Rethinking the Centrality of Customer and Supplier Interaction in Innovation

Thomas Johnsen, Wendy Phillips, Nigel Caldwell, and Michael Lewis
University of Bath, UK

Please address correspondence to:
T. Johnsen
University of Bath School of Management
Centre for Research in Strategic Purchasing and Supply,
Bath BA2 7AY, UK
E-mail: mnstj@management.bath.ac.uk
Tel: 01225 383 361

Abstract

This paper evaluates the assumption that interaction within customer-supplier relationships is always the pivotal point for innovation. It argues that the relevance of customer and supplier relationships depends on the nature and maturity of the technology being developed, thus exploring the potential variation in customer-supplier interactions during different phases of the innovation life cycle. The paper commences with a brief introduction to the literature and then uses the findings from an exploratory set of interviews to illustrate the premise of the paper. The paper concludes with a discussion of the implications of the findings and outlines the plans for the next stage of the research.

Keywords: technology, interaction, relationships, innovation life cycle.

Introduction

Interaction within customer-supplier relationships is generally, not least in IMP research, regarded as the crux of innovation (Håkansson 1987). Extensive studies have been conducted into the relevance of interaction with customers (e.g. Von Hippel 1988; Lundvall 1986; Biemans 1989; Ritter and Walter 2003) and suppliers (e.g. Håkansson and Eriksson 1993; Wynstra 1998; Handfield *et al* 1999; Johnsen and Ford 2004). Håkansson (*ibid*) suggested that co-operation within customer-supplier relationships is critical for technological development due to 1) knowledge development; 2) resource mobilisation, and 3) resource co-ordination. Thus, for example, the right suppliers may contribute specialised process capabilities that are critical to the innovation.

However, the industrial and technological context for this theory is often not well understood, although it would appear that it is of most relevance to fairly mature technologies that have been put to use in different product/service applications. In comparison, the relevance of customers and suppliers in emerging technologies, in which the tangible part of the product/service offering is less significant or at least still to be developed, may be less significant. In such settings, horizontal interaction with, for example, universities and research centres may be far more critical. Indeed, suppliers may have a relatively limited role to play in the early stages of the innovation process where the product/service offering is still experimental and industry-wide standards are often yet to be established. In other words, the key suppliers that may be important at this stage may be those that 'supply' intangible knowledge, such as research centres and consultants, rather than material or component suppliers. Indeed, this is supported by Pavitt (1984), Hagedoorn (1993) and Tidd and Trewhella (1997) who have contributed frameworks to establish the sources of innovation across various sectors, yet the role of suppliers, and potentially the wider supply networks, at different stages of technological development remains ambiguous.

The central research question driving this paper is therefore whether industry and firm differences, in terms of their innovation life cycle position, is a key factor in determining the degree and type of customer-supplier interaction. Underpinning the question is the idea of industrial innovation life cycles (e.g. Abernathy and Utterback 1978; Utterback 1994). The paper will commence with a review of the relevant literature, followed by a description of the methodology employed for an exploratory survey and an overview of the technological and industrial context. Findings from exploratory research are presented, which are then analysed in the context of the literature and conclusions drawn in terms of theoretical and managerial implications.

Literature Review

In developing a framework for this study we examined analytical models of the innovation life cycle, drawing on the work of Abernathy and Utterback (1978) and Utterback (1994) which looks at the commercialisation strategies undertaken by firms for different technologies and sectors at different stages of innovation. Abernathy and Utterback describe the pattern of industrial innovation in terms of three phases: the fluid stage, the transitional phase and the specific phase. Table 1 summarises the key aspects of each phase.

Table 1. Three Phases of Industrial Innovation

	Fluid, emerging phase	Transitional, growth phase	Specific, mature phase
Type of innovation	Radical product innovation, high technological uncertainty	Increasing process innovation	Mainly process innovation, mostly incremental product innovation
Product line	Diverse, often customised	Emergence of a stable dominant design	Mainly undifferentiated, standardised products
Number of competitors	Number of actors initially low but increases rapidly as market opportunities become apparent	Decreasing number of actors, following emergence of dominant design	Dominated by a few large actors
Barriers to entry	Low – flexible production near to research centres	Medium –becoming more rigid, some automation and specialised equipment	High –capital intensive, mainly specialised automated equipment
Competitive emphasis	Technical performance	Product differentiation	Price/cost

Source: Adapted from Utterback, 1994; Powell and Moris, 2004 and Tidd et al, 2005

The 'fluid phase' is marked by a high degree of uncertainty and experimentation resulting in a variety of different products and the emergence of new industrial sectors. A profusion of science-based entrepreneurial SMEs compete for specialised niche markets until gradually a dominant design emerges with innovation occurring along a defined technological trajectory (Dosi 1982), in which the emergence of an industry-wide standard marks the start of the 'transitional phase'. This phase is characterised by differentiation, increased investment in resources and capital and a reduction in the number of competing firms. The final 'specific phase' is defined by high barriers to entry brought by the high capital costs of specialised equipment and market domination by a few large key players. Innovation is focused on cost reduction and quality improvements in order to bring about increased productivity. As the innovative possibilities diminish there is a threat of disruption from new emerging technologies, often from outside industries. Indeed, as Pisano (1997) has pointed out by referring to 'process enabling' contexts such as biotechnology, such technological innovations may be triggered by process innovations. The implication of his work is therefore that process innovation is no longer merely an issue in mature contexts, but is nevertheless still relatively dominant in the mature phase.

Pavitt's taxonomy of sectoral patterns of technical change supports the innovation life cycle model, which classifies four types of firm: science-based, supplier-dominated, scale-intensive and specialised suppliers. Here, less mature science-based industrial sectors relate to the fluid phase: a rapid influx of small entrepreneurial firms pursuing emerging or non-existent markets and an absence of industry standards (Powell and Moris 2004). Often the firms are spin-outs from universities. More mature science-based sectors e.g. electronics are illustrative of the transitional phase where, in addition to product differentiation, there is increased differentiation on cost. For the supplier-dominated and scale-intensive category the focus of innovation is on productivity and a move away from science-based innovation. Here, Pavitt (ibid) suggests that firms compete on price for cost conscious end-customers and often look to incremental product and process innovations to bring about cost reductions. A further dimension to product life cycles is introduced by considering CoPS (complex product systems). CoPS can be defined as high cost, technology intensive, customised, capital goods, systems, networks, control units, software packages, constructs and services (Hobday, 2000). "The product life cycle model is unable to explain the pattern of innovation and industrial competitiveness in CoPS, which tend to remain in the fluid phase of product innovation and follow a different cycle … While CoPS do mature, a mature phase when standardised goods are produced in long-runs for mass markets is seldom, if ever reached". (Davies & Brady, 1998:295)

The models highlighted above can also be compared with Ford and Ryan's (1981) technology life cycle model, which distinguishes between six stages: technology development, technology application, application launch, application growth, technology maturity, and degraded technology. Like Ansoff's (1984) combined technology and product life cycle model, it shows how product life cycles represent a

range of different technology applications. It does not, however, specifically identify the type of relationships that may be relevant at the different stages or how these relationships relate to the maturity of the technology area or industrial sector. It is also essentially a product life cycle model and not an (industrial) innovation life cycle and as such relates more closely to product innovation and development.

The issue of collaboration during different stages of technology development and product/service application is interesting in the context of the emergence of literature discussing the need for supplier involvement in product development (e.g. Håkansson and Eriksson 1993; Wynstra 1998, Handfield *et al* 1999). The notion of supplier involvement in product development concerns involvement of key suppliers at different points in the product development process and often the literature highlights the importance of the need for early involvement, ideally during concept development (although the assumption that 'the earlier the better' has been questioned by some observers, e.g. Hartley (1994)). This may indicate that the role of suppliers relates to technology application rather than technology development, although the picture is rarely clear-cut. Indeed, Johnsen (2004) found that some suppliers, for example in telecommunications, may be more closely involved during technology programmes than during product development projects and thus technology application. However, such models do not consider how the products relate to the innovation life-cycle model or in other words whether the product is being introduced early on in the life cycle or later on. Such positioning may have important implications for innovation management and, indeed, the management of supplier relationships. Developing an understanding of this may be significant in determining the level of supplier involvement required for a specific technology or product/service application.

The research question emerging from our literature investigation was therefore:

How do innovation life cycles affect the relative importance of suppliers and customers during innovation?

Methodology

The study formed part of a larger research project into 'Innovation in Supply Networks' in the healthcare sector. It was decided to conduct an exploratory survey as the first empirical part of the project in order to develop a more structured conceptual structure for further empirical investigation. The focus on healthcare ensured that it was possible to include examples from across the industrial innovation life cycles. A further structural framework was adopted to select the sample and identify the theoretical categories (Eisenhardt 1989: 537), namely Pavitt's (1984) taxonomy of sectoral patterns of innovation. Employing his taxonomy ensured that the selected organisations represented a range of different types of firm.

Consequently, twelve UK-based healthcare organisations were selected (see Table 1) and semi-structured interviews were conducted with personnel from either commercial and/or technical functions; for SMEs these were often the CEO. The use of semi-structured interviews allowed comparisons to be made across cases but also allowed the interviewee to discuss issues freely, testing any presumptions held by the interviewers (May 1993). The interview guide was designed around an analytical framework supporting the analysis of data in relation to dyadic relationships, focal firm networks, and the wider industrial network.

Table 1. Background to Cases

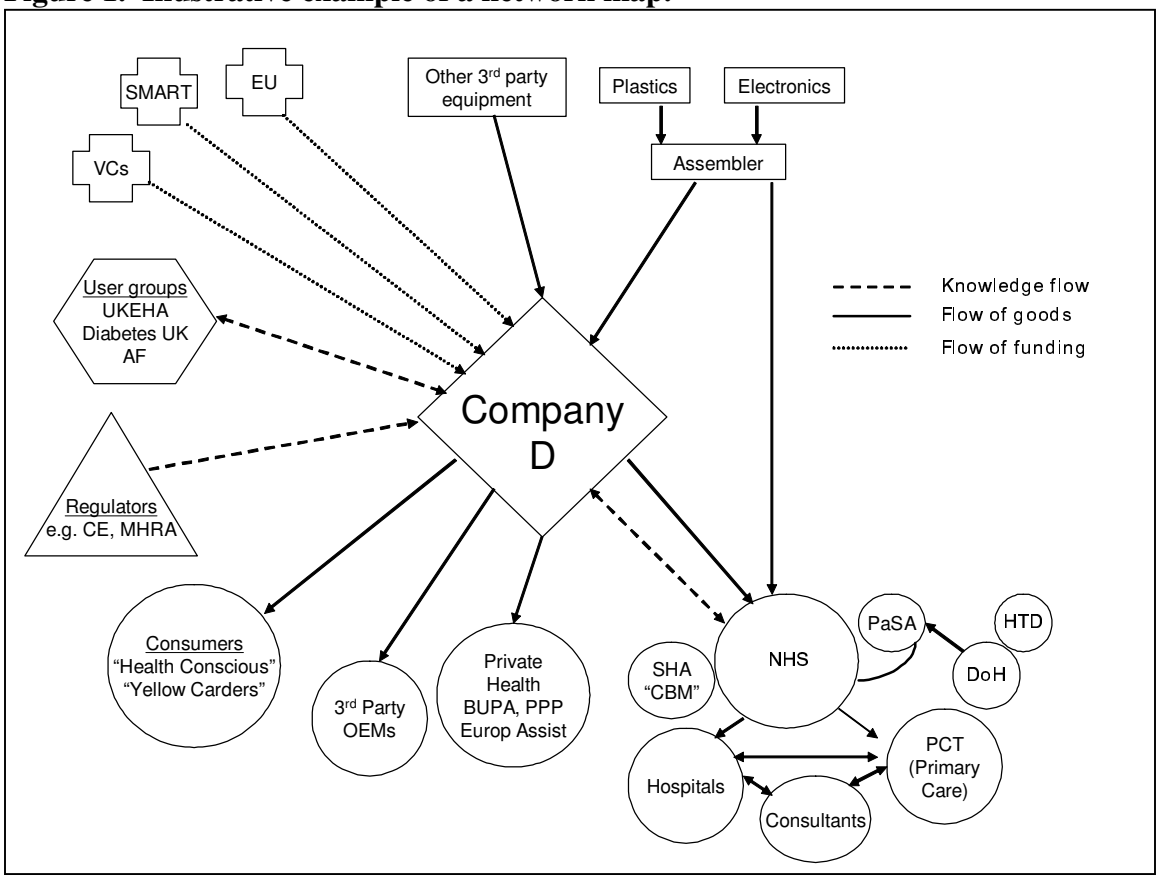
Focal Firm	Firm type	Sector	Product	Ownership	Turnover ($)	Employees
AT1	Supplier dominated	Assistive technology	home medical equipment e.g. wheelchairs, lifters.	US parent, international company (7 sites in Europe)	US-1.4 bn Eur-400m	550 Eur, 135 UK
AT2		Assistive technology	Paediatric prods, bathing equip, chairs	US parent, company is worlds leading rehabilitation products provider	45m	110
AT3		Assistive technology	specialist wheelchairs & general accessories	Owner run (UK)	4m	40
M1	Scale/ Production Intensive	manufacturing	Healthcare equipment manufacturer, e.g. beds and hospital 'furniture'	Part of bigger private limited company, UK owned	18m	130
M2		manufacturing	Rubber gloves & artificial tears	Acquired by American company	-	200 (UK), 2200 worldwide
C1	Science-based firms	Cardiovascular	Implanted medical devices cardiovascular diseases	Privately owned (UK), part of a group of five inter-locked privately owned companies. Were AIM listed, now going to Nasdaq.	18-22m	42
TE1		Tissue engineering	Soft (repair) tissue	Global business, US parent	1.25 trillion	7,000 world wide
TE2		Tissue engineering	tissue implant products	Private limited company, UK owned	6.3m	40
TE3		Tissue engineering	tissue implant products	Owner managed	N/A	100
T1	Specialised suppliers	Telecare	Telecare – range of community care based systems	Owner run (UK)	4m	34
T2		Telecare	Telecare chronic diseases	Owner managed	Start-up	4 (with associates)
T3		Telecare	Telecare	Venture capital owned	125-135m	750

The firm types (supplier dominated, scale based, science based firms and specialised suppliers) were derived from Pavitt's taxonomy. Some of the specific industries deserve a little introduction. Tissue engineering is a relatively new scientific discipline, the aim of which is to regenerate or recreate human tissue in a laboratory, to give an implantable tissue product that can be used to repair tissue damage or disease. Assistive technology has a primary role of replacing or augmenting some function of the body for people who would otherwise be handicapped by their disability, examples of products would range from walking aids to sophisticated voice generating devices with their own input vocabulary and the ability to automatically adapt to their user. One sub-field within assistive technology is telecare,

which can be broadly defined as the use of telecommunications technology to support independent living, for example devices that monitor the user and can feedback information to a central call centre if an intervention appears necessary, e.g. the user has not moved in their bed for some hours.

In order to grasp the wider network picture data collection involved the use of network mapping whereby the interviewee was requested to diagrammatically represent their network with respect to those actors that influence the process of innovation. Through network maps it was possible to develop an insight into the firm's range of business relationships and also to view the positive and negative impact that different interactions have upon the adoption and diffusion of innovations (Gardner and Cooper 2003). As only one company was interviewed in each case these drawings mainly captured the level of the single firm-centred, or focal firm, network, although the research team attempted to explore more distant connections wherever possible. Figure 1 is illustrative of the networks drawn during the interviews.

Figure 1. Illustrative example of a network map.



The network map above of Company D refers to a Telecare company, T2, in Table 1. T2 is a small start up company selling a "life style" monitoring device, capable of detecting changes in the patient/users physiognomy. For example, an obese patient, could receive dietary information on a regular basis, and could interact with the system in such a way that their compliance with a prescribed dietary regime could be encouraged and monitored remotely. Such devices have the benefit of providing real time information that could be condition critical, whilst saving healthcare professionals travel and consultation time. Interventions (i.e. physical interaction with the patient) can then be made on an exceptions basis, freeing up valuable and constrained resources.

Findings

In order to analyse the findings the innovation projects that were involved in the survey were positioned along the lifecycle model, according to the key technology being developed, drawing on the characteristics identified by Utterback (1994) and more recently adapted by Powell and Moris (2004). The innovation projects were grouped accordingly, e.g. TE3 was a tissue engineering project in the early stages of development with no product yet on the market. In comparison, the innovation project in M2 already had a standardised product and therefore could use main stream project management techniques.

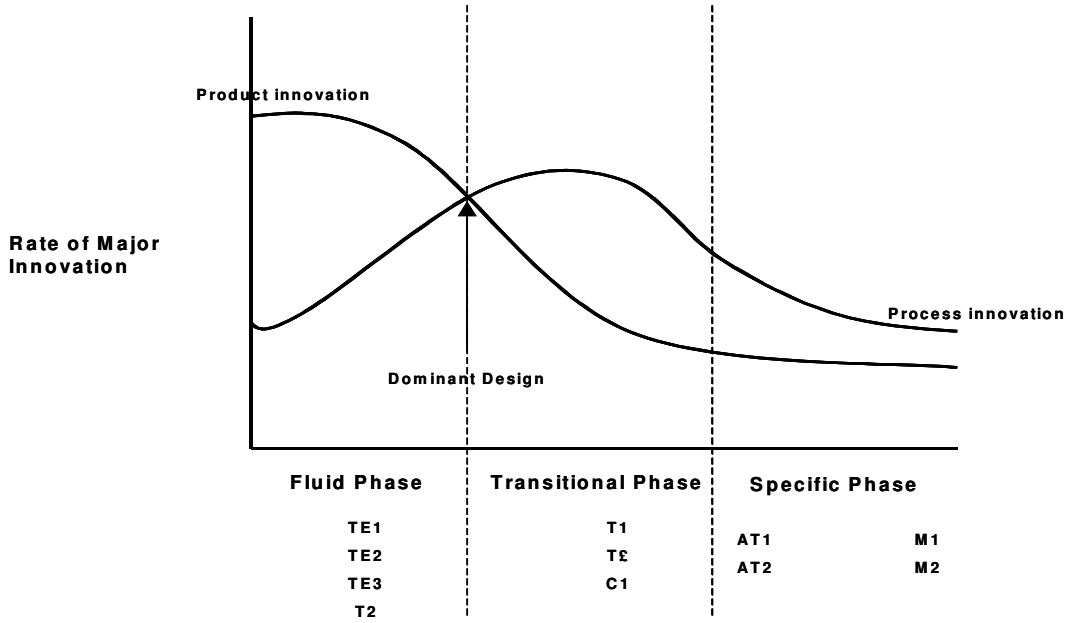


Figure 1 Industrial Innovation Life Cycle (Adapted from Abernathy)

Group 1 Fluid phase: TE1, TE2, TE3 and T2

The technological foundations of the companies mapped onto the fluid phase of the innovation life cycle were tissue engineering (TE1, TE2 and TE3) and also one company developing a technology for an emerging market: telecare systems for the monitoring of chronic diseases as opposed to the more mature community care market (T2).

Within this group it was clear that, as yet, no industry standard had emerged and that none of the firms had an established supply network. The lack of standardisation and the inherent risk associated with these technologies had major implications for the management of supplier relationships. In all cases it was apparent that the issues of marketing, distribution and supply were under consideration but were not being developed until it was clear in which direction the industry was heading. Two of the tissue engineering firms were keen to engage with universities to address the problems associated with the supply of their products and the nature of future supply networks. When discussing this issue one CEO said:

"UK universities are out of touch with what industry really wants and needs. Rather than supplying more prototypes, lots of infrastructural service problems need to be addressed."

This quotation highlights the frustrations often expressed in this sector that the 'route to market' infrastructure was simply non-existent for such novel products. In terms of providing a route to market, and thereby reducing risk, regulation was seen as a key factor and was viewed (perhaps surprisingly) positively in the sample innovation projects in tissue engineering, as it set the parameters that were

useful in development and provided an indicative framework of what would be commercially viable products. On the negative side regulation was perceived as overly stringent and the costs of compliance including auditing of all supplies, suppliers and processes – and the time delay they add to the overall process of innovation (the process of conducting these audits was itself often outsourced, allowing the companies to focus on innovation).

However, for tissue engineering, the regulators were also waiting to see how the industry develops and the actors were keen to "sit at the table" to ensure their involvement in any policy developments. This was mirrored by the largest innovation project in the telecare sector, which also kept engaged with the relevant regulatory body. Several interviewees expressed concern that one telecare organisation, through market dominance, might be able to influence industry development to their own benefit. These horizontal relationships thus appeared to be critical during the fluid phase.

The high degree of risk and fear of litigation had a significant influence on supplier interactions. First, the customer firms were constrained by which suppliers they could work with. For instance, in sourcing animal tissue, one firm was required to use New Zealand suppliers since there have been no reported outbreaks of Creutzfeldt-Jakob Disease (CJD) in that country. Second, the TE actors found it difficult to find suppliers willing to supply the more controversial materials such as tissue and organs for fear of future litigation.

In all the cases the users appeared to be clearly defined and in contrast to their supplier relationships, seemed to have developed strong ties. For the tissue engineering firms this tended to be with surgeons and clinicians (often acting as lead users) whereas the telecare company had developed close relationships with user groups such as Diabetes UK.

Group 2 - Transitional phase: T1, T3 and C1

The companies representing the transitional phase included telecare companies providing technologies to support the move towards community rather than hospital based healthcare (T1, T3). One other company, C1, produced implanted medical devices for the treatment of cardiovascular diseases. In both industries a standard was beginning to emerge and for the telecare companies T3 was well-established in the marketplace and positioned as a dominant player.

In all the cases, the companies placed surprisingly little emphasis on the role of suppliers; and there appeared to be very little supplier interaction. For the cardiovascular company the lack of interaction with suppliers was reinforced through its use of distributors who undertook the sourcing of raw materials (and as such performing a supplier role). The suppliers to the telecare companies provided electrical and plastic components and, hence, were not perceived as pertinent since they were not immediately associated with healthcare. This was highlighted by one telecare executive:

"By and large ideas don't come from the supply side as they don't know anything about social services or healthcare."

This may indicate the limited dependency of the suppliers on the healthcare sector, or that the respondents simply had little idea or experience of the potential benefit of supplier interaction during innovation. Nevertheless, for all the firms within this group most of their resources were directed towards targeting the customer, the focus being on marketing (in a narrow sense) as opposed to purchasing and supply. Much time was spent on lobbying and public relations, since these were identified as key enablers to the success of the innovations. The use of product champions was also highly rated:

"Treat the surgeon champion as an initial route to market…After the surgeon champion does his presentation that's it. The name is now in the frame." (scientific technical director)

Thus, the horizontal links as well as customer or user links appeared to be highly significant during the transitional phase, whilst supplier relationships were not perceived as critical.

Group 3 – Specific phase: AT1, AT2 , AT3, M1 and M2

The actors representing this phase were involved in the production and distribution of assistive technologies, such as wheelchairs, aids to daily living for those with disabilities and hospital beds. In these sectors the emphasis was on cost reduction and the focus was on competing on price and

meeting the needs of the end customer. In all cases there was evidence of standardised products and it was clear that the rate of major innovations had slowed down, as the operations manager of an assistive technology company pointed out:

"Inertia in the marketplace…a very, very, very, highly established marketplace. You have to be truly innovative or, more than likely, it's a very slow calculated series of improvements, driven from the end-users – that we've established – but truly heavy inertia in the market place."

In these cases, the role of suppliers seemed more significant and was perceived as a means of bringing about cost reductions. One CEO expressed concern for his company, fearing that the fierce competition on price would bring about closure of SMEs. Many of the larger companies in his industry (assistive technology) were now outsourcing to cheaper oversea suppliers, which was supported by our interviews with such companies. The sales and marketing director of one assistive technology company suggested that the trend was towards continued price pressure, more manufacturing in China and a global marketplace. Consequently, UK suppliers were being squeezed out of the market:

"UK suppliers, that's a good one!! There are very, very few UK manufacturing facilities, they are disappearing." (CEO of wheelchair manufacturing company).

Regulations were seen as well established so there was less interaction with regulatory bodies (although regulatory uncertainty and the length of regulatory approval were still perceived as major constraints).

Supplier relationships, therefore, were regarded as essential during the mature or specific innovation phase, even if increasingly shifting to suppliers from low cost regions. Horizontal relationships appeared to be relatively less significant during this phase.

Conclusions and Implications

This paper has explored the question of whether customers and suppliers are always the important actors with whom to interact during the innovation process. The paper has attempted to use an innovation lifecycle approach to argue that the role of customer-supplier relationships depends on the stage of innovation. Using the lifecycle approach, we suggest that suppliers may be less important factors in the innovation process in emerging industries, than in mature sectors.

The findings from our exploratory survey suggest that the majority of respondents did not regard suppliers as important actors in the innovation process, although customers were generally seen as critical. The explanatory factor may simply be that the role of such relationships was underestimated by the respondents, and possibly a result of the nature of the respondents that represented the focal companies that took part in the survey. But we have offered a number of alternative reasons why this may also be the case. These are briefly summarised in the following.

We have argued that current models of supplier involvement in (product) innovation lack an appreciation of the context in terms of the degree of industrial maturity, and we have argued that there is a need to better understand the positioning of technology/industry on the innovation life cycle. This paper has explored the notion that for early technology areas/industry sectors supplier involvement may not be so important. Our exploratory findings suggest that suppliers may not be critical during the transitional phase but this remains an area of further research.

An emerging theme from the findings was the need to focus on the development of the wider infrastructure – the network – rather than the development of single new technologies or product applications. For example, innovation in telecare seems to be about innovating the infrastructure first (or at least in parallel) before the 'technology' part of the innovation is considered, e.g. to support telecare there needs to be a 24 hour visiting service in place to visit users who have summoned the service, and a network of non-acute i.e. non hospital services to provide support without admission to hospital. We would suggest that this may be more difficult than implementing the technology – and at least as expensive. This shifts the focus from not only the development of (tangible) product applications to the development of the product/service offering but more fundamentally towards development of new value propositions. The role of (dyadic) supplier relationships in this context is far from clear in current research. This presents an important area of future research.

The research presented here represents work in progress. The plan for future research is to investigate the themes emerging from the research so far through a set of in-depth case studies, which will enable a less focal firm-centric perspective than was evident in our initial survey. The research themes will include the need to develop what may be seen as the 'infrastructure', or network, as part of the technological innovation and possible product applications, indeed the role of suppliers and customers in the 'infrastructural support' appears to be a critical area of future research.

References

Abernathy, William J. (1978) *The productivity dilemma: Roadblock to innovation in the automobile industry*. Johns Hopkins University Press, Baltimore.

Abernathy, William J. and James M. Utterback (1978) Patterns of Industrial Innovation, *Technology Review*, Vol. 80 (June/July), pp. 41-47.

Biemans, Wim G. (1989) *Developing Innovations Within Networks*, Doctoral Thesis, Faculty of Industrial Engineering and Management Science, Eindhoven University of Technology.

Davies, Andrew and Tim Brady (1998) Organisational capabilities and learning in complex product systems: towards repeatable solutions. *Research Policy*, Vol. 29, pp. 931-953.

Dosi, Giovanni (1982) Technological paradigms and technological trajectories: a suggested interpretation of the determinants and direction of technical change. *Research Policy*, Vol. 11, No. 3, pp. 147-162, Elsevier: Amsterdam.

Eisenhardt, Kathleen M. (1989) Building theories from case research, *Academy of Management Review*, 14, 4, 532-550

Ford, David and Chris Ryan (1981) Taking technology to market, *Harvard Business Review*, March-April, pp. 117-126.

Gardner, John T. *and* Martha C. Cooper (2003) Strategic Supply Chain Mapping approaches. *Journal of Business Logistics*, Vol. 24, 2, pp. 37-65.

Hagedoorn, John (1993) Understanding the Rationale of strategic Technology Partnering: Inter-organisational Modes of Cooperation and Sectoral Differences, *Strategic Management Journal*, Vol. 14 (5), pp. 371 – 385

Håkansson, Håkan, (ed.) (1987) *Industrial Technological Development: A Network Approach*, Croom Helm, London

Håkansson, Håkan and Ann-Kristin Eriksson (1993) Getting innovations out of supplier networks. *Journal of Business-to-Business Marketing*, Vol. 1 (3), pp. 3-34.

Handfield, Robert B., Ragatz, Gary L., Kenneth J. Petersen, and Robert M. Monczka (1999) Involving suppliers in new product development. *California Management Review*, Vol. 42, No. 1, Fall, pp. 59-82.

Hartley, J. L. (1994) *Understanding supplier involvement in their customer's product development*, doctoral thesis, Department of Quantitative Analysis and operations Management, University of Cincinnati.

Hobday, Mike. (2000) Editorial "Innovation in complex products and system", *Research Policy*, 29,793-804

Johnsen, Thomas (2004) *On the Management of Collaborative Innovation*, unpublished PhD thesis, University of Bath, February.

Johnsen, Thomas and David Ford (2004) The Appropriateness of Strategies for Managing Product Innovation in Networks, *the 20th Annual Conference of the Industrial Marketing and Purchasing (IMP) Group*, Copenhagen, Denmark, 2 - 4 September.

Lundvall, Bengt-Åke (1986) Product innovation and user-producer interaction. *Industrial Development Research Series*, No. 31. Aalborg University Press.

May, Tim (1993) "Social Research: Issues, Methods and Process," Open University Press.Omta,

Pavitt, Keith (1984) Sectoral patterns of technical change: towards a taxonomy and a theory. *Research Policy*, Vol. 13, No. 6, pp. 343-374.

Powell, Jeanne and Fransisco Moris (2004) Different Timelines for Different Technologies, Journal of Technology Transfer, Vol. 29, pp. 125-152

Ritter, Thomas and Achim Walter (2003) Relationship-Specific Antecedents of Customer Involvement in New Product Development. *International Journal of Technology Management*, Vol. 26 (5/6), pp. 482-501.

Rothwell, Roy and Mark Dogson (1991) External Linkages and Innovation in Small and Medium-Sized Enterprises, *R&D Management*, Vol. 21 (2), pp. 125-137.

Tidd, Joe and Martin J Trewhella, (1997) Organizational and technological antecedents for knowledge acquisition and learning. *R&D Management*, Vol. 27, No. 4, pp. 359-375.

Tidd, Joe, John Bessant, and Keith Pavitt (2005) *Managing Innovation: Integrating Technological, Market and Organizational Change*, Wiley.

Utterback, James M. (1994) *Mastering the Dynamics of Innovation: How Companies Can Seize Opportunities in the Face of Technological Change*, Harvard Business School

von Hippel, Eric (1988) *The Sources of Innovation.* Oxford: Oxford University Press.

Wynstra, Finn (1998) *Purchasing Involvement in Product Development*. PhD Thesis, Eindhoven Centre for Innovation Studies, Eindhoven University of Technology.