



journal homepage: www.elsevier.com/locate/emj



UNIVERSITY
of
GLASGOW

Services innovation: Knowledge transfer and the supply chain

Robert A. Paton *, Stephen McLaughlin

University of Glasgow, Department of Management, Gilbert Scott Building, Glasgow G12 8QQ, United Kingdom

KEYWORDS

Services science;
Services innovation;
Knowledge transfer;
Services exchange

Summary The past decade has seen, in response to the growth in service industries, increasing interest in what has been termed services science and innovation. This embryonic research field has been promoted by far sighted enterprises, government agencies and academics, the basic premise being that for far too long we have concentrated on the study and practice of physical and aesthetic innovation: designed to add value through maintaining end product leadership. Services science embodies and marshals a multi-disciplinary approach: science, engineering and management; in an effort to address and build upon complex service related opportunities. A sub-set, or possibly the driving force, of services science, is services innovation: dealing not so much with the end product but rather with the support, development and delivery of services: that are now the lifeblood of our developed economies.

This paper provides a brief overview of services science and innovation, articulating a case for ensuring that we do not, in our pursuit of sustained competitive advantage and short-term economic growth, adopt a too narrowly defined and puritanical view of innovation and ignore the importance of the service exchange. Sustainable growth, we argue, is based upon identifying, supporting and nurturing meaningful service exchanges that exploit, develop and embody value added knowledge transfer within and across industry. It is time to broaden the services innovation debate in an effort to reach the many practitioners, academics and policy makers not as yet engaged with this exciting now field.

© 2008 Elsevier Ltd. All rights reserved.

Introduction

The service sector, for a variety of well-documented reasons, now dominates the economies of the developed world.

Westernised enterprises and governments, along with their associated infrastructures, now recognise the need to build their futures on knowledge combined with technology and innovation (Chesbrough *et al.*, 2006; Miozzo and Walsh, 2006; Ichijo and Nonaka, 2007). Westernised economies, with substantial commitments to education, health, inclusion and social justice, combined with relatively high

* Corresponding author.

E-mail addresses: r.paton@lbss.gla.ac.uk (R.A. Paton), s.mclaughlin@krobus.com (S. McLaughlin).

labour and infrastructure costs, can no longer rely on manufactured goods and associated exports to maintain sustainable futures (OECD, 2005; HM Treasury, 2005; OECD, 2006).

Knowledge economies, societies and enterprises represent the future (OECD, 2006). Maintaining a knowledge advantage promotes economic leadership by ensuring that emerging ideas, innovations and viable 'new' product and services reach the market place (Bell, 1999; Tidd and Hull, 2003; Karmarkar, 2004). At their core, Western economies are based on services (creation, development and management) and innovation (knowledge acquisition, development and exploitation). Over 75% of the United Kingdom and United States workforce can be classified as belonging to the service sector, with at least 50% of Japanese, German and Russian workers being similarly classified (OECD, 2006). Yet, we continue to concentrate, almost at all costs, on promoting, fostering and applauding physical and aesthetic innovation linked to the physical product or environment (Confederation of British Industry (CBI), 2005; Department of Trade and Industry (DTI), 2007; Sainsbury, 2007).

The CBI (who produce regular and extensive innovation related reports) and Sainsbury (a UK Government commissioned report on the effectiveness of economic and innovation policy initiatives) both stress the economic and social necessity to engage in primary research and development. However, Sainsbury also points to the need to address the issue of globalisation, noting that *value add* is often gained across an international supply chain: through the collaborative efforts of the chain members. Increasingly the innovative supply chain will provide the sustainable future: the DTI also stress the need to take a broader view of the innovative process and to tap into the ideas potential of both the service provider and their associates. The CBI acknowledges the need for a more inclusive definition of innovation: suggesting that it be considered as being the '*the successful exploitation of new ideas*'. They go on to recommend that the support for innovation must recognise the changing shape of the economy and that there is a need to foster industrial networks that collaborate across the supply chain to stimulate the creation of new ideas. The CBI survey indicated that 85% of the respondents acknowledged the importance of the supply chain as being the major source of external knowledge, skills and ideas.

Traditional research and development clearly underpins knowledge creation and exploitation. However, it does not secure, on its own, economic well-being and growth (Gallo-ujj, 2002; DTI, 2007). Services science (Horn, 2005; Hipp and Grupp, 2005; Chesbrough and Spohrer, 2006; Spohrer *et al.*, 2007) addresses this shortcoming by focusing on innovation within the service exchange.

Services science and innovation: a new way forward

Services science, along with services innovation, is an emerging discipline that has been nurtured by both practitioners and academics (IfM and IBM, 2007). Services science, management and engineering (SSME) can be traced back to researchers at IBM and associated schools and centres (Maglio *et al.*, 2006). The basic premise is relatively

straightforward. In complex environments, neither one discipline nor philosophy will offer the practitioner, or researcher, an answer to the challenges associated with creating and sustaining 'success'. Services science aims to harness the power of science and engineering to support knowledge workers within complex service environments through knowledge centred technological architectures and solutions, while ensuring that 'workers' are managed towards maintaining and developing knowledge driven value add (Bitner and Brown, 2008).

By focusing science, engineering and management upon service exchanges within and outwith the enterprise the intention is to encourage more effective and efficient interaction and engagement, as well as foster proactive dialogue and cooperation (IfM and IBM, 2007). A service exchange, as opposed to the transfer of a good or commodity, requires the collaboration of both parties prior to, during and following the exchange (Maglio *et al.*, 2006; IfM and IBM, 2007). Suppliers and users enter a dialogue to ensure clarity of understanding and to define the nature and extent of the exchange. They then continue this dialogue to ensure that the exchange has been effective. Lastly, by monitoring satisfaction and maintaining an understanding of the client's requirements, both parties can extend their relationship and cement ongoing meaningful exchanges. Of course, their supply chain exchanges involve varying degrees of complexity and at the complex end of the spectrum they deal with the transfer of knowledge. It is this transfer of knowledge that crucially influences operational effectiveness, and with it the ability of the chain to grow and innovate effectively (McLaughlin *et al.*, 2006).

The subject of innovation within services sector industries appears to have, in relation to product driven research and development, been somewhat neglected (OECD, 2005; Hauser *et al.*, 2006). This must be of concern to those Western economic stakeholders. How can one maintain a knowledge led strategy without investing in its acquisition, review and exploitation? Recent years have seen a dramatic growth in the interest shown by both practitioners and academics in the general field of services innovation: indeed the DTI have described the growing interest as a 'surge' (DTI, 2007). The increasing importance of the service dimension within what once may have been classified as manufacturing or process industries has been recognised by researchers. The forward looking, paradigm searching and multi-disciplinary nature of many operations related papers, suggests that answers are being sought as to how best to tackle the service dimension within complex, global and emerging supply chains and increasingly service orientated enterprises (Roth and Menor, 2003; Johnston, 2005; DTI, 2007; IfM, 2007; Neely, 2007; Voss and Mikkola, 2007).

To date emerging economies have tended to build their economic success upon the ability to manufacture product and secure commodities at low cost. As these economies develop, they too are investing in the service sector. India and China are enhancing their capability to compete at a services level by investing in education, infrastructure and externalisation. They are not standing still, nor allowing the developed economies to monopolise the high value end of the service exchange (HM Treasury, 2005; OECD, 2006). Service innovation through the appliance of services science may offer a means of securing knowledge leadership.

In this paper services science is taken to be an umbrella term encompassing integrated disciplines that are required, in practice, to promulgate services innovation and growth. The paper focuses on services innovation within complex supply chain networks. It builds upon previous research that dealt with the identification and management of barriers to knowledge transfer (McLaughlin and Paton, 2008). By better understanding how the parties engaged in service provision personally view and manage their exchanges and observe process mechanisms, it may be possible to develop more productive and collaborative ties between them. In other words, by maximising the intellectual as well as capital return from an exchange, both parties should benefit from a sustained and informed relationship.

Complex supply chains

There is little doubt that the future of the Westernised economies and their associated societies and enterprises are seen by many to be dependent upon maintaining a knowledge driven competitive advantage. Perceived wisdom suggests that by maintaining a knowledge based lead supported and underpinned by technological wizardry, intellectual capacity and human resource commitment, and driven by a compelling and enlightened visionary strategy - the Westernised economies will survive and prosper. In short, the knowledge economy is still seen by many as being the principal means of sustaining economic stability and growth (Rooney *et al.*, 2003, 2005).

The growth in the service sector, as the underpinning economic and social driving force behind sustainable Westernised solutions, cannot be attributed solely to an increase in demand for traditional services such as finance, retail, utilities, travel and tourism. The truth is that traditional manufacturers have 'merged' with service providers; sub-contracted their manufacturing capability and emerged as solution providers; redefined their strategic goals to encompass service excellence. Defining an enterprise by an industry sector based on rather static and archaic rules no longer provides meaningful results. The world of industry and commerce has grown more complex and dynamic, supply chain networks are simultaneously the present and future, the maintenance of a leading and innovative stance is increasingly seen as being crucial to success and survival (IfM and IBM, 2007).

Today's leading enterprises operate on a global basis cooperating with suppliers, partners and a multitude of stakeholders to deliver service and/or product packages. It is the complex supply chain that delivers the service or product package: not any single component entity (McLaughlin *et al.*, 2006; Paton and McCalman, 2008). Service innovation must come from within the supply chain or network: from knowledge workers acting as individuals or groups within or outwith the enterprises immediate supply chain.

By understanding how the chain or network manages the transfer of the innovation commodity – knowledge – and subsequently engages with this knowledge – we will be better able to stimulate meaningful innovation and general value add (Chesbrough *et al.*, 2006; Harreld *et al.*, 2007; Ichijo and Nonaka, 2007).

Service innovation with complex supply chains

You don't need a research and development job label to be innovative, within a supply chain, any individual or partner, who is capable of contributing a suggestion, idea, innovation or connection adds to the ultimate value of the network and helps sustain the relationship. Such workers are often termed knowledge or artful workers (Drucker, 1995; Schultze, 2000; Kleinman and Vallas, 2001; Hill *et al.*, 2006): they are the ones who add value through, in the main, their discipline; managerial; and, functional acumen. These workers within the supply chain may have multiple 'employers' and belong to differing functional silos: but they do have the supply chain in common.

To fully exploit the innovative potential within such complex environments one has to address three issues (McLaughlin and Paton, 2008):

1. how best to support the knowledge worker?
2. how best to engage with the knowledge worker?
3. how best to align interests?

The first issue is, in the main, addressed through the first and last disciplines associated with SSME: science and engineering. The knowledge worker must be seen as being not only critical to the operational success of the supply chain but also to its future well being. In supply chains there is little benefit to be gained by pursuing, at any cost, ever-enhanced means of systems/process management. There is a limit to what can be achieved by continuously enhancing manufacturing, delivery, customer and general service support systems: at some point the 'law of diminishing returns' must apply. However, there is tremendous scope and potential, both operationally and strategically, in addressing how the worker interacts with the wider systems and more importantly how do they interact with each other (Miozzo and Walsh, 2006; Chesbrough *et al.*, 2006; Ichijo and Nonaka, 2007). How best can systems technology and architecture support them? As our technological giants, IBM, Sun Systems and HP moved into the new millennium they all appear to have reappraised their core missions: no matter how it is dressed, or expressed, they are all service orientated solutions companies. They strive to provide service management support systems that will engage with the knowledge worker and release their full innovative potential: the service orientated architectures and associated knowledge enabling tools currently being both developed and promoted by IBM (Bieberstein *et al.*, 2005). In addition, developing internet enabled innovations: MySpace, Wikipedia, web 2.0 and YouTube; are further enhancing our capability to engage in knowledge transfer, management and innovation. But as we know (Chesbrough *et al.*, 2006; Paton and McCalman, 2008), no matter how hard one tries there is little point investing in technological systems and solutions if they are not going to be adopted, as intended, nor utilised to full advantage.

Organisations have to find a means of engaging in a meaningful manner with the knowledge workers. This is not an area in which technology alone can provide the answers: the third dimension of SSME, namely management, must inform the manner in which the engagement is approached. Technological solutions must be embedded

not simply with the systems infrastructure but also with the organizational and individual's cultural dynamic: the change and knowledge transfer must be managed in an integrated and inclusive manner (Paton and McCalman, 2008; McLaughlin and Paton, 2008).

Lastly, interests must be aligned: how can one ensure that the 'workers' interests are aligned with those of the employer? The traditional view of employee/employer alignment sees both coming together to manufacture a product, or service a need, and by so doing share in the experience and gain mutual benefits. But in today's service, public or private, orientated economy, particularly within the supply chain networks, this relationship is far more complex (Goerzen, 2005; Osborne and Brown, 2005; McLaughlin *et al.*, 2006; Kestilä *et al.*, 2007). Technology has freed the knowledge worker and enabled employers to utilise their services from remote locations – the alignment is no longer based on a need for physical proximity:

- Knowledge workers often operate from home or remote (out in the supply chain network) locations, but no matter their location they must be fully engaged in the design of support systems (Patrick and Dotsika, 2007);
- Client relationships are crucial: so often the knowledge worker is embedded with the clients network and may identify, over time, with the client more than the employer (Pate and Martin, 2004; Thompson and Heron, 2005);
- Knowledge workers can be expensive and their services non-standard: they are often employed on contract and are remote from core activities (Fenwick, 2007);
- Knowledge workers no longer stay with their employers for life: careers are made by moving not staying so how does one attract, retain and manage knowledge if it doesn't stand still (Martin *et al.*, 2005).
- Knowledge is security, power and freedom: is it always in ones interests to share?

There are many factors impinging upon the alignment issue: technology may assist in supporting the alignment process but it will not deliver sustainable results without the intervention of best and informed management practice.

Delivering service innovation

As noted earlier, Service Science is an emerging discipline that aims to combine fundamental science and engineering theories, models and applications with facets of the management field, particularly knowledge, supply chain and change management, in order to enhance and advance service innovation. Service innovation is fast becoming the key driver of socio-economic growth and as such warrants increasing academic and commercial research attention (Paulson, 2006). IBM and associated academic (Allen *et al.*, 2006; Chesbrough *et al.*, 2006) governmental and commercial partners have been in the vanguard of those pioneering and promoting Service Science (Allen *et al.*, 2006; Paulson, 2006).

IBM through its research wing and associated institutions are assisting to promote, define and develop *Service Science* related research (Paulson, 2006; Spohrer *et al.*, 2007). Activ-

ity to date has focused on what might be considered the technological underpinnings of the new discipline (Abe, 2005). But it is increasingly recognised that what is required is a cross-disciplinary collaboration if the power of service innovation capability is to be truly harnessed (Abe, 2005; Allen *et al.*, 2006; Chesbrough *et al.*, 2006; Paulson, 2006).

Whither services science and associated derivatives, such as services innovation, are indeed new emerging disciplines is in many respects of little importance. What is abundantly clear is that there is a practitioner demand for assistance, understanding and partnership working. Fostering a better understanding of how best to address innovation, knowledge transfer and growth, within an ever increasingly complex economic and social environment, will not be answered by practitioners, academics or government agencies who have entrenched and static silo based views of today's global and networked world. Complex issues are seldom best addressed by any single function or grouping.

The need for practitioners and academics to address the silo issue is not unique to fields of management, science and engineering. Medics, educators, lawyers and architects, together with engineers, scientists and managers, have all been at some time accused of harbouring a silo mentality – of not 'thinking out of the box'; 'failing to see the wood for the trees'; dealing with symptoms and not the causes; and, in general, focusing in on a well defined area of expertise while hoping that someone else is looking after the 'big picture' (Vakola and Bouradas, 2005; Bleakley *et al.*, 2006; Stoddart, 2007; McLaughlin and Paton, 2008; Paton and McCalman, 2008).

For services science, innovation and change we need organisations, employees and graduates who can cope with complexity and diversity (CBI, 2005; IfM, 2007; DTI, 2007; Sainsbury, 2007). Solutions, for business, science, engineering or socio-economic systems, now and increasingly in the future we need to be holistic. Silo based education and development, concentrating on functional and/or subject specialism, is unlikely to disappear. We need people who can 'go deep' into complex issues and problems and through their specialist knowledge produce solutions: but we also need a significant percentage of these people to be capable of seeing, in an innovative and creative manner, the bigger picture (Lam, 2005; Martin *et al.*, 2005; Raybould and Shedy, 2005; Proctor, 2005; Kelly, 2006; Bilton, 2007). This non-silo capability skills have been dubbed by some as being the 'T' skills set or knowledge base (Maglio *et al.*, 2006): the vertical component of the 'T' represents the in-depth knowledge and understanding of a particular core discipline: science, engineering, or the humanities. However, the horizontal bar represents the capability of seeing beyond the obvious. It represents the ability to think across, industry, disciplines and personal boundaries (Craig *et al.*, 2005; Humphrey *et al.*, 2005; Shuman *et al.*, 2005). Complex service industries economies need these 'holistic', creative and innovative skills, indeed they need to manage and develop these non-functional/discipline roles and capacities to maintain their knowledge based competitive advantage and increasingly to face and solve global issues (Gratton, 2007; Mason and Karin Wagner, 2005; Ichijo and Nonaka, 2007; Chesbrough *et al.*, 2006) such as: our collective carbon footprint; climatic change; social and economic

disparities; and of course the challenges of truly global supply chain networks, competition and opportunity.

CSIRN: the rationale

Delivering sustainable knowledge based economies, within complex global supply chain environments, will require the 'players': industry and commerce; academia and research institutes; and government funding agencies; to work together to deliver service, as well as technological and product, innovation.

The authors, together with a multi-disciplinary team of researchers, in association with IBM, have formed and launched CSIRN (Complex Service Innovation Research Network). The overarching aim being to further our understanding of the knowledge transfer challenges within complex supply chain environments: overcoming the barriers to services innovation and enhancing E2E performance. CSIRN (www.gla.ac.uk/departments/csirn) will build upon ongoing knowledge and change management research related to supply chain complexity to investigate how best to foster innovation and growth from a services perspective.

The team at CSIRN are well aware that there are many others, for example the Institute for Manufacturing at Cambridge and SSMEUK at Manchester Business School, academics and practitioners, engaged in research associated with the emergent field of services science. It is equally clear that there are multiple agendas being pursued and that to date the main drivers have been the technological, solutions orientated, multi-nationals; manufacturing and research and design research institutes; and, to a limited extent government funding agencies. There is some emerging evidence that the cross-over to a truly multi-disciplinary approach is occurring and that there is growing interest from the ultimate users of the solutions technology.

To further foster the multi-disciplinary debate, while maintaining an engagement with practice, CSIRN, the EMJ and Elsevier, have joined forces to mount a services science exposé. Contributors from the North America and Europe have joined forces to bring an extensive array of papers and thoughts relating to services science to the EMJ community of academics and practitioners. It is our sincere hope that over the series that everyone will find something of interest: hopefully providing the trigger for debate and engagement. The editorial preceding the launch of the services science and innovation series explains how to join the debate by logging on to the Elsevier *blog*.

Concluding remarks and an invitation to join the debate

There is growing evidence that to maintain and develop a competitive edge in an increasingly complex, competitive and global market place that a new paradigm, both managerial and business, maybe required. Services science purports to offer at least the foundations of a new way of engaging with the knowledge creators and service deliverers. The evidence for the rise of services science as an answer to the complexity of our global, knowledge intensive, industries may not as yet be conclusive. However, we do know that there is an issue to be addressed.

The last decade has seen a sceptical world 'warm' to the notion that the environment matters and that we need to address climate change with a sense of urgency. Although there is now a consensus that climate change is indeed a fact of life there is still a debate, of sorts, as to the exact nature of the route causes: but if we wait for conclusive evidence we will be managing the aftermath of a crisis and not managing our futures. We have to identify what can be done and act now. In many ways the services science debate is similar.

Services science's basic premise is that the world of business and commerce is changing. How we manage this new world will also have to change. To maintain a competitive edge in high cost base economies we have to consider how we create and build on knowledge. Knowledge that is increasingly being 'worked' from within what many would now classify as being service environments. Applying traditional physical and aesthetic driven research and development methodologies to this new world will not provide the sustainable advantage that developed economies require: engaging with the service providers, both internal and external, to the increasingly complex supply chain may provide an innovative means of leveraging greater performance from an expensive and volatile resource base.

We invite you to read, consider and contribute to the services science debate. Your views, experiences and general inputs will be reviewed, analysed and summarised and reported back, by CSIRN, via the EMJ.

References

- Abe, T. (2005) The development of service science. *Japanese Economy, Fall 2005* 33(3), 55–74.
- Allen, S. G., Mugge, P. and Wolff, M. F. (2006) Service science to be taught in NC state. *Research Technical Management* 49(6), 6–7.
- Bell, D. (1999) The coming of post-industrial society: A venture in social forecasting. Basic Books, New York.
- Bieberstein, N., Bose, S., Walker, L. and Lynch, A. (2005) Impact of service-oriented architecture on enterprise systems, organizational structures, and individuals. *IBM Systems Journal* 44(4), 691–708.
- Bilton, C. (2007) *Management and Creativity*. Blackwell Publishing, London.
- Bitner, M.J., Brown, S.W. (2008) The Service Imperative, *Business Horizons, 50th Anniversary Issue*, Jan/Feb.
- Bleakley, A., Boyden, J., Hobbs, A., Walsh, L. and Allard, J. (2006) Improving teamwork climate in operating theatres: The shift from multiprofessionalism to interprofessionalism. *Journal of Interprofessional Care* 20(5), 461–470.
- Chesbrough, H. and Spohrer, J. (2006) A research manifesto for service science. *Communications of the ACM* 49(7), 35–40.
- Chesbrough, H., Vanhaverbeke, W. and West, J. (2006) *Open Innovation: Researching a New Paradigm*. Oxford University Press.
- Confederation of British Industry (CBI) (2005), *Innovation Survey*, CBI, November.
- Craig, N., Thompson, N., Donath, L. and Matthews, M. (2005). *Incorporating Complexity into Undergraduate Engineering Development through the Research Communications Studio. ... Proceedings of the 2005 American Society for Engineering Education Annual Conference and Exposition*. American Society for Engineering Education.
- Department of Trade and Industry (2007) *Innovation in Services*, DTI Occasional Paper No. 9, June, HMSO.
- Drucker, P. F. (1995) *Managing in a Time of Great Change*. Penguin, London.

- Fenwick, T. (2007) Knowledge workers in the in-between: Network identities. *Journal of Organizational Change Management* 20(4), 509–524.
- Gallouji, F. (2002) *Innovation in the service economy: The New Wealth of Nations*. Edward Elgar, Cheltenham.
- Goerzen, A. (2005) Managing alliance networks: Emerging practices of multinational corporations. *The Academy of Management Executive* 19(2), 94–107.
- Gratton, L. (2007) Handling hot spots. *Business Strategy Review* 18(2), 9–14.
- Harreld, J. B., O'Reilly, C. A. and Tushman, M. L. (2007) Dynamic capabilities at IBM: Driving strategy into action. *California Management Review* 49(4), 21–43.
- Hauser, J., Tellis, G. J. and Griffin, A. (2006) Research on Innovation: A review and agenda for marketing science. *Marketing Science* 25(6), 687–717.
- HM Treasury (2005) *Globalisation and the UK: Strength and Opportunity to Meet the Economic Challenge*. HMSO.
- Hill, C., Yates, R., Jones, C. and Kogan, S. L. (2006) Beyond predictable workflows: Enhancing productivity in artful business processes. *IBM Systems Journal* 45(4), 663–681.
- Hipp, C. and Grupp, H. (2005) Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy* 34(4), 517–535.
- Horn, P. (2005) The new discipline of Services Science: It's a melding of technology with an understanding of business process and organization ... and it's crucial to the economy's next wave, *Business Week*, January 21st.
- Humphrey, J. D., Coté, G. L., Walton, J. R., Meiningner, G. A. and Laine, G. A. (2005) A new paradigm for graduate research and training in the biomedical sciences and engineering. *Advances Physiology Education* 29, 98–102.
- Ichijo, K. and Nonaka, I. (2007) *Knowledge Creation and Management: New Challenges for Managers*. Oxford University Press.
- IfM and IBM (2007) Succeeding through Services Innovation: a discussion paper, Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing.
- Johnston, R. (2005) Service operations management: from the roots up. *International Journal of Operations and Production Management* 25(12), 1298–1308.
- Karmarkar, U. (2004) Will you survive the services revolution? *Harvard Business Review* 82(6), 100–107.
- Kelly, T. (2006) *The Ten Faces of Innovation*. Profile Books, London.
- Kestilä, T., Mäkipää, M., Salmela, H., Salmivalli, L. (2007) Building Commitment and Trust to ICT Collaboration in Partnership Networks, Proceedings of the 30th Information Systems Research Seminar, Scandinavia, IRIS.
- Kleinman, D. L. and Vallas, S. P. (2001) Science, capitalism, and the rise of the "knowledge worker": The changing structure of knowledge production in the United States. *Theory and Society* 30(4), 451–492.
- Lam, A. (2005) Work Roles and Careers of RandD Scientists in Network Organizations. *Industrial Relations* 44(2), 242–275.
- McLaughlin, S., Paton, R. A. and Macbeth, D. K. (2006) Managing Change Within IBM's Complex Supply Chain. *Management Decision* 44(8), 1002–1019.
- McLaughlin, S. and Paton, R. A. (2008) Identifying Barriers that Impact Knowledge Creation and Transfer within complex organisations. *Journal of Knowledge Management* 12(4).
- Maglio, P. P., Srinivasan, S., Kreulen, J. T. and Spohrer, J. (2006) Service Systems, Service Scientists, SSME and Innovation. *Communications of the ACM*(July), 81–85.
- Martin, G., Beaumont, P., Doig, R. and Pate, J. (2005) Branding: A New Performance Discourse for HR. *European Management Journal* 23(1), 76–88.
- Mason, G. and Karin Wagner, K. (2005) Restructuring of automotive supply-chains: the role of workforce skills in Germany and Britain. *International Journal of Automotive Technology and Management* 5(4), 387–410.
- Miozzo, M. and Walsh, V. (2006) *International Competitiveness and Technological Change*. Oxford University Press.
- Neely, A. (2007) The servitization of manufacturing: an analysis of global trends, 14th European Operations Management Association Conference, Ankara, Turkey.
- Organisation for Economic Cooperation and Development (2005) "Promoting Innovation and Services", Paris.
- Organisation for Economic Cooperation and Development (2006) "The Knowledge Based Economy", Paris.
- Osborne, S. P. and Brown, K. (2005) Managing Change And Innovation. In *Public Service Organizations*, Routledge, London.
- Pate, J., Martin, G. (2004) Trust and the Psychological Contract. In V. Mangematin, D. Harrison, C. Thuderoz (Eds.), *Trust and Confidence*. CNRS Editions, Paris.
- Paton, R. A. and McCalman, J. (2008) *Change Management: A Guide to Effective Implementation*. (3rd ed.). Sage, London.
- Patrick, K. and Dotsika, F. (2007) Knowledge sharing: developing from within. *The Learning Organization* 14(5), 395–406.
- Paulson, L. D. (2006) Service science: A new field for today's economy. *Computer* 39(8), 18–21.
- Proctor, T. (2005) *Creative Problem Solving for Managers: Developing Skills for Decision-Making*. Routledge, London.
- Raybould, J. and Sheedy, V. (2005) Are graduates equipped with the right skills in the employability stakes? *Industrial and Commercial Training* 37(5), 259–263.
- Rooney, D., Hearn, G., Mandeville, T. and Joseph, R. (2003) *Public Policy in Knowledge-Based Economies: Foundations and Frameworks*. VCH, Edward Elgar.
- Rooney, D., Hearn, G. and Ninan, A. (2005) *Handbook on the Knowledge Economy*. Edward Elgar, Cheltenham.
- Roth, A. V. and Menor, L. J. (2003) Insights into service operations management: A research agenda. *Production and Operations Management* 12(2), 145–164.
- Sainsbury, Lord (2007) Race to the top: A review of the Government's science and innovation policies, Independent HM-Treasury Report, HMSO, October.
- Schultze, U. (2000) A Confessional Account of an Ethnography about Knowledge Work. *MIS Quarterly* 24(1), 3–41.
- Shuman, L. J., Besterfield-Sacre, M. and McGourty, J. (2005) The ABET 'Professional Skills' – Can they be taught? Can they be assessed? *Journal of Engineering Education*(January), 41–55.
- Spohrer, J., Maglio, P. P., Bailey, J. and Gruhl, D. (2007) Steps toward a science of service systems. *IEEE Computer Journal*(January), 71–77.
- Stoddart, L. (2007) Organizational culture and knowledge sharing at the United Nations: using an intranet to create a sense of community. *Knowledge and Process management* 14(2), 82–189.
- Thompson, M. and Heron, P. (2005) The difference a manager can make: organizational justice and knowledge worker commitment. *The International Journal of Human Resource Management* 16, 383–404.
- Tidd, J. and Hull, F. M. (2003) *Services Innovation: Organisational responses to technological opportunities and market imperatives*. Imperial College Press, London.
- Vakola, M. and Bouradas, D. (2005) Antecedents and consequences of organisational silence: an empirical investigation. *Employee Relations* 27(5), 441–458.
- Voss, C., Mikkola, J.H. (2007) Services Science: the opportunity to re-think what we know about service design, A position paper for the: *IfM and IBM (2007) Succeeding through Services Innovation: a discussion paper*, Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing.



ROBERT A. PATON is currently Professor of Management at the University of Glasgow. He researches, publishes and lectures in the fields of managing change, knowledge transfer and in organizational innovation. Robert is presently concentrating his efforts on knowledge transfer strategies within complex change scenarios, in particular, the role of services science and innovation. Robert, with IBM support, has recently

launched the Complex Services Innovation Research Network. He has recently published in: *JIT*, *Management Decision*, *EMJ*, *Journal of Knowledge Management and IJOPM*.



STEPHEN MCLAUGHLIN is currently an Adam Smith Research Fellow at the University of Glasgow. Stephen is a former IBM senior manager with responsibility for supply chain optimisation and enhancing associated performance management. He is interested in determining how best to optimise knowledge transfer within complex organizations: identifying and managing inhibitors to performance related knowl-

edge transfer. He has published in *Management Decision* and the *Journal of Knowledge Management*. He is presently engaged in CSIRN research and consultancy (through KROBUS LLP).