

Development of a New Technology Service In a Knowledge-Based Context Through An Alliance Partnership

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Abstract

Since many firms no longer derive competitive advantage through products by themselves, they are obliged to complement their products with increasingly innovative services. Increasingly this is achieved through strategic alliances since individual firms lack high technology expertise or the means to embark on uncertain business ventures. Technology and knowledge are used as barriers to imitation, but regular enhancement for longer-term competitive advantage is essential. The research described in this paper investigates the development of a new technology service in an alliance between a principal partner in the industrial lubrication sector, and a number of high technology partners and clients. The development of the service over three years is analysed with reference to a number of propositions derived from the literature. The study identifies the importance of the negotiation context, clearly defined strategic objectives, the knowledge contributions by partners, and control mechanisms as the dynamics of the alliance change. The analysis addresses the issues involved in developing and evaluating the service, the difficulties encountered by the alliance champion in acquiring data and information, and transferring knowledge to alliance partners.

Keywords: technology, service, alliance, knowledge

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INTRODUCTION

New capabilities are increasingly achieved through technology and knowledge-based strategic alliances. While these allow faster access to new technologies located beyond individual firms' boundaries and capabilities, alliances face difficulties in the choice of partners, in their governance and from partners' different perceptions and expectations¹. Over time the changing contribution of partners may result in a modified product or service, which leads to a revised evaluation of the role of partners and the effectiveness of the alliance.

As a contribution to greater understanding of the development of a new high technology service, this research considers the evolution of technology and knowledge-based competencies in an alliance context. The experiences of one organisational alliance are described in order to examine the conditions that facilitate successful service provision. The paper investigates the changing relationships between alliance partners as they lead to technological transformation through the development of new products and services.

Although lubrication by itself may not be considered a particularly skilled activity, the alliance partners construed the service offered by the alliance as requiring high-technology expertise. Particle and chemical analysis of oil as a preventive activity requires a high level of knowledge of lubrication theory, metallurgy and theory of machines. Spares management requires an understanding of machine and component failure, maintenance management information systems, and inventory control theory.

The methodological approach adopted in this paper is one of exploring the applicability of a number of propositions taken from the literature relating to new technology products in a knowledge-based alliance context. A review of the literature is followed by a discussion of the approach to the study. A narrative of the development of the service is provided and the propositions are analysed. The broader implications for managers are discussed, and some final conclusions are drawn.

LITERATURE REVIEW

This review concentrates on the literature relating to the development of technology and knowledge-based products and capabilities in a strategic alliance context. The term strategic alliance used in the literature encompasses equity partnerships, technology alliances, R&D alliances, joint ventures, licensing agreements, distribution and supply agreements, and technical exchanges. No attempt is made to provide prescriptive lists of critical success factors for effective strategic alliances, as these do not necessarily cater for different products and services, alliance structures, and operating contexts.

Relationships built around clear and realistic objectives are central to technology and knowledge-based products. Where current capabilities, resources and time are limited, an alliance strategy for new products and services is invoked. Alliances may result from upfront negotiation where partners define the new product with a great deal of precision, or alliances emerge from the relationship as a supplier becomes an indispensable business partner. In conditions of technological and environmental uncertainty, alliance partners may prefer flexible alliances with complementary resources and a limited need for control². The establishment of partnerships is frequently through word-of-mouth and informal networking, rather than on formal search procedures³.

The focus of an alliance is to provide a link in the value-adding activities of a number of partners that establish a portfolio of core competences constituting a product or service. Competitive advantage is gained not through sharing activities, but from the transfer of knowledge and intangible assets. This involves focussing on relationships where external know-how, interchanges of technology between partners, application of physical assets, and knowledge, reopen or exploit a window of opportunity. In this instance the novelty of the situation encourages a focus on new technology as “a distinct and malleable tool”⁴.

A major challenge for alliance partners is to achieve short and long-term compatibility of strategic objectives, and to agree and embed order qualifying and order winning criteria. Exposure to new ideas and stimulation of firms’ R&D and internal innovations offer strategic

advantage. Rapid access to new technologies located beyond the boundaries of the firm leads to first mover advantage. When a new portfolio of products renders current technologies and competencies obsolete, first mover status is eroded through the transfer of what was once a new product into a commonplace commodity. A broader range of products appears, appealing to additional markets that demand flexibility and quick responses, not easily available from integrated organisations⁵. Common accord and accommodation need to be reached on more subtle and less quantifiable issues such as image, credibility, respectability for the alliance, marketing and sales, and in some cases partners additionally become competitors, customers, suppliers, and distributors⁶.

Strategic alliances emerge because of the difficulty in attaining and sustaining self-sufficiency in high technology product and service provision. In order to remain state-of-the-art and retain leading edge capabilities, alliances require continual enhancement. The literature suggests that knowledge is a mechanism for binding technology-based strategic alliances. At the same time, alliances create opportunities for providing knowledge-based products and services as pillars of competitive strategy. This circularity suggests that the acquisition of knowledge is haphazard and non-linear, but knowledge can form the basis of a superior product provided partners value knowledge, which is both accessible and transferable⁷.

Competitive advantage is attainable when knowledge, derived from documented and explicit technological expertise, is convertible into a product. This is considerably more difficult with tacit knowledge that relies on experience, skills, and understanding acquired and internalised over time. The true secrets for applying knowledge lie within tacit dimensions based on personal beliefs, experiences, and values embedded within the fabric of the alliance organisations in which the knowledge has been developed⁸. Knowledge is described and measured in a number of ways. Several authors provide prescriptive definitions that distinguish between data, information and knowledge: data are unstructured facts without meaning, information is data endowed with relevance and purpose, and knowledge embodies cognition, insight, erudition and scholarship⁹. (Some authors add wisdom as a consequence of fusing knowledge with values and experience, but this is not considered in this paper.)

Collinson¹⁰ proposes three “domains” in technology and knowledge products: technology-as-hardware (products, machinery), the knowledge-base (products, systems, suppliers, customers, environment), and routines (to develop and apply the knowledge-base of the firm). Routines are observable and transferable, and are a major focus of restructuring and change as the firm improves its performance or responds to new conditions. While it is appealing to study a routine as a relatively stable knowledge construct, the forces of routinisation can be disrupted by events that raise new issues and require re-examination of old problems. This emphasises the importance of studying dynamic processes in inter-organisational involving disparate leaderships.¹¹

The operation of an alliance is unlikely to be static, and it can be difficult to isolate the causal variable. The literature suggests that prior knowledge facilitates effective utilisation of new knowledge, and it is easier to acquire new knowledge about activities with which people are familiar. Should this result in one partner’s gaining substantial knowledge over time, the value of the knowledge contributed by the other partner may erode, breaking down the bargaining relationship. This means that the more a firm learns, the less need it has to remain in the alliance¹². This may change the structure of an alliance.

The literature refers to the benefits of alliance governance through collaborative partnerships of trust and overlapping responsibilities. Technology sharing and the formation of linkages enable knowledge to “spiral up the organisation”¹³. Whatever the governance structure, several authors propose a dedicated strategic alliance with organisational legitimacy to improve knowledge-based products. This increases external visibility, provides internal coordination, and eliminates accountability and intervention problems. A looser perspective is a ‘hub’ organisation, which takes a leading or brokering role and views the alliance as a coordinating mechanism for a long-term strategic partnership. In either event, the literature suggests that “after one year, partnership norms are established as an intertwined set of interpersonal relationships among various levels of managers”.¹⁴

Governance issues should be addressed early in the evolution of an alliance, despite the difficulties in planning all details of a product or service. Weick¹⁵ claims that “the point at which technology is introduced is the point at which it is most susceptible to influence. Beginnings are of special importance because they constrain what is learned about the technology and how fast it is learned”. At the same time the introduction of a new technology may trigger “an initial burst of adaptive activity as users explore the new technology and resolve unexpected problems ... Users often refocus their attention on unresolved problems or new challenges, creating additional spurts of adaptive activity”¹⁶. It may be expected that patterns of adoption become “lumpy” as new technology applications are built into standard operating procedures.

Less tangible aspects of strategic alliances include rapport and communication, and the inextricable link between trust and control being “exercised subtly and almost implicitly”¹⁷. Informal governance is enhanced through the emergence or appointment of a champion, who may influence the bargaining power bases that shape the pattern of management control. Context-based power considers the strategic importance of the product or service to each partner, so partners with several alternatives are more powerful as they can threaten to leave. Resource-based power derives from control or possession of critical resources and capabilities. Another possibility occurs where strategic alliances create value through collaborative processes, effectively distributing the power bases of each partner. Yan and Gray suggest that partners with high levels of control claim better products and greater levels of performance. This agrees with Beamish who believes imbalance of control corresponds to imbalance in performance: one partner does well, one does not, and equal management control may be associated with balanced and relatively high performance of both partners¹⁸. Common goals are an informal control mechanism, and mutual trust may be an important contingent or moderating factor in control-performance considerations¹⁹.

The effectiveness of a product should be seen from all partners’ perspectives. Success may be assessed by the extent to which partners achieve strategic objectives, and the general level of stakeholder satisfaction with an alliance’s products. Common objectives typically include

profit, market share, growth and credibility with clients. In niche alliances, more qualitative measures embrace the extent of acquiring or supplying technology, import substitution, and the degree of learning. Value is created through the synergy resulting from joint actions, which partners would not have been able to achieve individually. Even with stable alliances, measures of performance are more dynamic than in single, stand-alone organisations, and are likely to change as an alliance matures. Timing may also be important in evaluating products as partners may observe benefits at different stages of product development²⁰.

A different form of assessing the success of a product of service is the ability to which alliance partners succeed in overcoming resistance to new technology, and ensuring receptivity of a new service. Rigid managerial beliefs associated with a reluctance to cast off or unlearn past practices can severely limit the effectiveness of a new product. Issues relating to receptivity need to be managed. These include cultural attitudes towards learning, unlearning ability, gaps in knowledge that have to be bridged, internal mechanisms for integrating individual knowledge into organisational knowledge, and the capability to diffuse new knowledge within an organisation²¹.

APPROACH TO THE STUDY

The purpose of the research is to understand how and why events unfolded in an alliance, and to identify issues that affected new technology services. Using a research approach where “the primary questions concern how some causal process works out in a particular case” (Sayer²²), a narrative provides an episodic dimension of an account of the development of the service and the alliance. Analysis of the data addresses causal explanations of why events occur. The research uses qualitative methods, causal analysis, observation and informal interviews. Data is of a qualitative nature, consisting of words rather than numbers. The intention is to show the merging characteristics of the service, rather than to draw conclusions about the generalisability of findings. In this context Miles and Huberman²³ consider data analysis to consist of a number of concurrent flows of activities: data reduction, data display and conclusion drawing, where data reduction refers to “the process of selecting, focusing,

simplifying, abstracting, and transferring ‘raw’ data ... the researcher’s choices of which data chunks to code, which to pull out, what the evolving story is, are all analytical choices”.

From the literature review five themes are identified that relate to the development of new technology products and services in a knowledge-based alliance context. The themes are set out as propositions and are explored later as the basis of the analysis of the case alliance:

- 1 The negotiation context and a clear relationship focus are important issues in new product and service development in an alliance context
- 2 Strategic objectives and partner intentions should be articulated
- 3 Expertise contributed by partners determines the characteristics of knowledge-based products and services
- 4 Control mechanisms and distinct inter-organisational boundaries provide essential governance structures for the introduction of new products and services
- 5 Measures of success of new technology products and services are equivocal.

A shortcoming of academic studies of alliances and new product developments is that they are examined at a single point in time, and usually in the formative stages without following the alliance through its life or even a business cycle, as strategic and environmental conditions change²⁴. In order to overcome this drawback, the development of the service was studied over 3 years. A schedule of significant events over this period is given in Table 1. It will be seen from the case description in the next section that the study ends at a convenient point in the development of the service.

Unstructured interviews were held with managers, engineers and foremen in the alliance. The five propositions had not been finalised at the beginning of the study, so discussions in the interviews covered the latest new service and alliance developments, as well as a wider range of topics found in the literature. Once the ‘product’ offered by the alliance had been identified as a knowledge-based service, interviews concentrated on this aspect, and how organisational

learning was progressing, as other activities were relatively stable. The following section describes the alliance case, and summarises the findings from the interviews.

CASE DESCRIPTION

The principal alliance partner is a lubricating oil supplier, operating in a sector noted for rapid competitor imitation of any new initiative²⁵. Firms in this sector have long realised that a low cost strategy for the sale of lubricants is insufficiently profitable. Value to the product has been added by offering surveys of lubrication requirements for all plant and equipment in an installation. These have proved relatively effective as the 'recommended' lubricant is invariably only sold by the supplier undertaking the survey. An enhanced feature is the management of oil stocks on behalf of a customer. The supplier is linked to the client's information systems via an extranet facility, monitors lubrication stock levels, and guarantees availability of all lubricants. A total lubrication service is also offered by adding the actual lubrication of machines to the other services. Outsourcing of the entire lubrication function carries contractually binding guarantees of oil usage and penalties for breakdowns attributable to lubrication-related defects. Over time the clients moved from somewhat adversarial bargaining to close long term relationships organised as partnerships or alliances with an element of risk and reward sharing²⁶.

The principal partner will be referred to as OilUK, the lubrication division of a UK multinational company. Table 1 summarises the main events in the 3-year period studied. Figure 1 illustrates the developmental stages of the strategic alliances described in this section. At Stage 1 OilUK was offering a fully outsourced service to clients in the UK, or through a subsidiary or distributor in other countries. OilUK then sought to dominate this highly competitive sector through a range of innovative services. Clients were to be offered an oil analysis condition monitoring service that would both assist the client in predicting failures, and also reduce the risk to OilUK of having to pay penalties for lubrication-related breakdowns. A number of pilot studies were to be conducted through OilUK's South African subsidiary (OilSA) before launching a global service. A UK conditioning monitoring company, Connon, was enlisted to analyse and interpret oil analysis and machine performance data.

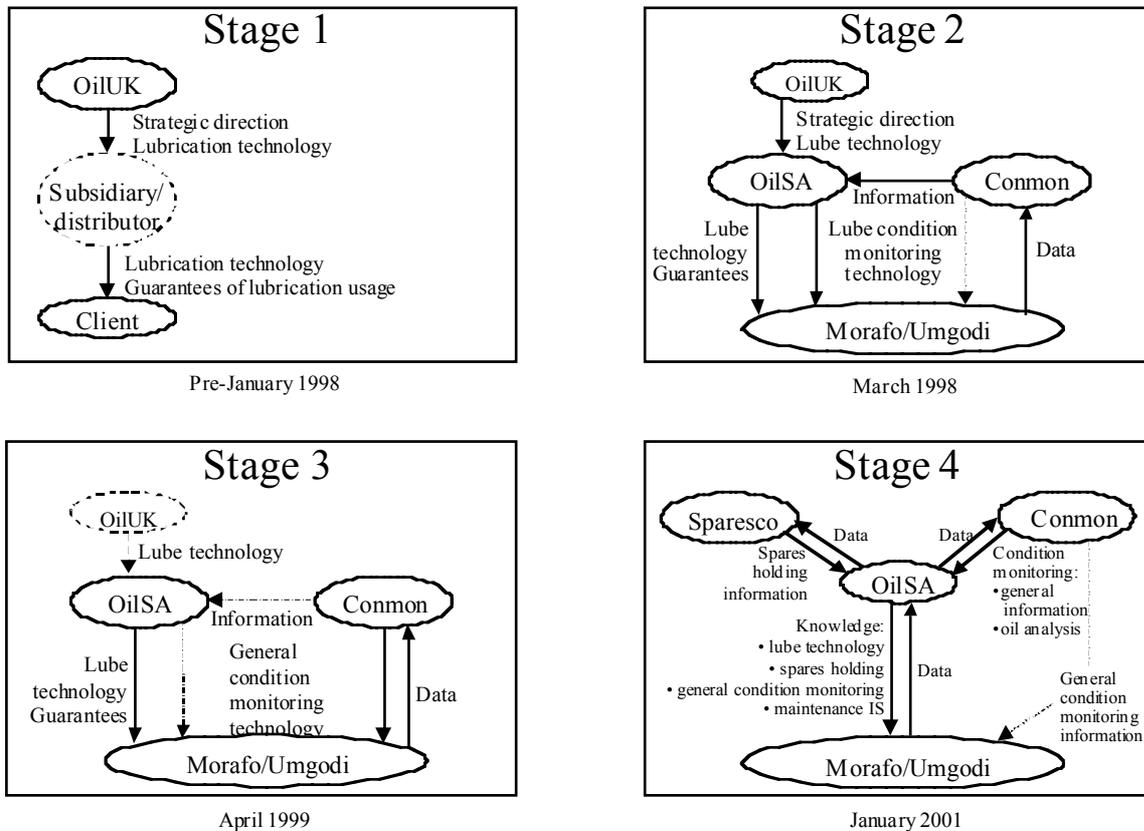


Figure 1 Stages of service development

A loose alliance was formed between the OilUK, OilSA, and Common early in 1998. Two OilSA project managers coordinated day-to-day activities of the pilot studies. Two clients (opencast coal mines) agreed to make use of the condition monitoring service, and effectively became partners in the alliance (Stage 2). The companies will be referred to as Morafo and Umgodi (Sotho and Zulu words for ‘mine’). In conjunction with mine technical staff, the project managers selected a number of critical items of equipment at each mine, including 250-ton ‘dump’ trucks, conveyors, crushers and compressors. Maintenance and operations staff at both mines were trained in the techniques of condition monitoring and condition-based maintenance, and two maintenance engineers from each mine visited Common in the UK to be briefed on the condition monitoring process. At Morafo this complemented an existing reliability-centred maintenance (RCM) programme, which is designed to determine the maintenance requirements of physical assets. The RCM methodology requires teams of operations and maintenance staff to analyse equipment in order to determine maintenance

tasks and recommend the frequency at which these should be performed. The RCM process specifically recommends condition monitoring tasks if applicability and effectiveness criteria are met. Umgodi planned to modify existing maintenance practices incrementally on the basis of the condition monitoring findings.

Oil samples from machines and equipment were subjected to a variety of particle (ferrography, X-ray fluorescence) and chemical (spectrometric chromatography) monitoring processes. Initially, historical data was relayed via the internet to Conmon in the UK. Analyses of the oil sample data and recommendations were returned to OilSA who then took appropriate lubrication action in accordance with their lubrication contracts. Any other appropriate information was passed on to the mines, which adjusted their maintenance programmes if necessary. At both mines remarkable results were achieved within weeks. Lubrication is an expensive and intrusive process, which sometimes requires plant stoppages, so recommendations for increasing lubrication intervals and reducing quantities of lubricant were welcomed. Further, two catastrophic equipment failures were prevented at Morafo in June 1998.

Towards the end of 1998 engineers at Morafo recognised the potential for expanding the conditioning monitoring facilities, and installed equipment to measure bearing vibration and compressor performance. This data was sent to Conmon for analysis, and again some potentially expensive failures were prevented. Umgodi utilised this facility to a lesser extent. Within a few months relationships within the alliance were changing: most communication took place directly between the mines and Conmon, with OilSA being largely sidelined (at this stage OilUK had effectively been excluded from operational activities). Conmon provided a wide variety of analyses, and the mines took appropriate action, without referral to OilSA (Stage 3).

In June 1999 real time data (coming directly from sensors reporting on the measured level of variables) relayed to Conmon was processed and returned as information. OilSA recognised the potential of taking the process further by creating higher stages of knowledge. OilSA's

intention was to re-establish control of the alliance by becoming the intermediary for all data and information transfer, and then by providing the mines with maintenance knowledge. In order to do this, OilSA effectively assumed control of the maintenance management information systems of the both mines in early 2000.

OilSA introduced a further service in August 2000, in conjunction with a second UK company, Sparesco, which offered advice on maintenance spares holding policies. With previous history now held by OilSA, and wear and deterioration rates provided through Connon, Sparesco was able to recommend stockholding policies that greatly reduced investment in maintenance spares. The situation is depicted in Stage 4 where OilSA had largely taken control of most data and information transfer between alliance partners. With non-lubrication matters the mines continued some direct communication with the UK advisory companies.

Date	Activity	Interviews
Jan 1998	OilUK decision to proceed with pilot project	
Feb 1998	OilUK discussions with Connon	OilUK
Mar 1998	OilSA discussions with potential South African clients Agreement from Morafo First oil samples taken, data sent to Connon, feedback received	OilSA
April 1998	Agreement from Umgodi Oil samples sent to Connon, feedback received	OilSA, Connon, Morafo
May 1998	Condition based maintenance training at mines Morafo and Umgodi engineers attend training in UK	OilSA, Umgodi
June 1998	Deterioration found in Morafo crusher gearbox oil, unit taken out of service, incorrect additives found in oil. Expensive gearbox failure averted	Connon, Morafo
July 1998	Lubrication intervals increased at Umgodi	Umgodi
Oct 1998	Compressor bearing failure at Morafo leads to request to Connon for vibration analysis	OilSA, Morafo
Jan 1999	Vibration analysis at Morafo commences Lubrication intervals extended at Morafo	Connon, Morafo
April 1999	Real time data sent from Morafo to Connon OilSA complains of direct communication between mines and Connon	OilSA
June 1999	OilUK discussions with Sparesco	OilUK, OilSA
Aug 1999	Agreement with Sparesco	Sparesco, Morafo, Umgodi
Nov 1999	Detailed inventory reviews at Morafo and Umgodi	OilSA, Morafo
Dec 1999	Redesign of Morafo conveyor idlers resulting from condition monitoring analyses	
Jan 2000	OilSA assumes control of maintenance information system at Umgodi. Review of schedules	OilSA
Feb 2000	Reduction in spares holdings recommended at Morafo. OilSA controls maintenance information at Morafo	Morafo, Umgodi
June 2000	OilSA workshop with partners to discuss knowledge-based nature of alliance	OilSA, Connon
Aug 2000	Reduction in maintenance spares recommended at Morafo	Morafo
Oct 2000	OilSA agreement with Morafo for maintenance services	Umgodi
Jan 2001	Maintenance planning by OilSA at Umgodi	

Table 1: Alliance activities and researcher interviews

EXPLORING THE PROPOSITIONS

In the literature review not all possible themes in product development and strategic alliances were covered so, using the ideas of Miles and Huberman concerning data reduction, the items selected are those that shed light on the development of the service described in the narrative. The analysis examines each of the five propositions listed above.

1 Negotiation context and relationship focus

OilUK wished to broaden its business by introducing a novel application of specialised condition monitoring. Initially this was seen, in Schumpeterian terms, as establishing a monopoly position through an extension of current services. Although unplanned, the real innovation went beyond the use of existing technologies to the evolution of a knowledge-based service. This agrees with the literature that a service may emerge through a relationship of what became indispensable partners.

The pilot project was to establish whether OilUK should ultimately develop the planned services internally or through alliance collaboration. OilUK's South African subsidiary had been used before in product testing, as the South African market for mining-related products is highly competitive and technologically sophisticated. OilUK further recognised that there may not be a critical mass ready to absorb the technology in South Africa, but this would be a valuable learning experience. This illustrates the use of the service as a 'malleable' tool.

Despite the early stage of development of the service, a number of South African clients were prepared to take part in the venture, and in fact wanted OilSA to agree to demanding, early commitments for its new service. OilUK was reluctant to commit the company to a project with financial penalties for simultaneously complex and novel technologies. The alliance partners comprised two existing clients (whose operations were well known to OilSA), and Common and Sparesco (who had been associated with OilUK on several previous occasions). This exemplifies the use of networks and informal contacts in alliances.

OilUK acknowledged that it had had inadequate initial focus. The imprecision of the service to be offered resulted in a weak negotiation context and the fluctuating control of the alliance. It was only when the precise nature of the service had been defined that partners became more focussed and the emphasis moved from a sharing of activities (OilSA, Connon and Sparesco providing assistance to the mines) to management of the flow of knowledge. OilSA recognised the window of opportunity whereby the provision of knowledge effectively permitted it to take control of the management of the mines' maintenance systems.

2 Strategic objectives and intentions of partners

OilUK's strategy was global dominance through innovation "primarily from interactions with clients, and interactions between team members around the world"²⁷: an expert lubrication service based on condition monitoring analyses. As the service developed, OilUK's early strategic thinking was overtaken by a stream of innovative operational events: the initial oil analysis was followed by client requests for wider and more extensive condition monitoring, OilSA introduced the idea of managing maintenance spares, and so on. Strategic objectives required managers to distinguish between core and complementary activities. The main product (core competency) of the principal partner (OilUK) was lubrication; other partners provided the complementary or peripheral services that were essential for overall commercialisation, extending beyond the boundaries of the principal firm. The compatibility of short and long term objectives referred to in the literature was not specifically addressed in determining the service.

OilUK's strategic approach was to use technical research networks to monopolise the market with its service, so OilSA was constantly looking out for signs that the durability of first mover status was being eroded, as had happened in the past. The challenge for managers was to delay or end the cycle of leap-frogging by eliminating the prospect of imitation through continuous expansion of the product portfolio. As suggested in the literature, flexibility and fast responses were an important element in the development of the service, despite this not having been planned at the outset. Some of the less quantifiable aspects of the service relating

to image, marketing and partners' changing roles (as customers, suppliers, distributors) did not play a significant role. The credibility of the service was not questioned because of the reputation of alliance partners and their close contact with the mines.

The principal partner aimed to achieve its objectives through a technology-based service and client support. The strategies of the alliance partners were somewhat different. They had a vested interest in the first-mover advantage established through the alliance, and benefited from the additional business generated by the alliance. However, the need for total commitment and the importance of the alliance to their overall business strategy were tempered somewhat by their not being exclusively tied to the lubrication business. They also offered other applications for their services to a different set of clients. Discussions with Connon and Sparesco suggested that they were not too concerned with the first-mover element of strategy: their services were novel and in the growth stage of what they perceived to be a relatively long product life cycle. OilUK's lubrication service was mature, so it was vital that the service offered by the alliance as the solution to a declining service, should have first-mover advantage.

3 Partner expertise and knowledge-based services

The original intention was for the service to be provided as a system of interdependent technologies that would be 'fine-tuned' to meet client service requirements. OilSA set up the communication systems and coordinated the R&D. While Connon possessed the condition monitoring expertise, OilSA established procedures for taking oil samples, for acquiring the equipment required for analysing these at the mines, and specified the systems for forwarding the results electronically to Connon. For the first few months OilSA also coordinated the dissemination of results. Results were then increasingly accepted from Connon because a rapport had been established between Morafo and Connon as a result of some early successes. Contacts between Connon and Umgodi were not as intimate, but the credibility of OilSA assisted in enhancing the trust between alliance members. Difficulties arising within the alliance were recognised, but partners felt they provided a good service. This supports

Inkpen's view that attitudes change once a pattern of interaction develops and deeper ties between partners become the norm.

The lack of personal contact between partners in the UK and South Africa meant that knowledge was codified electronically, rendering it independent of a particular person ('depersonalisation'), and storing and re-using knowledge in a person-to-document manner. However a system of 'personalisation' emerged when Conmon discussed analyses directly with mine staff. OilUK, rather than OilSA, had set up the relationship with Conmon, so communication between Conmon and OilSA was initially limited, whereas OilSA had daily contact with the mines. This meant that OilSA only became part of the data-information management 'personalisation' loop when it started to regain responsibility for gathering data and disseminating information from April 1999. OilSA was not satisfied with the proactive maintenance intervention taken as a result of the information passed on to the clients.

By mid-2000, OilSA had recognised that knowledge was emerging as a core competence in the service provided. The OilSA project manager at Morafo then assumed an unofficial role of champion or 'knowledge manager', as he appreciated that the explicit knowledge at his disposal had to engender meaning and action if full benefits were to be derived from it. His task was to make use of codified knowledge (failure records, deterioration rates, performance trends, and so on) and make this explicit. This required an understanding of processes so that problems can be headed off through 'feed-forward' control (this is the basis of predictive maintenance). Transferring explicit knowledge to individuals (at the mines) would enable them to internalise it, and create new (tacit) knowledge. The result, as suggested by Inkpen, was knowledge internalised as part of an organisation's knowledge base. The service provided by the alliance relied on social knowledge about interpersonal relationships. This enabled OilSA to cope with cultural issues and commonly accepted, but fundamentally incorrect routines and practices that were carried over from past experiences and practices.

Providing a full condition monitoring and maintenance spares service created dependencies that resulted in quiet jostling between OilSA and Conmon to establish the 'owner' of the

knowledge, and thereby to assess the partners' relative power bases. OilSA wished to manage the knowledge to ensure control of the entire project, yet Conmon generated the information on which the explicit knowledge was derived. These developments did not corroborate Inkpen's contention that a firm using an alliance as a substitute for knowledge it does not create on its own is prepared to remain dependent on a partner and thus, place a relatively low value on knowledge acquisition. OilSA was dependent on Conmon and Sparesco for information that generated knowledge as a pillar of core competence. In terms of Collinson's domains of technology and knowledge products, the service progressed from supplying a product (lubricants in the correct quantities), through the knowledge-base (predictive maintenance), to routines (setting maintenance policies on the basis of knowledge).

4 Governance structures and inter-organisational boundaries

There was never a question of equity exchanges between alliance members, as Conmon and Sparesco had agreed charging-out procedures for supplying their service. While there was a genuine desire among partners to cooperate, OilUK felt the alliance was unstable because individual partners firmly retained their independence, and could break away at any stage. This was despite the assurances by Conmon and Sparesco that they were unlikely to terminate their relationship with a service that was becoming increasingly lucrative to them. The service was managed by a 'hub' organisation with OilSA at the centre. Experiences within the alliance support the view of Wieck that the greatest susceptibility occurs at the point at which technology is introduced. Condition monitoring was the first new technology, and at the point of its introduction, OilSA felt control drifting towards Conmon, and that closer Conmon-mine contacts would ultimately exclude it from being part of the service.

When spares management was added to the service, OilSA set up new data communication channels so that it could regain control (following the general pattern suggested Yan and Grey), but in fact OilSA only really asserted its authority when it identified the potential for processing the information from Conmon and Sparesco and transforming it into a knowledge-based service. This did not continue to a stage of imbalance hypothesised by Beamish where one partner profits from providing the service at the expense of another.

Control and communications difficulties were experienced because management processes within the service were never formally stated and some partners undervalued alliance knowledge (as suggested by Inkpen). The problem was not one of organisational legitimacy, but clients expressed some frustration with the inconsistency of data and information transfer ‘connections’ and technology linkages (communication was first with OilSA, then with Connon, and reverted back to OilSA, even for non-lubrication matters). Because there were no binding performance agreements (apart from lubrication contracts between OilSA and the mines, boundaries had been permeable, resulting in inadequate demarcations of limits of responsibility. Information processing and control difficulties between partners could not be ascribed to diverse boundaries and cultural distances (for example, Connon, a UK company, doing business in South Africa). The transformation of the service from information generation by Connon and Sparesco to a knowledge-based service provided by OilSA had not been discussed among alliance partners.

Progress to a knowledge-based service evolved imperceptibly at first, as OilSA managed data and information transfer, and took control of the mine maintenance management information systems. OilSA’s aim was to determine maintenance policies on a knowledge-basis, rather than relying on suspect failure history data and anecdotal experience. Certain individuals at the mines were uneasy and even resentful as they perceived the OilSA project managers effectively to be their maintenance managers. There was also a feeling that OilSA’s activities went beyond the scope of the service as originally configured into new areas of competence. OilSA project managers involved as many mine staff as possible and played a subtle game of using the knowledge at their disposal in justifying their recommendations. Top mine management, not being close to the development of the service, were eminently satisfied with significantly reduced maintenance costs and improved reliability.

Events in the case alliance supported views in the literature that interpersonal relationships may be established within a relatively short time. Morafo managers felt that a good service was being delivered. Umgodi managers were less enthusiastic and had not formed the same

deep relationship with alliance partners. By the end of 2000, the service offered by OilSA was coordination of all lubrication and condition monitoring-related maintenance at both mines, as well as managing the maintenance information systems. The case illustrates the change of structure and positioning within the alliance, and demonstrates how reporting processes varied during the development of the service.

5 Achievement of strategic objectives

OilSA managers felt that the company had enjoyed symbolic leadership for the service for a while in 1998, only regaining control once it changed to a knowledge-based service. By 2001 the service had been extended beyond what was originally intended. Alliance partners acknowledged that strategic objectives and control had been casually formulated and that each was pursuing its own agenda, which fortuitously had resulted in an excellent service. OilUK was ambivalent about the success of the new venture, as its extension beyond the envisaged target was perceived as a by-product of the original condition monitoring. Further, the alliance had been sidetracked into a less tangible service. Even though the new service was deemed beneficial by the mines, the original proponents at OilUK felt that rigid intentions had not been met. OilSA claimed that success could be demonstrated by the expansion of their service to include condition monitoring, spares management three years after inception of the service. Further agreements had been signed with three additional clients, as proof of its success.

Oil condition monitoring is a well-known technique, but the real value in the service lay in the variety of analyses that Common could undertake, and its profound ability to interpret deterioration trends. Provided lubrication is correctly done, it adds stability to an operation, and the mines welcomed this. As the service produced results, engineers became aware of further condition monitoring techniques that could assist them in other applications, and they became impatient for the next development. The RCM initiative at Morafo created the mechanism for inclusion of outputs from the service in standard operating procedures (agreeing with Tyre and Olikowski). An engineer at Umgodi said staff at his mine showed less enthusiasm for new condition monitoring applications because of the additional work involved in setting up and conducting condition monitoring. At Umgodi, some equipment was

subject to condition monitoring, and certain stocks of spares were adjusted in accordance with Sparesco's recommendations, but the lack of a framework (such as RCM at Morafo) for accommodating new practices produced haphazard and rather inconsistent implementation.

As mentioned earlier Tyre and Olikowski suggest that circumstances may trigger adoption of new interventions. An example of an "unusual event" was a large compressor bearing whose failure was prevented by oil analysis. This illustrated the benefits of condition monitoring, although subsequent investigations revealed that vibration analysis would have been useful in determining the failure process more accurately. This encouraged Morafo to approach Connon to extend the oil condition monitoring to vibration monitoring techniques. At this early stage Morafo engineers expressed their gratification with the service.

Maintenance supervisors and craftsmen at the mines had an intuitive feel that many maintenance tasks were inappropriate, but they were not in a position to change current practices. When feedback from Connon and further input from OilSA supported their views, they readily accepted new, less intuitive, information from these sources. Maintenance staff could understand and relate to the engineering logic behind the conditioning monitoring recommendations, but were less easily convinced of the need to reduce spares stocks, because their intuition did not match Sparesco's recommendations. Maintenance foremen were not exposed to, and would not have understood, the mathematical and financial rationale behind the Sparesco suggestions. This supports Inkpen's contention that the greater the difference between partner firms (an intellectual difference in Sparesco's case), the more difficult it is to create a learning partnership. As the mines benefited from the service, they more readily accepted how much could be learnt. Managers at the mines felt that the publication of the financial benefits from the reduction in spares stocks improved the credibility of the new maintenance spares policy.

The South African mining environment is notoriously conservative, with management and engineering policies firmly embedded in past practices, traditions and safety legislation. Managers warned that changing such policies was fraught with difficulties. An interesting

difference was evident in the behaviour of the two mines in that Morafo attempted to cast off and unlearn past practices, particularly as a result of the learning that accompanied the RCM implementation. Umgodi retained its traditional procedures, with improvements only deriving from isolated recommendations by OilSA, Connon and Sparesco. The differences in perceptions at the two mines illustrate how management supporting structures can influence the outcome of a new intervention.

Both mines attributed the benefits derived from the service to the manner in which the social context of their organisations had been penetrated. Frequent contact between OilSA and mine staff, and the initial visits by mine engineers to Connon facilitated communication and reduced suspicions between South African mine staff and UK technology specialists. Managers at the mines felt that early successes at the mines established an environment of credibility, trust, and recognition of the expertise of the UK alliance partners.

OilSA claimed that staff at the mines had learnt a great deal, and this indicated the success of the service. This was dependent on the mines' receptivity and ability to absorb skills and knowledge. Differences in receptivity explain why Morafo derived greater benefit from the alliance than Umgodi. One respected engineer at Morafo was British, so his acceptance of British expertise (from Connon) was instrumental in early implementation of Connon's recommendations. The RCM programme at Morafo encouraged, or even forced, 'unlearning' of old practices, bridging gaps in understanding functionality and the nature of equipment failure. Morafo management provided a training mechanism for integrating individual knowledge (by those initially involved with Connon) into organisational knowledge (when condition monitoring was rolled out across more plant and equipment, involving most maintenance personnel). Umgodi had less of this, and implemented recommendations reactively. The difficulty in deciding whether or not the service was successful lies in the lack of definition by the alliance partners of what the original alliance was really trying to achieve.

In summary, the research supports the first proposition that a formalised negotiation context could have stabilised the alliance earlier. The loose relationship focus led to changes in the

control of the alliance, and that this was only settled once the service had been defined. The strategic objectives of the partners were defined, although their intentions to offer a high tech service were clear. The service offered by Connon and Sparesco could be construed as a ‘subset’ of the knowledge-based service finally developed by OilSA. Alliance partners did not feel that differing objectives had seriously affected the service, although a common strategy would have facilitated the development of the service. The second proposition is thus corroborated as expedient, but not a necessary condition for a successful service.

The competencies of Connon and Sparesco, and the abilities of OilSA to convert these to a knowledge-based system for maintenance planning confirm the third proposition relating to the expertise of partners. Governance of the service was loose from the outset, confirming views in the literature that organisational boundaries are malleable, but not to the extent of benefiting one partner to the detriment of another. This suggests that the importance of clear structures set out in the fourth proposition is not fully borne out. The fifth proposition concerning measures of success of a service is supported by the many interpretations of success by alliance partners. These and broader issues are discussed in the next section.

BROADER IMPLICATIONS FOR MANAGERS FROM THE CASE STUDY

While the previous section analyses the propositions with reference to the case, it is useful to consider broader implications for managers. The propositions again form the basis of this discussion.

From a relationship focus perspective, the mines recognised that OilSA’s contribution as the champion of the service was invaluable in establishing linkages between alliance partners. Mine staff felt that without OilSA’s dynamism, it is unlikely that the service would have survived. OilSA provided the focus and management structures for further development, and while not directly contributing financially to partners, OilSA carried the R&D and overhead

costs for the new service. Internally, the knowledge-based service revived the alliance, entrenched OilSA's control, and provided a platform for further development. Externally, OilSA had created a barrier to immediate imitation in that competitors did not have the infrastructure, expertise or alliance partners to provide a comparable service (according to a Morafo manager who had spoken to a number of OilSA's competitors).

This suggests that a champion is essential for developing new high tech services. Technical expertise is a necessary condition, but without a coordinating focal point in an alliance, the direction taken for a new service is more likely to be subject to the negotiating power of partners. The danger is the creation of an internal power struggle, without adequate attention being paid to the strategic focus necessary for market growth. The study shows that power bases and structures in an alliance are likely to change, and that these changes may well result in a different focus or service.

Initially no one, including OilSA, was sure what the service entailed, so it was difficult to focus on a particular strategy to draw the alliance partners together. OilUK's strategy, as far as it was stated, was less ambitious than that which emerged, and had OilUK been the champion rather than OilSA, it is likely that a condition monitoring service would have been the sole outcome of the alliance. The challenge is therefore to define the strategy of the alliance, even if the precise nature of the service is unknown. This is a significant finding as it indicates that it may be unrealistic to assume that all partners can agree a common strategy at the launch of a new service. Yet, a specific direction is essential if the momentum is to be retained for dominating the market through a distinctive competency.

The sequence of events followed patterns predicted in the literature. As an innovative application of condition monitoring technology the initial strategy opened "windows of opportunity", and progressed as "bursts of adaptive activity". Loose controls for the first year were attributable to unclear objectives. The turning point was recognition of the value of knowledge, and the concept was 'sold' to other partners as a knowledge-based service. The suppliers of the technology (Common and Sparesco) believed that technological advantage

resulted from the innovative ideas within the alliance, but a more sober assessment is that the ‘knowledge-base’ was initially little more than OilSA controlling data and information.

This assessment suggests that knowledge creation is not easy, and even vast amounts of data and information do not necessarily yield high stages of knowledge. A degree of explicit knowledge may be transferred through training and documentation processes. Retaining tacit knowledge may preserve the dependency of some partners on another, but in the spirit of an open alliance, greater use of hard data and codified procedures (explicit knowledge) to develop analytical skills should be encouraged (as suggested by Inkpen). However, the true ‘secrets’ of knowledge-based capabilities remain embedded as tacit knowledge.

The mines accepted that OilSA’s management of their maintenance information systems provided far better maintenance planning than when these systems were operated by the mines themselves. Engineers accepted that at first, little knowledge was ‘created’. At Morafo they recognised that revised maintenance policies were based on intelligent application of the principles espoused by the RCM process as well as the use of the maintenance management information system coordinated by OilSA. The implication is that a management system is required on which to ‘hang’ the outcomes of a knowledge-based service. This places the knowledge in a context, since it cannot be applied in a vacuum. Without providing the mechanism with which to structure knowledge (in the case of Morafo, this was the RCM system), the result is likely to be an unstructured application (as was found at Umgodi).

Two further issues are important: the transferability of the service to other clients, and the durability and sustainability of the alliance itself. Morafo and Umgodi had been part of the evolution of the alliance. Some mine staff were convinced of the value of the alliance because they had derived benefits from it. The challenge for the champion of the service is to convince new customers of the merits of a service where they have not been associated with the development of the service. Subsequent customers will not be alliance partners, but clients buying a service which is very much a ‘black box’ which processes data and produces information, and ultimately knowledge. The process may persuade the new client, but the

research suggests that transferring knowledge and acquiring a knowledge-based service require some structure in which the knowledge can be contextualised.

Transferability and durability may be construed as measures of success. The difficulty lies in assessing what is being sustained. A rigid definition of the initially intended service would mean that that the service described in this research was a failure. Yet, the clients and providers of the service claimed it was successful. The actual service provided was an extension rather than a by-product of the original service. Whether or not to continue with a service requires consensus on what is understood by successful performance. The departure of existing clients does not necessarily indicate failure. Once the knowledge base of a service is mastered, it is possible for a client to continue outside the alliance that created the service.

CONCLUSION

Generalisability from one case is limited, but this study contributes to the management of strategic alliances providing a knowledge-based service in a number of ways. In order to overcome the criticism that much academic research addresses only the start-up of strategic alliances, the study analyses the development of the alliance over a period of 3 years. References to the literature place the findings in a research context. Important features are the focus and the role of the champion, in nurturing relationships between partners. The study strongly supports this, suggesting that a high technology service is totally dependent on individuals.

Technology and knowledge-based services through alliances are widely espoused in the literature (Inkpen), but this study claims that the technology and knowledge do not stand-alone. Indeed, when a definition of the service of this alliance is sought, the answer is not condition monitoring technology or spares management, but the provision of a number of technology and knowledge-based services. Illustrations are given of what constitutes knowledge and its transfer, as it is too easy to accept claims of knowledge-based alliances, when the reality is no more than an intelligent use of information. This is underplayed in the literature, and more research is required into this aspect of new technology services. The

study stresses the difficulties resulting from poor formulation of each partner's strategic objectives and control mechanisms.

This research analyses a new technology service in a knowledge-based context. The service is an application of technology development and sharing where the original intention was to create a relatively loose alliance where islands of technology would remain within the domain of each partner. Under these circumstances an early difficulty for the principal partner was an alliance that was losing its cohesion.

A problem for OilSA was the Schumpeterian notion of 'creative destruction' whereby the initial idea of oil condition monitoring and analysis was almost usurped by Conmon as the 'product' expanded into conditioning monitoring on a much wider basis. The challenge for OilSA was to "leverage complementary assets via interfirm cooperation ... to adapt to radical technological change"²⁸. OilUK was hesitant in recognising that the service had been successful (and therefore whether the pilot project was to be rolled out globally), as it did not accept that the service was or should be about managing knowledge. After all, this was not the original strategy. There is now a possible conflict situation between the initiator of the alliance (OilUK), its champion (OilSA), and other partners. As the alliance matures, managers at the two mines are left wondering whether they still remain partners ('guinea pigs' for testing and applying new technologies), or relegated to mere clients. OilUK may assume the role of a hub organisation, with a series of strategic alliances extending to various countries, just one of which will be South Africa. Conmon and Sparesco will remain part of the OilSA alliance, but may have to form additional alliances with other regional champions. From OilUK's perspective, this is what the defence, expansion and development of new capabilities mean.

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