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Title	Innovation management in a multi-national corporation's subsidiary of Ireland's evolving knowledge economy.
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Publication Date	2006
Publication Information	Costello, G. J., Donnellan, B., Ginn, M. L., Rochford, C., Whelan, E., & Xu, S. (2006). Innovation Management in a Multi-national Corporation's Subsidiary of Ireland's Evolving Knowledge Economy. Paper presented at the PAKM.
Publisher	Springer Verlag
Link to publisher's version	http://dx.doi.org/10.1007/11944935_3
Item record	http://hdl.handle.net/10379/1391

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Innovation Management in a Multi-national Corporation's Subsidiary of Ireland's evolving Knowledge Economy

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Abstract. Innovation management is now seen as an important competitive advantage for Multi-national Corporation (MNC) subsidiaries located in Ireland's changing economy. This paper reports on the initial stages of a case study in the Operations division of American Power Conversion (APC) Ireland. The results of an innovation audit are presented that provide a reference point to begin the transformation to an innovative supply chain organization. The paper proposes the development of Networks of Practice to enable the diffusion of resulting innovations across the corporation.

Keywords: Innovation Management, Networks of Practice, Innovation Audit

1. Introduction

The development of Ireland's knowledge-economy was initially driven by foreign direct investment (FDI) from North American multi-national corporations (MNCs) setting up manufacturing facilities to avail of low tax incentives, a young educated workforce and proximity to their growing number of European customers. However, this initially successful model 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" [1].

This paper reports the initial findings of a case study on the management of innovation within the Irish Operations function of the American Power Conversion (APC) Corporation. Firstly a literature review of innovation management is presented and the role of information and communications technology (ICT) to support the enabling

and diffusion of resulting innovations is discussed. The next section provides an overview of the case study and the proposed research approach. The results of an innovation audit carried out in APC Ireland Operations are then presented and the emerging concepts, ideas and insights from this initial study are considered. Finally the conclusions, implication for practice, research limitations and future direction of the research are outlined.

2. Literature review

2.1 Innovation Management

This section provides an overview of the current changing landscape and paradigms of innovation and knowledge management. One of the main challenges facing organizations that aspire to being innovative is that of dualism: mixing the need for operational efficiency in the present while at the same time trying to innovate successfully for the future. There is the problem of “opposing logics” between operating and innovating organizations. Furthermore, according to Ralph Katz, the main issues facing innovation managers is not the technical area but in overseeing the complex interplay and motivation of the people involved [2]. Eric von Hippel speaks about the democratization of innovation where product and service users increasingly have the ability to innovate for themselves and the resulting move from manufacturing-centric to user-centric innovation processes [3]. Software examples include open source development such as Linux and Apache Web server software. There are a number of product examples from the field of sporting equipment such as the development of high-performance surf boards in Hawaii. This shift in the locus of innovative activity has consequences for current business models and government policies which currently favor the “manufacturer”. Consequently, von Hippel advocates the need to educate managers on the management of user-centered innovations as important innovations are often brought into an organization through informal channels such as attendance at conferences. Chesbrough [4] argues that in many industries the centralized approach to R&D, which he terms “closed innovation”, characterized by in-company methodologies [5], has become outdated and must be replaced by “open innovation” which adopts external ideas and knowledge in conjunction with the internal process. A number of factors are influencing this change such as: the mobility of skilled people; the increasing presence of venture capital, emergent high-tech start-ups and the significant role of university research. One of his principles is that “not all the smart people work for us” and he advocates that the smart people within the organization connect with the smart people outside.

“Lean” is a supply chain term defined as the “enhancement of value by the elimination of waste” [6]. Because of where it originated it is commonly known as the Toyota Production System (TPS) and contains many Japanese terminology such as muda (waste) and poka-yoke (mistake-proofing). An analysis of many of the techniques employed reveals that the methodology is an umbrella for many standard industrial engineering practices. The promoters of Lean thinking insist that it is not the

latest quick-fix program but requires a five-year commitment for an organization to effect the desired transformation [6]. Such a relatively long term investment can provide significant stability in these turbulent times for manufacturing facilities. Lean also requires a critical organizational transition from top-down directives to bottom-up initiatives where managers become coaches and employees become pro-active and a move to more strategic buyer-supplier relationships [7].

The importance of the motivation of technical professionals is of paramount importance as evidence suggested that it is better to have a team with an A-rated motivations and B-rated capabilities than visa-versa [8]. In the related area of creativity, Nemeth [9] proposes that creativity begins with a questioning attitude and the ability to “look outside the box”. Recent research in psychology indicates that teams can stimulate creativity and problem solving by being open to dissenting voices and minority viewpoints that in normal circumstances would be rejected or ridiculed and that “cult-like” corporate cultures stifle creativity. The work of von Krogh et al. [10] provide new ideas about how knowledge can be created in organizations and used for competitive advantage. However it is interesting to contrast many of the very tidy and mechanistic methodologies of Lean thinking with the very organic and colorful approaches of some companies that specialize in product design [11]. The way in which information and knowledge is disseminated in an organization is very important especially in light of research quoted by Allen which shows an inverse relationship between contact of technologists with outside personal and technical performance [12]. The most effective model, he argues, is where the organization has key people or “technological gatekeepers” on which most people rely for information. These gatekeepers are mediators with the outside world in terms of relevant literature, links to academics and networks of practice. A number of paradigms in which innovation must be managed have been reviewed above; now the paper will examine ways in which ICT can support this process.

2.2 Knowledge Management and Innovation Networks

This section discusses how ICT supported networks can increase the innovative capacity of a firm and provide the capability to diffuse innovations across organizations. One of the underlying principles of the open innovation model, discussed in the previous section, is that not all the ‘smart’ people work in one team or one organization. They are distributed over multiple organizations and finding successful ways to work with them will lie at the heart of ‘innovating’ innovation [4]. ICT offers new tools to help in this meta-innovation by connecting ‘smart’ people and enabling them to exchange their knowledge. Individual learning and new knowledge creation occur when people combine and exchange their personal knowledge with others [13, 14]. Thus, ICT can contribute to the innovative capacity of a firm by connecting people from different disciplines and different institutions and allowing them to exchange their knowledge.

Knowledge management has been identified as critical for organizational success and sustained competitive advantage while ICT is proposed as the key to success for managing organizational knowledge. However, there is evidence that these knowl-

edge management systems fail to recognize the importance of knowledge workers in their context. For example, Kelly et al. [15] investigated the use of a Lotus Notes-based application to share knowledge in a large professional services organization. The investment enjoyed limited success partly due to the formal nature in which the system was used. Many employees expressed anxiety about the way in which colleagues in other offices might interpret and use publicly available information about work activities. As a result, the information posted was usually uncontroversial, sanitized accounts of their work. Studies indicate that 50-70% of KM projects fail to meet objectives and this has been attributed to over reliance on IT [16]. Consequently, Kelly et al. [15] argue that management need to cultivate communities that share a social context within which they can interpret the contributions of others; norms and behaviors that reduce feelings of vulnerability and promote trust; and a sense of mutual solidarity as a motivation for participation.

Research on work practices has consistently shown that social relationships (or lack of them) are an important factor in knowledge flows. However, the paradox is that individuals generally form these relationships not according to what the formal organization dictates, but based on personal biases and preferences for collaborators who may be either inside or outside the firm. These relationships are the basis for informal, naturally occurring networks or “networks of practice” (NoPs). For this reason, employees are exploiting interactive communication technologies to develop networks of people with expertise and interest around a specific area of practice. Brown et al. [17] have distinguished between two types of networks, communities of practice (CoPs) and networks of practice (NoPs). CoPs consist of people who are informally, as well as contextually, bound by a shared interest in learning and applying a common practice. NoPs are a similar concept in that people have practice and knowledge in common but unlike CoPs, they are mostly unknown to each other. NoP members may be geographically distributed but use technologies such as listservs, bulletin boards and blogs to access another person and identify what expertise they have. Electronic ties are loosening the constraints of organizational structure and physical proximity to allow connectivity between individuals who would otherwise find it difficult to identify and sustain contact with others who share similar interests [18]. The ability to reach everyone in a NoP contrasts with the localized tight-knit relationships in a CoP. Consequently, NoPs act as a forum where participants can tell stories of personal experiences and discuss and debate issues relevant to their practice. Recent empirical findings by Teigland et al. [19] highlight the contribution NoPs can make to the innovative capacity of an organization. They examined whether individual creativity and performance were related to participation in various NoPs and found that high reliance by individuals on internal CoPs as sources of help results in lower levels of creativity. This suggests that participation in intra-organizational distributed NoPs enhances creativity as evidenced by the positive relationship between internal knowledge trading and both creativity and efficient performance. Individuals participating in internal distributed networks of practice are able to act as bridges between local CoPs, accessing non-redundant knowledge from other locations and integrating it with knowledge of their own [19].

There is increasing evidence that knowledge workers are utilizing ICT to create dynamic on-line discussions forums, rather than utilizing and contributing to static knowledge repositories. The BBC is one organization which has seen success from its

NoP initiatives. Rather than investing in an IT-based KM system, they installed simple bulletin board technology in order to move knowledge around rapidly. The site currently gets 450,000 page views a month from 8,000 unique users - startling in an organization of 25,000. The primary role of the forum is to ask questions and get answers but according to the BBC's Chief Knowledge Officer; "the board wouldn't have taken off if it were restricted to the dry discussions of pure business. The board has entered the daily life of BBC employees because it's fun and interesting as well as useful" [20]. This section has provided an overview of the role and opportunity of ICT for knowledge and innovation management. Now the paper will provide the context in which the research is being carried out and the initial approach to the work.

3. Research Method

3.1 Research Context: The Case

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™ architecture in order to meet the critical availability requirements of internet service providers (ISP) and data-centers. This modular design integrates power, cooling, rack, security, management and services, which allows customers to select standardized modular components using a web-based configuration tool. 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 [21]. However, APC's president and chief executive officer Rodger B. Dowdell, Jr. had indicated, in recent financial reports, that the company needs to implement significant improvements in manufacturing and the supply chain [22]. According to the CEO, the company must work to develop a "lean, customer-centric, ambidextrous organization" in order to reach "optimal efficiencies in our processes" [23].

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 customized 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. In Ireland, a “Knowledge Exchange Forum” is promoted by the Platform Engineering group as part of the EMEA initiative to educate peer groups. This forum provides the opportunity for engineers to meet with customers and academics to trade knowledge concerning latest product development and topics of mutual interest. In a related program, APC run a User Group community for InfraStruXure™ customers.

3.2 Theoretical Considerations

This section will review the characteristics and assumptions, presented in the literature, of two possible research approaches to the study of innovation management: the case study and action research. Case study is an exploration of a case over time through detailed, in-depth data collection involving multiple sources of information rich in context [24]. Dube and Pare divide case study attributes into three main areas: research design (which includes experimental design and research questions), data collection (data collection methods and tactics for enhancing reliability and validity), and data analysis (process description and data analysis) [25]. According to these researchers, 87% case studies are done from a positivist philosophical perspective, with 12% being interpretive, and 1% critical. This positivist perspective is accompanied by a broad commitment to the idea that the social sciences should emulate the natural sciences [26]. Here “the researcher is seen to play a passive, neutral role, and does not intervene in the phenomenon of interest.” An interpretive perspective addresses meaning, understanding, and interpretation, in a systemic and methodical way, and in the process “yields much of the desire to predict and control upon which positivist science rests its claims” [27]. Critical science seeks to recall both the positivistic potential to support emancipation as well as the capacity to develop mutual understanding through the use of language enabling people to cooperate more effectively [28]. In sharp contrast to the positivistic case study, action research is a post-positive approach [29], where the researcher is directly involved in planned organizational change. “Unlike the case study researcher, who seeks to study organizational phenomena but not to change them, the action researcher is concerned to create organizational change and simultaneously to study the process” [30]. Action research is empirical, yet interpretive; experimental yet multivariate; observational yet interventionist. To a positivistic perspective this seems very unscientific [29]. Dube and Pare note that while case study and action research can share many characteristics (such as a natural setting as source of data, the researcher’s central role in data collection, and a focus on participant perspectives), their objectives and inherent challenges as well as the criteria by which to judge their quality are quite different. In contrast to a positivist’s neutrality, an action researcher intends to help the system change by helping it to gather information it needs in order to change. Bentz and Shapiro continue to explain that this follows an “assumption that a system is more likely to change if it gathers its own information about its problems, potential, future direction, and so on” [31]. The

researcher helps the system plan its actions and conduct fact-finding procedures so it can learn from them, become more skillful, set more realistic expectations, and discover better ways of organizing. This section has discussed two possible research approaches to study the management of innovation in APC, Ireland: the next section will explain why case study methodology has been initially chosen as the best fit.

3.3 Research Method: Case Study Design

Yin [32] defines a case study as an “empirical enquiry that investigates a contemporary phenomenon within its real-life context” and where a “how or why question is being asked about a contemporary set of events over which the investigator has little or no control”. The initial research aim of this study was to consider the human and technological factors involved in the management and diffusion of innovation. To this end the following preliminary research questions were posed:

RQ1: How well does APC Ireland Operations currently manage innovation?

RQ2: How is a culture of innovation developed in APC Ireland Operations?

RQ3: How is the diffusion of resulting innovations to the wider APC multinational corporation (MNC) facilitated?

This paper deals with the first of these research questions. It is considered that APC Ireland meets the case study criteria in the real-life context of both the need for the region to increase levels of innovation and APC’s requirement for the transformation to a lean innovative a supply chain.

4. Innovation Audit

This section provides the results of an innovation audit carried out in APC Ireland Operations and a discussion of the emerging concepts from this initial study. Tidd et al. [33] propose that innovation must not be seen as a lottery but as a continuous improvement process and point out that based on recent research on innovation successes and failures, a number of models have been developed to help assess innovation management performance. Such self-assessment tools have been widely used in the area of total quality management (TQM) in order to benchmark an enterprise against best in class, for example, the Malcolm Baldrige National Quality Award [34]. In order provide some initial reference point on innovation management it was decided to use the self-assessment tool and audit framework developed by Tidd et al. [33] to obtain a response to the question “How well does APC Ireland Operations currently manage innovation?”. As this was part of the exploratory phase of the research, the intention of the questionnaire was to discover ideas and insights and not test any hypothesized causal relationships [35]. The survey consists of forty questions using a Likert scale to score each statement between 1 (= untrue) and 7 (= very true) in order to gauge five dimensions of innovation management: Strategy, Processes, Organization, Linkages and Learning. As this was a small scale and focused survey, it was decided to limit the questionnaire to the population of management and engineering staff in APC Ireland Operations [36]. Questionnaires could be completed by email or

on a hardcopy and anonymity was guaranteed. The analysis of the responses showed that out of a possible score of 7, the actual scores ranged between 2.9 and 3.8 for the five dimensions. Clearly it can be seen from the self-assessment indicator that there is considerable room for improvement in the management of innovation in the location.

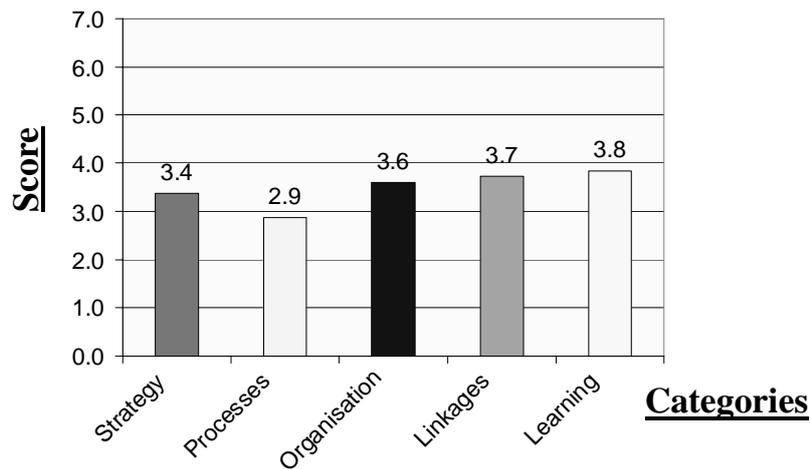


Fig. 1. Innovation Self-assessment Audit Results

The next step of the methodology was to represent the results of the audit in terms of four possible “archetypes” of innovation capability in order to provide a reference point for future continuous improvement. The taxonomy ranges from Type 1: where an organization doesn’t know what or how to change, to Type 4: where a firm sees itself as having the capability to generate and absorb innovation. This “snapshot” is shown in figure 2 and the audit results indicate that APC Ireland Operations sees itself as being a Type 2 firm: know they need to change but unsure about how to bring this about.

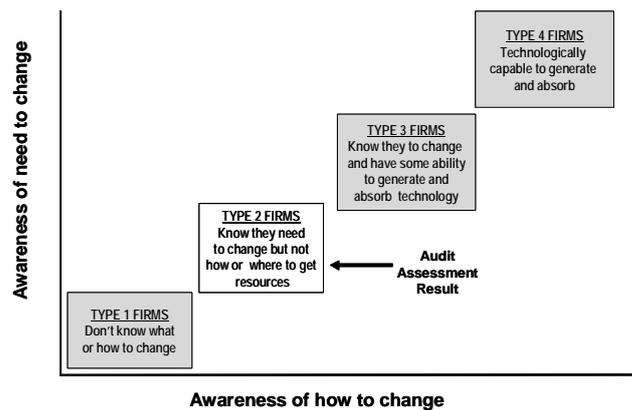


Fig. 2. Innovation Capability Self-assessment

The above section described the use of an innovation audit questionnaire to survey the Operations management and engineering personnel on innovation management capability. The results indicate that the organization is willing to develop competence in this area but need a strategy, roadmap and resources to achieve this.

5. Discussion

5.1 Significance of present work

Using the four broad categories, the “4Ps” of innovation- proposed by Tidd et al. [33], 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 centers and server farms). But there is a need for improvement in process innovation (delivery of products and services) and paradigm innovation (organizational models). This context provides both challenges and opportunities for APC Ireland Operations function. The fact that APC Ireland undertook an audit, to establish benchmark data on innovation and knowledge management, 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. Browne et al. stress the importance of quick-wins and projects to encourage a culture of innovative actions [37].

5.2 Implications for Knowledge Management practice

Lotus Notes is the collaborative software system used by APC to manage its knowledge flows. It provides an environment for asynchronous group work: where collaborators have different or independent work patterns. The software solution provides access to scheduling, messaging, and the sharing of documents and data. The present corrective action process embedded in the Lotus Note databases is designed to facilitate tightly controlled feedback procedure but is unlikely to inspire the diffusion of innovations. In order to increase its innovative capacity APC Ireland could lead the creation of a globally distributed NoP focusing on lean manufacturing techniques. The role of the technology is to create a global NoP by connecting these CoPs together. This ensures a rich diversity of skills, abilities and cognition among network participants which should enhance the opportunities for innovation [38]. As in the BBC example, the technology used can be simple and low cost. But it must be borne in mind that the social infrastructure is very important when using technology to facilitate better communication and knowledge sharing within and between geographically distributed groups. Significantly, research has shown that NoPs will only thrive when it is free to decide its own agenda and free from managerial control. To further increase its innovative capacity, APC Ireland should consider establishing supply

chain focused communities accessible through shared knowledge environments that mirror the company's product focused User Communities described earlier.

5.3 Implications for research and limitations of the study

The benefits of case study include a depth of understanding that is beyond that available from large-scale survey research, and that a focus on one case reduces travel costs, eases access issues, and in general makes complex in-depth research doable. The risks of a case study include a prolonged engagement costing additional time and money, and that this investment may be lost if the project is ended before being completed. Finally, over time the desired level of objectivity of the experimenter can be compromised given a significant level of communication with the case under study. Action research is another approach, different in several important ways, which could be considered for structuring research beyond the current effort. This option is perhaps made more attractive when it is seen that the current case study would be a partial fulfillment of the initial step of identifying a problem as called for in the action research approach as noted in the above literature review. Many of the risks of action research are the same as the risks encountered in a case study. Another risk of action research is that the researcher will be swept up in the effort to solve the presenting problem and abandon the rigor required to produce new scientific findings.

The innovation audit presented in this study provides evidence that the use of such a framework can provide a quick snapshot for practitioners that provides a reference point to launch a continuous improvement program for innovation and knowledge management. The methodology of the innovation audit raises a number of questions concerning the reliability and validity of the findings. The framework would require additional work to develop it beyond its use here as a vehicle for emerging concepts and the creation of ideas. The increasing move to an "open innovation" model would suggest that this paradigm needs to be incorporated into innovation audit frameworks to fill the gap that presently exists in the literature.

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. Literature reviews of the current context of innovation management and the ICT enablers of knowledge management were 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. The results of a self-assessment innovation audit were then presented with the conclusion that it provided a reference point for the next steps: the development of an innovation strategy, roadmap and the

allocation of resources. The paper proposed that the creation of Networks of Practice (NoPs) can provide APC Ireland with the ability to enable innovation within the Operations functions and diffuse the resulting innovations throughout the corporation. Finally the significance of this research for the management of innovation in MNC subsidiaries and the associated implications for knowledge management were presented. Future work is suggested on the role of innovation audits both as an aid to practitioners and as a research method.

Acknowledgements

The authors would like to acknowledge the assistance of Bronagh Collins and Derek Brogan in carrying out the innovation audit.

References

1. Enterprise Strategy Group, *Ahead of the Curve, Ireland's Place in the Global Economy*. 2004, Forfás Secretariat: Dublin 2004.
2. Katz, R., *Introduction*, in *The Human Side of Managing Technological Innovation: A Collection of Readings*, R. Katz, Editor. 2004, Oxford University Press: Oxford.
3. von Hippel, E., *Democratizing Innovation*. 2005, Massachusetts: The MIT Press.
4. Chesbrough, H.W., *Open innovation : the new imperative for creating and profiting from technology* 2003, Boston: Harvard Business School.
5. Cooper, R.G. and E.J. Kleinschmidt, *Stage Gate Systems for New Product Success*. Marketing Management, 1993. **1**(4): p. 20-29.
6. Womack, J.P. and D.T. Jones, *Lean thinking : banish waste and create wealth in your corporation*. 2003, London: Free Press.
7. Lamming, R.C., P.D. Cousins, and D.M. Notman, *Beyond vendor assessment : Relationship assessment programmes*. European Journal of Purchasing & Supply Management, 1996. **2**(4): p. Pages 173-181.
8. Katz, R., *The Motivation of Professionals*, in *The Human Side of Managing Technological Innovation: A Collection of Readings*, R. Katz, Editor. 2004, Oxford University Press: Oxford.
9. Nemeth, C.J., *Managing innovation: When less is more*, in *The Human Side of Managing Technological Innovation: A Collection of Readings*, R. Katz, Editor. 2004, Oxford University Press: Oxford.
10. von Krogh, G., K. Ichijo, and I. Nonaka, *Enabling knowledge creation : how to unlock the mystery of tacit knowledge and release the power of innovation* 2000, Oxford: Oxford University.
11. Kelley, T., *The Art of Innovation: Lessons in creativity from IDEO, America's leading design firm* 2001, New York Doubleday.
12. Allen, T.J., *Communication Networks in R&D laboratories*, in *The Human Side of Managing Technological Innovation: A Collection of Readings*, R. Katz, Editor. 2004, Oxford University Press: Oxford.
13. Kogut, B. and U. Zander, *Knowledge of the firm, combinative capabilities, and the replication of technology*. Organization Science, 1992. **3**(3): p. 383-397.
14. Nahapiet, J. and S. Ghoshal, *Social capital, intellectual capital, and the organizational advantage*. Academy of Management Review, 1998. **23**(2): p. 242-266.
15. Kelly, S. and M. Jones, *Groupware and the social infrastructure of communication*. Communications of the ACM, 2001. **44**(12): p. 77-79.
16. Baxter, A., *Keeping the know-how of a retiring generation*, in *Financial Times*. 2006: London. p. 1.

17. Brown, J.S. and P. Duguid, *The social life of information*. 2000, Boston: Harvard Business School.
18. Van Baalen, P., J. Bloemhof-Ruwaard, and E. Van Heck, *Knowledge sharing in an emerging network of practice: the role of a knowledge portal*. *European Management Journal*, 2005. **23**(3): p. 300-314.
19. Teigland, R. and M. Wasko, *Integrating Knowledge Through Information Trading: Examining the Relationship Between Boundary Spanning Communication and Individual Performance*. *Decision Sciences*, 2003. **34**(2): p. 261-287.
20. Weinberger, D., *The BBC's low tech approach to knowledge management*. 2005, (available on-line through <http://www.knowledgeboard.com/item/1627>, last accessed August 2006)
21. APC, *American Power Conversion Corporation* 2006, (available on-line through <http://www.apcc.com/>).
22. APCC Results, *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).
23. APCC Results, *American Power Conversion Reports First Quarter 2006 Financial Results. 2006*, (available on-line through http://www.apcc.com/corporate/press_room/index.cfm).
24. Creswell, J.W., *Qualitative inquiry and research design: Choosing among five traditions*. 1998, Thousand Oaks, CA: SAGE Publications.
25. Dube, L. and G. Pare, *Rigor in information systems positivist case research: Current practices, trends, and recommendations*. *MIS Quarterly*, 2003. **27**(4): p. 597-635.
26. Lee, A., *A Scientific Methodology fro MIS Case Studies*. *MIS Quarterly* 1989. **March 1989**: p. 33-50
27. Hatch, M.J. and D. Yanow, *Organization theory as an interpretive science*, in *The Oxford handbook of organization theory: Meta-theoretical perspectives*, H. Tsoukas and C. Knudsen, Editors. 2003, Oxford University Press: New York. p. 63-87.
28. Willmott, H., *Organization theory as a critical science? Forms of analysis and 'new organizational forms'* in *The Oxford handbook of organization theory: Meta-theoretical perspectives*, H. Tsoukas and C. Knudsen, Editors. 2003, Oxford University Press: New York. p. 88-112.
29. Baskerville, R.L. and A.T. Wood-Harper, *A critical perspective on action research as a method for information systems research*. *Journal of Information Technology*, 1996. **11**: p. 235-246.
30. Baburoglu, O.N. and I. Ravn, *Normative action research*. *Organizational Studies*, 1992. **13**(1): p. 19-34.
31. Benz, V.M. and J.J. Shapiro, *Mindful Inquiry in Social Research*. 1998, CA: SAGE Publications: Thousand Oaks.
32. Yin, R.K., *Case study research : design and methods* 1994, London Sage Publications.
33. Tidd, J., J. Bessant, and K. Pavitt, *Managing innovation : integrating technological, market and organizational change /*. 2005, Chichester: John Wiley & Sons.
34. Baldrige, *Baldrige National Quality Program*. 2006, (available on-line through <http://www.quality.nist.gov/index.html>).
35. Ghauri, P. and K. Gronhaug, *Research Methods in Business Studies : A Practical Guide*. Second Edition ed. 2002, Harlow: Pearson Education Limited.
36. Gillham, B., *Developing a Questionnaire*. 2000, London: Continuum.
37. Browne, J., et al. *"Innovation Management for Product and Process Development"*. *Proceedings of the International Conference of Information Technology in Business, August 2000, Beijing, China 2000*.
38. Justesen, S., *Innoversity in communities of practice*, in *Knowledge Networks: Innovation Through Communities of Practice*, P. Hildreth and C. Kimble, Editors. 2004, Idea Group Publishing: London. p. 79-95.