitive advantage to sustain employment and standards of living. The Enterprise Strategy Group's report "Staying Ahead of the Curve" states that the application of research and development (R&D) and technology to the "creation of new products and services, now require comprehensive and intensive development and will mark the decisive new orientation of Irish enterprise policy" (O'Driscoll, 2004). The Border, Midland and Western (BMW) region of Ireland is designated by the European Union (EU) as "Objective 1": a less well developed area that qualifies for special focus for structural funds under the EU state aid scheme. It is also one of the fastest growing regions of Europe. The gap analysis provided by the "Audit of Innovation" (BMW, 2004) quantifies the ground that has to be made up in terms of the innovative capacity. The BMW survey found that only 53% of companies undertook innovative activities, a figure that is below the national average of 63% and significantly lower than the estimated level of 79% in the South and Eastern (S&E) region. The continuing slide of the Irish economy in world competitiveness rankings is another reason to make innovation a priority. The country is now 12<sup>th</sup> in the IMD World Competitiveness Scoreboard 2005 (IMD, 2005), down from 10<sup>th</sup> in the previous year, while the country is rated 30<sup>th</sup> by the current World Economic Forum Global Competitiveness Report which is a fall of twenty places since 1999 (WEF, 2005). However, some commentators are concerned at the tendency to overstate the threat from the low-cost economies given Ireland's commitment to

developing a knowledge-based economy (STI Strategy, 2006). Also, figures from 2004 reveal that 7 per cent of the total global investment in manufacturing by American companies was for projects in Ireland (Amcham, 2006).

The paper now proceeds as follows. Firstly a brief review of enterprise level innovation models and national innovation models are presented. The next section provides an overview of a case study on innovation management being carried out in the Ireland Operations function of American Power Conversion (APC) Corporation. Following this, a conceptual view is presented of the required move from the present two dimensional (2-D) innovation process within organisations to a more external focused three dimensional model (3-D). Finally the conclusions, implication for practice, research limitations and future direction of the research are outlined.

## **2 BACKGROUND**

Models of innovation can be divided into two broad areas. The first area deals with design and development methodologies carried out within enterprises. The second area deals with the economic, institutional and social context of innovation dynamics. The process of product design has been well road-mapped (Pugh, 1991, Cross, 2000) as has product development methodologies (Ulrich and Eppinger, 2000, Otto and Wood, 2001, Cooper, 1994). A number of these in this area have proposed an integrated approach to the management of the innovation process such as systems innovation management (SIM) (Dooley, 2000) and a product innovation management (PIM) framework for networked organisations (Cormican, 2001). The practice of innovation is also taking place within radical redesign of business processes (Hammer and Champney, 1994) and the change from “task” based organisations to “process centred” organisations (Hammer, 1996). World class companies have been found to specialise or excel in one of three core value disciplines, namely operational efficiency,

product development or customer intimacy (Treacy and Wiersema, 1993). The increasingly important role of academia in supporting innovation in knowledge-based societies has led to the development of a number of models from national systems of innovation (NIS) (Lundvall, 1995) to the more recent Triple-Helix model of university-industry-government relations (Etzkowitz and Leydesdorf, 2000).

Presently there is little connection between enterprise level methodologies of product development and macro theories of innovation. This gap needs to be closed given the increasingly interlinked environment of enterprises being supported by academia and government in regions where innovation is being promoted. For example, studies by Dooley (2000) and Cormican (2001) provide detailed software and knowledge management solutions of product development but have a primary intra-organisational focus based on the accumulated knowledge of past approaches. However, they do not address the transformations required for sustainable innovation in the knowledge economy within the dynamic of academic, enterprise and government partnership.

### **3 RESEARCH CONTEXT**

The case study is based in APC, Ireland a subsidiary of the American Power Conversion (APC) Corporation. APC designs, manufactures and markets back-up products and services that protect hardware and data from power disturbances. The explosive growth of the Internet has resulted in the company broadening its product offerings from uninterruptible power supplies (UPS) to the high-end InfraStruXure<sup>TM</sup> architecture in order to meet the critical availability requirements of internet service providers (ISP) and data-centres. This modular design integrates power, cooling, rack, security, management and services, which allows customers to select standardised modular components using a web-based configuration tool. Industry analysts consider that this is a big change for the corporation and is in-line with the

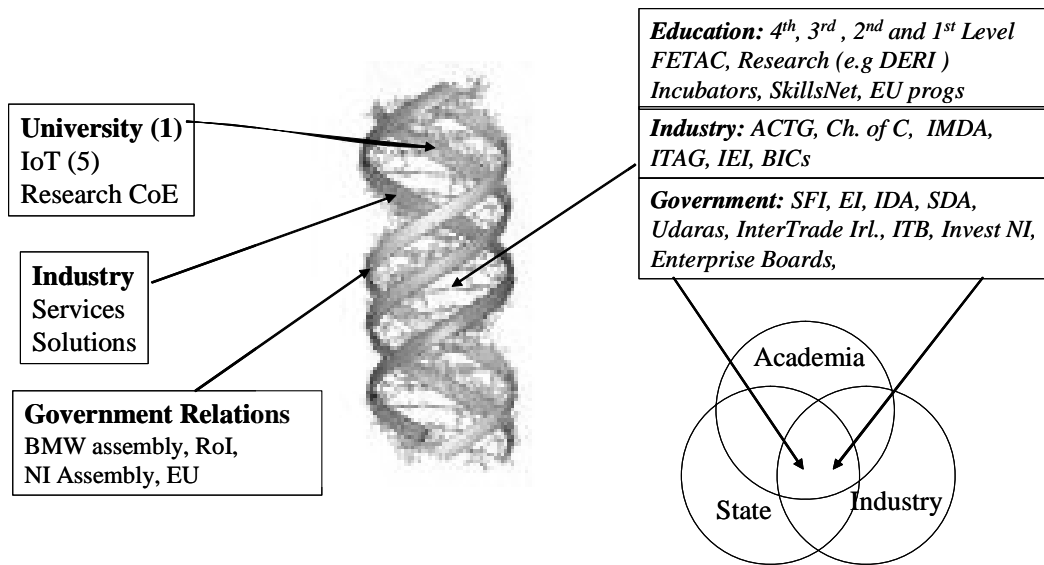
open software-first strategy currently being employed in the technology industry by companies such as EMC and Hewlett-Packard (Lindquist, 2004). APC reported sales of \$2 billion in 2005, globally employs approximately 7,000 people and is a Fortune 1000 company. The Corporation aims to set itself apart from the competition in three areas: financial strength, innovative product offerings and efficient manufacturing (APC, 2006). However, APC's president and chief executive officer Rodger B. Dowdell, Jr. has indicated, in recent financial reports, that the company needs to implement significant improvements in manufacturing and the supply chain (APCC Results, 2005). According to the CEO, the company must work to develop a “lean, customer-centric, ambidextrous organisation” in order to reach “optimal efficiencies in our processes” (APCC Results, 2006).

APC has two locations in the West of Ireland that serve the European, Middle East and Africa (EMEA) region. The company announced a streamlining of its operations in Ireland in June 2006. The Manufacturing Operations site, based in Castlebar, employs approximately 150 people and a number of functions including sales, information technology, business support and R&D are situated in Galway with a workforce of approximately 300. The widening of focus from the manufacturing of discrete products, such as UPS, to the delivery of customised InfraStruXure™ solutions provides both challenges and opportunities for the Operations function. Responding to the challenge set by the CEO, a Lean Transformation project was set-up in the Castlebar campus in February 2006 with a cross-functional team of twelve members drawn from Management, Engineering, Manufacturing, Materials Planning, Quality, and Logistics functions. One objective of the Lean project team is to quickly deliver the message that Ireland is responding to, and leading, the corporate initiative and to provide a platform for the Irish subsidiary to obtain a reputation as an innovative location. Initial corporate feedback is that this project is “ahead of the curve” in terms of the other regions.

On the product side, APC has launched an open on-line educational initiative called the Data Center University (Data Center U, 2006). It is geared to enable IT and other professionals to take basic and advanced courses on the design, build and operation of data centres and the instruction is vendor neutral as it does not promote APC products (Industry Ticker, 2006). In Ireland, a “Knowledge Exchange Forum” is being delivered and promoted by the Platform Engineering group as part of the APC EMEA initiative to educate peer groups. The forum, hosted in the Customer Solutions Centre of the Galway site, provides the opportunity for engineers to meet with customers and academia to trade knowledge concerning latest product development and topics of mutual interest.

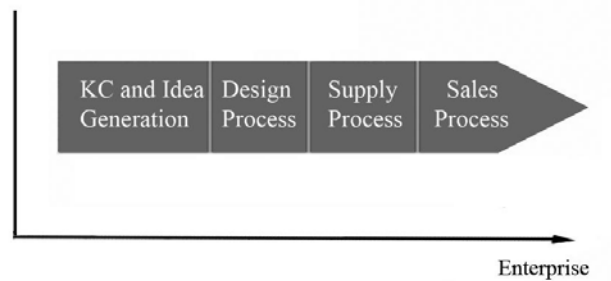
#### **4 INNOVATION MODELS: A NEW PERSPECTIVE**

This section initially maps a triplex helix model of university-industry-government relations for Ireland’s BMW region based on the work of Etzkowitz and Leydesdorff (2000). The current intra-organisational two dimensional model of innovation is then presented and finally a new three dimensional model is proposed that re-orientates the present form to suit the emerging triplex-helix dynamics. Figure 1 shows a number of the main actors from academia, industry and state supported organisations in the BMW region. It expands the “university” portion of the helix to include the five Institutes of Technology in the area which now have a definite research mandate and also the increasing focus on developing research centres of excellence. Likewise the “industry” helix is expanded based on the growing importance of services in a modern knowledge economy and the movement up the value chain from selling product to providing integrated customer solution (Grimes, 2003). Furthermore the “Government” helix has been expanded to include not only the national government but the influence of EU policy and funds, the presence of a Regional Assembly and the growing cross-border economic initiatives.



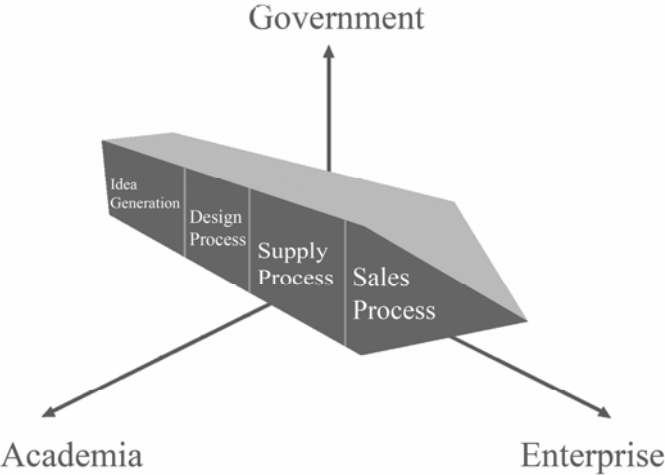
**Fig.1:** A model of the BMW Triple Helix

Figure 2 presents a generic view of the main steps of the innovation process currently employed in enterprises. The model is based on the product development methodologies discussed in section 2; however the structure is increasingly being modified to include process development and solutions provision. It is by and large internally centred and self-sufficient; focused on mobilising the resources within an organisation to deliver new products and services to the marketplace with emphasis on Time to Market (TTM).



**Fig.2:** A Generic 2-D Enterprise innovation model

Figure 3 illustrates a conceptual model of a three dimensional (3-D) innovation process that re-aligns the 2-D model of figure 2 to include the dynamics of the triple-helix presented in figure 1. The increasing importance of academia and government bodies requires organisations with a traditionally closed innovation process to move to an open innovation position (Chesbrough, 2003) that engages with the other significant regional actors.



**Fig. 3:** Proposed 3-D Enterprise innovation model

**5 DISCUSSION**

Enabling and managing innovation in Ireland’s evolving knowledge economy is now a major priority driven by important recent national and regional studies and the continuing decline in competitiveness. The increasing importance of the triple-helix of academia-enterprise-government requires companies to expand present inward focused methodologies to engage with external actors. This has implications for the case study being undertaken as part of this research project. Using the four broad categories, the “4Ps” of innovation- proposed by Tidd et al. (2005), APC can be regarded as being an innovative company in the area of product innovation (for example the success of InfraStruXure™ ) and in position innovation (the relatively new markets of data centres and server farms). But there is a need for improvement in process innovation (delivery of products and services) and paradigm innovation



(organisational models). This context provides both challenges and opportunities for APC Ireland Operations function. The fact that APC Ireland is engaging with local academia to develop its innovation management processes indicates that the site is willing to embrace the challenge presented by the CEO. Also, the quick response in setting-up a local Lean Transformation project to support the corporate strategy which is globally “ahead of the curve” is very significant. This is in the context of innovation itself been increasingly seen as a major source of competitive advantage and the insistence of the promoter of Lean Thinking that such a transformation requires at least a five-year commitment (Womack and Jones, 2003). Also, manufacturing enterprises are becoming progressively more dependant on knowledge and information systems to stimulate innovation and increase efficiency and effectiveness. Another factor is the importance of quick-wins and projects to encourage a culture of innovative actions (Browne *et al.*, 2000). Furthermore, the EMEA “Knowledge Exchange Forum” initiative being driven by the Platform Engineering group in APC Ireland is significant in the light of von Hippel’s thesis on the importance of engaging with lead users. However, any organisation embarking on an innovation transformation should heed the highly regarded counsel of Swanson for the need for “mindful” innovation and the dangers of frantic “mindless” innovation (Swanson and Ramiller, 2004).

## **6 CONCLUSIONS**

This paper has provided some preliminary results, findings and reflections from an ongoing case study of innovation management in the Operations function of a subsidiary of the APC Corporation located in Ireland’s BMW region. A literature review of innovation methodologies in the current context of the move to open innovation models within the triple-helix of academia-enterprise-government was presented. An overview of the subsidiary was then provided that placed it in the context of the global Lean Transformation program being

undertaken by APC. The challenges of Operations management in turbulent times were then discussed as well as the opportunities for a motivated team to take the initiative and be seen as corporate role models for innovation. The importance of the long-term commitment to a location required by “lean thinking” was highlighted. A conceptual model of a three dimensional (3-D) innovation process that re-aligns the current 2-D model to include the dynamics of the triple-helix was then illustrated. This paper proposes that models of enterprise innovation need to be updated to meet the needs of the knowledge economy within the context of academic and government support structures. There is a need to close the gap between policy, theory and practice and offer enterprises R&D and process development methodologies suited to the requirements of knowledge-based innovation. It was argued that the 3-D model outlined in this document can provide a framework in which enterprises can engage more productively with the changing dynamics of innovation. The direction of this on-going research will focus on making a contribution in the following areas:

- the role and contribution of innovation processes within the supply chain of an MNC located in Ireland’s BMW region.
- understanding the function of an MNC subsidiary in increasing the innovative capacity of a region.
- the narrative of a key actor within a region in transition to a knowledge-based economy.

Future work is required to investigate the implications of this 3-D model for the deliverables and detailed structure of the methodologies.

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## References

- AMCHAM (2006) America2006 : Special Report in association with the American Chamber of Commerce Ireland. *The Irish Times*. Dublin
- APC (2006) American Power Conversion Corporation (available on-line through <http://www.apcc.com/> ).
- APCC RESULTS (2005) American Power Conversion Reports Record Revenue for the Fourth Quarter and Full Year 2005. (available on-line through [http://www.apcc.com/corporate/press\\_room/index.cfm](http://www.apcc.com/corporate/press_room/index.cfm) ).
- APCC RESULTS (2006) American Power Conversion Reports First Quarter 2006 Financial Results. (available on-line through [http://www.apcc.com/corporate/press\\_room/index.cfm](http://www.apcc.com/corporate/press_room/index.cfm) ).
- BMW (2004) Audit of innovation in the BMW Region. The Square, Ballaghaderreen, Co. Roscommon, Border, Midland & Western Regional Assembly.
- BROWNE, J., CORMICAN, K., DOOLEY, L., YU, M. & O'SULLIVAN, D. (2000) "Innovation Management for Product and Process Development". Proceedings of the International Conference of Information Technology in Business, August 2000, Beijing, China
- CHESBROUGH, H. W. (2003) *Open innovation : the new imperative for creating and profiting from technology* Boston, Harvard Business School.
- COOPER, R. G. (1994) New Products : The Factors that Drive Success. *International Marketing Review*, 11, 60-76.
- CORMICAN, K. T. (2001) Product innovation management for networked organisations. Ph.D. thesis, National University of Ireland, Galway.
- CROSS, N. (2000) *Engineering Design Methods: Strategies for Product Design*, Chichester, John Wiley & Sons Ltd.
- DATA CENTER U (2006) Data Center University (available on-line through <http://www.datacenteruniversity.com>).
- DOOLEY, L. I. (2000) Systems Innovation Management. Ph.D. thesis, National University of Ireland, Galway.
- ETZKOWITZ, H. & LEYDESDORF, 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.
- GRIMES, S. (2003) Ireland's Emerging Information Economy: Recent Trends and Future Prospects. *Regional Studies*, 37, 3-14.
- HAMMER, M. (1996) *Beyond Reengineering: How the process-centred organisation is changing our work and our life*, New York, Harper Business.
- HAMMER, M. & CHAMPEY, J. (1994) *Re-engineering the Corporation*, New York, Harper Business.
- IMD (2005) World Competitiveness Scoreboard ( available online at <http://www02.imd.ch/wcc/ranking/> accessed July 2005 ). International Institute for Management Development, Lausanne.
- INDUSTRY TICKER (2006) APC Launches Online Data Center University. *Energy and Power Management February*
- LINDQUIST, E. (2004) A tale of 3 vendors: Entrenched Hardware makers seek revenues via software. *eWEEK*, June 21.

- LUNDVALL, B.-A. (1995) *National Systems of Innovation: towards a theory of innovation and interactive learning* London, Pinter.
- O'DRISCOLL, E. (2004) *Ahead of the Curve, Ireland's Place in the Global Economy*. Dublin, Enterprise Strategy Group, Forfás Secretariat.
- OTTO, K. & WOOD, K. (2001) *Product Design: Techniques in Reverse Engineering and New Product Development*, New Jersey, Prentice Hall.
- PUGH, S. (1991) *Total Design : Integrated Methods for Successful Product Engineering*, Addison-Wesley.
- STI STRATEGY (2006) *Strategy for Science Technology and Innovation 2006-2013*. Dublin Irish Government Publications.
- SWANSON, E. B. & RAMILLER, N. C. (2004) *Innovating Mindfully with Information Technology*. *MIS Quarterly* 28, 553-583
- TIDD, J., BESSANT, J. & PAVITT, K. (2005) *Managing innovation : integrating technological, market and organizational change /*, Chichester, John Wiley & Sons.
- TREACY, M. & WIERSEMA, F. (1993) *Customer Intimacy and other Value Disciplines*. *Harvard Business Review*, January-February, 84-93.
- ULRICH, K. T. & EPPINGER, S. D. (2000) *Product Design and Development*, Irwin McGraw-Hill.
- WEF (2005) *Global Competitiveness Report 2004-2005*. World Economic Forum <http://www.weforum.org/> July 14th 2005.
- WOMACK, J. P. & JONES, D. T. (2003) *Lean thinking: banish waste and create wealth in your corporation*, London, Free Press.