VERTICAL LINKAGES AS A SOURCE OF CORE COMPETENCES

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Abstract

This paper identifies vertical linkages as a source of core competences. It builds upon literature in the areas of transaction cost economics, strategic management and R&D management. A conceptual framework is developed to assess the impact of vertical buyer-supplier relationships on the core competences of the suppliers. The focus is on suppliers operating in a cost- and technology driven environment.

In a first stage, transaction cost economics is used as a tool to determine the structure of optimal contracts, given specific critical attributes of the transactions under consideration.

In a second stage, the conclusions of the design of optimal contracts are linked to the literature of strategic management. More specifically, two elements are analyzed. First, the impact of the specific vertical buyer-supplier relationships on the different segments or functions of the supplying firm's value chain. Second, the impact of these specific vertical linkages on the network of companies the supplying firm is associated with. In both cases, the question is answered whether such vertical linkages can lead to the creation of new core competences in the affected firms.

Finally, in the third stage, the question is answered whether technologically oriented, R&D intensive customers can contribute to the development of core competences of supplying firms, thus improving their potential to obtain a sustainable competitive advantage.

1. Introduction

How can vertical buyer-supplier linkages be used to enhance supplier core competences in an optimal way? This question is not only of importance to firms who are not in a free position to vertically integrate those external functions considered as vital to sustaining and enhancing the firm-specific core competences. In addition, the buyer may also be in a position where he cannot freely decide the trading interface with his suppliers but is nevertheless critically dependent on the complementary assets provided by external firms. A public organization, for instance, can seldom freely internalize functions its suppliers could be able to provide. On the contrary, public purchasing procedures in most cases aim at pushing purchases to the industry, even if the technologies were not well established.

This could be a problem for both the buyer and the supplier in cases where the related technologies were rapidly developing, where the time-scales are long and where the institutional boundaries of the buying organization causes further restrictions to the trading interface. Typically, governmental organizations are obliged to go for public tendering while purchasing equipment and in most cases they provide only fixed-price contracts. Recently, this has been the case for technologically very advanced defence technologies as well, not to mention advanced, non-defense scientific applications.

Under such conditions of high technological complexity and given institutional boundaries and environmental uncertainties, what would be the optimal trading interface or governance structure? Moreover, what type of impact could technology-oriented, government contracts have on supplier core capabilities?

This paper addresses these two major questions. It focuses on studying vertical linkages in a cost- and technology driven environment, typically described by the buying behavior of R&D-intensive government organizations such as research labs or technology-oriented scientific centres. The paper consists of three parts.

In the first stage, the literature on transaction cost economics is examined to determine the structure of optimal contracts, given the specific critical attributes of the transactions under consideration.

In the second stage, the conclusions of the design of optimal contracts are linked to the literature of strategic management. More specifically, two elements are analyzed. First, the impact of the specific vertical buyer-supplier relationships on the different segments or functions of the supplying firm's value chain. Second, the impact of these specific vertical linkages on the network of companies the supplying firm is associated with. In both cases, the question whether such vertical linkages can lead to the creation of new core competences in the affected firms, is examined.

Finally, in the third stage, the related literature is examined to find out whether technologically oriented, R&D intensive customers can contribute to the development of core competences of supplying firms, thus improving their potential to obtain a sustainable competitive advantage.

2. Transaction cost analysis on contractual buyer-supplier relationship in a complex and uncertain environment

A myriad of literature exists on buyer-supplier relationships[1] . In this study, a buyer-supplier relationship is viewed as an interaction initiated by either the supplier or the buyer, whereby both parties recognize their mutual interdependence and interest in each other's resources (Cunningham, 1980). This perspective differs from the classical view of analyzing buyer reactions to a supplier's offer as it assumes that "both companies are likely to be involved in adaptations to their own process or product technologies to accommodate each other" (Ford, 1980, p. 340). The buyer-supplier interface can also be complex and may involve many individuals (Spekman and Johnston, 1986).

Transaction cost analysis[2] addresses questions related to the optimal governance structure for transactions (Williamson, 1984). According to transaction cost analysis, there may be hidden risks - and therefore possible transaction costs - involved in a spot contract which can be reduced by choosing an alternative type of contractual agreement or some other type of governance structure[3] such as a joint venture, partnership, coalition or an alliance. Sometimes it is better to carry out the planned activity inside the firm rather than obtaining it from the market (Coase, 1937). When the external market indeed fails to provide economic activities efficiently, firms may respond with internalization (e.g., by integrating vertically[4]). This represents a choice between "markets and hierarchies" (Williamson, 1975).

The aim of transaction cost analysis as developed by Williamson is to minimize or economize on the related (buyer) transaction costs by selecting the most suitable governance structure for a given transaction. Transaction costs are the economic equivalent of friction in physical systems (Williamson, 1985) but not similarly directly quantifiable since transaction costs are primarily the consequence of the associated risks before (ex-ante) and during (ex-post) the transaction. Ex-ante contractual costs include costs of drafting, negotiating and safeguarding an agreement; ex-post costs include maladaption costs (transactions drifting out of alignment), haggling costs (correcting ex-post misalignments) and setup and running costs (Williamson, 1985)[5].

According to Williamson (1985), "it is the difference between rather than the absolute magnitude of transaction costs that matters... Empirical research on transaction cost matters almost never attempts to measure such costs directly. Instead, the question is whether organizational relations (contracting practises; governance structures) line up

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[1]For articles on industrial or organizational buyer behaviour and supplier response, see e.g., Webster and Wind (1972); Sheth (1973); Bonoma (1982); Cardozo (1983); Jackson (1985); Reichard (1985); De Bruicker and Summe (1985); MacMillan et al. (1986); Anderson and Narus (1990; 1996); Lyons et al. (1990).

[2]Other equivalent, commonly used terms are "transaction cost economics" or "transaction cost theory". A transaction occurs when a good or service is transferred across a technologically separable interface (Williamson, 1975, p. 1). Transactions costs represent the cost of running the economic system (Arrow, 1969, p. 48).

[3]By governance structure we mean the institutional framework within which the integrity of the transaction is decided (Williamson 1979, p. 235), that is, the contractual format designed to carry out the transaction.

[4]Vertical integration means managing economic activities within the firm. Porter (1980, p. 300) defines it as "the combination of technologically distinct production, distribution, selling, and/or other economic processes within the confines of a single firm. As such, it represents a decision by the firm to utilize internal or administrative transactions rather than market transactions to accomplish its economic purposes". For transaction cost related studies of vertical integration, see also e.g., Klein et al. (1978); Armour and Teece (1980); Balakrishnan and Wernerfelt (1986); Casson (1986) and Hennart (1988). For cases of vertical disintegration, see e.g., Boone and Verbeke (1991).

[5]From a different perspective, contractual costs can be divided into information, bargaining and enforcement costs (Rugman, 1986).

with the attributes of transactions[6] as predicted by transaction cost reasoning or not" (p. 22). So far, transaction cost analysis has not yet yielded into a formal analysis. However, for special cases, mathematical models for the analysis of transaction costs do exist (e.g., Grossman and Hart, 1986; Kreps, 1990a; Milgrom and Roberts, 1988; 1990).

Transaction cost analysis is based on an economic and business concept other than simply profit maximizing behaviour by economic organizations intending to carry out a transaction (Williamson, 1985). It shifts attention from considering production functions alone to studying the transaction as the basic unit of analysis (Commons, 1934), using the choice between a contractual relationship (Llewellyn, 1931) and a formal organization (Barnard, 1938) as the basic framework. Here, a firm is seen more as a governance structure than as a production function, but it is also more than just a "nexus of contracts" (Alchian and Demsetz, 1972; Jensen and Meckling, 1976; Fama, 1980). Modern transaction cost analysis is therefore a micro-analytic approach combining theories of economics, law and organization (Williamson, 1985)[7].

Transaction costs result from the way the economic system is run (Arrow, 1969) which in turn depends on both environmental and human factors (Williamson, 1975). Following Williamson's approach (1975; 1985; 1996), an environmental factor reflects the uncertainty or complexity surrounding the exchange[8]. This could result, for example, from market development uncertainties, technical difficulties related to the object of the transaction or from some form of unidentified contingency connected to the planned transaction. The human or behavioural factors are bounded rationality and opportunism.

Bounded rationality refers to the "limited capability of individuals to receive, store, retrieve and process information without errors" (Williamson, 1975, p. 21). Bounded rationality means that an individual is "intendedly rational but only limitedly so" (Simon, 1961, p. xxiv). Bounded rationality is closely connected to environmental uncertainty. Together with environmental uncertainty this implies that transactions are governed by incomplete contracts and that unexpected (costly) contingencies may arise. If unbounded (complete) rationality existed, one would be able to identify all possible contingencies and choose right away the best alternative without any costs, whereas bounded rationality only allows to reduce the possible risks, but at a cost.

Opportunism means self-interest seeking with guile. It reflects an incentive to cheat if this will improve one's position in the exchange. Opportunism is a form of strategic behaviour (see e.g., Schelling, 1960; Goffman, 1969) and it plays an important role when choosing among different contractual alternatives. It includes, e.g., strategic manipulation of information, non-disclosure of information even if asked, abuse of the other party's weakened position etc. Williamson (1985, p. 49) identifies opportunism as "a troublesome source of behavioural uncertainty". Both bounded rationality and opportunism can occur ex-ante and ex-post, which implies that the theory of transaction costs goes far beyond the scope of profit-maximizing neoclassical economic theories[9].

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[6]In this study, transaction attributes are understood as the characteristics of a transaction such as the necessary time-span needed to carry it out, the type of product or service in question, the type of payment or compensation and the type of human interaction necessary to facilitate the exchange.

[7]Transaction cost analysis should be viewed in a broader context, which includes the analysis of different costs such as those of production, the design of goods or services and , social aspects like customs or habits (Riordan and Williamson, 1985; Williamson 1985) or management costs of internalization (Demsetz, 1988).

[8]Williamson maintains that "the distinction between deterministic complexity and uncertainty is inessential" (Williamson, 1975, p. 23) and, referring to Simon (1972, p. 170) points out that "whatever its source, approximation must replace exactness in reaching a decision".

[9]Evolutionary theories (see e.g., Nelson and Winter, 1982) consider individuals in a society to be behavioural in a specified way without self-interest. In evolutionary economics the behavioural

Given the environmental and behavioural factors mentioned above one can identify transaction-specific factors such as asset specificity and the frequency of transactions. Asset specificity reflects the degree to which transactions need to be supported by transaction specific assets which cannot be deployed elsewhere, such as product-specific manufacturing equipment or tools needed to carry out the transaction[10]. It can also refer to the level of required technological and managerial know-how (Teece, 1984).

Williamson (1991a) identifies six types of asset specificity: site specificity (related to inventory and transportation expenses), physical asset specificity (e.g., specialized dies to produce a component), human-asset specificity ("learning by doing"), brand name capital, dedicated assets (discrete investments) and temporal specificity (related to the importance of timely responsiveness). The presence of asset specificity under conditions of uncertainty makes the transaction more complex and conventional trading arrangements associated with non-specific transactions may no longer be suitable. Instead, special transaction-specific arrangements may become necessary to carry out the transaction successfully.

The frequency of the transactions refers to how often the transactions take place. This may be an important factor, since together with asset specificity, it determines whether one should use standard or non-standard contracts[11]. Standard spot contracts are efficient in cases where the level of asset specificity is low, irrespective of the frequency of transactions. Here, the market mechanism works sufficiently well and one can use spot contracts. In cases where the level of asset specificity is high and the frequency of the transactions is low, long term contracts may be sufficiently flexible to absorb ex-post contingencies. However, in the case of transactions associated with both a high level of asset specificity and a high frequency, relational contracting within a unified governance structure is the most suitable solution. This implies that a firm needs to internalize the activity and carry it out in-house. Hence, the two polar extremes of "markets" and "hierarchies" (Williamson 1975; 1996).

It is the strong presence of both environmental and behavioral factors that lead to significant transaction costs. Obviously, if environmental and especially behavioral factors were not present, there would be no transaction costs. This is summarized in Figure 1.

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pattern and the evolution of the firm is governed by "routines which are the skills of an organization" (Nelson and Winter, 1982, p. 124) and not by deliberate choice of actions. Nelson and Winter state that "the core concern of evolutionary theory is with the dynamic process by which behaviour and market outcomes are jointly determined over time" (p. 18). Evolutionary economics has therefore strong implications for the strategic management of a firm's core competences, see infra.

[10] Asset specificity is a very strong condition in determining transaction costs and efficient economic organizations. Other theories, like contestability theory (Baumol, Panzer and Willig, 1982) acknowledge the existence of asset specificity but do not consider it to be significant. A perfectly contestable market has no entry barriers (extra costs) for entrants which are assumed to have full access to the same technologies with equal costs as the incumbent firms.

[11] This is the case when bounded rationality and opportunism are also present.

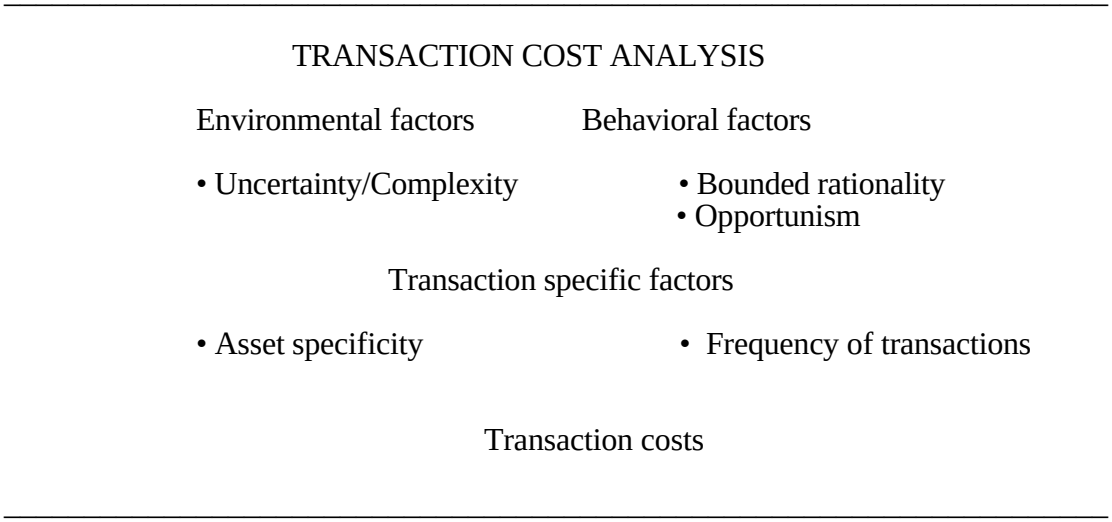

Figure 1. Factors contributing to the presence of transaction costs. When bounded rationality, opportunism and uncertainty are present, the transaction cost-determinants are asset specificity and the frequency of transactions. Factors in parentheses are secondary in nature, being a consequence of the primary factors.

The implications of the behavioral[12] and transaction specific on the contracting process are the following: if either of the behavioral factors (bounded rationality or opportunism) are absent whereas transaction specific factors (mainly asset specificity) are not, the contracting process can be simply based on straightforward planning or simple promise since both parties have the complete necessary information to carry out the transaction and neither will try to cheat the other. When behavioral factors are present but the transaction specific ones are not, the contracting process can be based on normal market forces and competition since despite imperfect information and attempts to cheat, there are enough suppliers to choose from and in the long run, the identity of each party is not too important. And if disputes do occur, they can be settled by court orderings.

When in particular behavioral charachteristics are present, namely bounded rationality and opportunism, and when transactions are associated with substantial asset specificity, an optimal governance structure must be designed due to incomplete planning (because of bounded rationality), low promise predictability (because of opportunism) and the importance of knowing the other party (because of asset specificity). Here the handling of legal disputes by court ordering is more problematic and requires very much the intervention of institutions of private orderings (e.g. use of an arbitrator) and it is here where transaction cost analysis is best applied. The attributes of the contracting process are summarized in Figure 2, adapted from Williamson (1985, Table 1-1).

[12]Environmental factors are here coupled to bounded rationality and opportunism.

Behavioral assumption		Transaction specific assumption	Implied contracting process
Bounded rationality	Opportunism	Asset specificity	
0	+	+	Planning
+	0	+	Promise
+	+	0	Competition
+	+	+	Governance

Figure 2. Attributes of the contracting process. Depending on the presence of behavioral and transaction specific factors, different contracting processes need to be applied to minimize related transaction costs. + stands for "presence in a significant degree" and 0 means that it is assumed to be absent. It is assumed that transactions are recurrent by nature on a transaction-specific level.

Depending on the degree of asset specificity (nonspecific, mixed or highly specific assets) and the frequency of the transactions (occasional or recurrent), different contractual governance structures can be selected to minimize subsequent transaction costs (Williamson, 1979). These are the classical, neoclassical and relational contracting formats.

In classical contracting (or market governance) the terms of the transaction are completely specified ex ante (Kreps, 1990b). The identity of the parties is irrelevant, remedies are narrowly prescribed and third-party participation is discouraged. Classical contracts are therefore based on legal rules, formal documents and self-liquidating transactions (Williamson, 1979). Enforcing such contracts can be problematic and often the courts are called in to adjudicate disputes (Kreps, 1990b). Classical contracts are suitable for transactions having nonspecific assets, such as purchasing standard equipment or materials.

Neoclassical contracts (or trilateral governance) in turn take into account ex post adaptations unforeseen ex ante and possible veridical disputes by prescribing third-party assistance to evaluate performance and resolve any disputes. Neoclassical contracts can therefore be long-term contracts executed under complex or uncertain conditions with a settlement machinery both parties can have confidence in (Williamson, 1979). Neoclassical contracts are thus suitable for occasional market transactions where asset specificity is mixed or high, such as purchasing customized equipment or constructing a plant [13].

In relational contracting (bilateral and unified governance) the adjustment process is more geared towards sustaining ongoing, transaction-specific relations and the reference point for the adjustments is the "entire relation as it has developed [through] time" (Macneil, 1978, page 890). Relational contracts can therefore handle recurrent and long-term contracts under uncertain conditions where asset specificity is mixed (bilateral governance) or high (unified governance), such as purchasing customized materials or site-specific transfers of intermediate products. In bilateral structures both

[13] "Neoclassical contracting" does not in this context fall under the title of neoclassical economics but is instead a synthesis of transaction cost analysis on Macneil's contract theory (1974) and subsequent terminology (Williamson, 1991b). Neoclassical contracting in this context does not therefore exclude transaction cost rationale.

parties remain autonomous and in unified structures the activity is removed from the market and organized within the firm (Williamson, 1985).

Unified governance structure take over when the costs of relational contracting start to rise due to increasing asset specificity and associated risks. In this case one party buys out the other and takes full command of and responsibility for the transaction (Kreps, 1990b). The efficient governance structures are shown in Figure 3 (modified after Williamson, 1985, Fig.3-2).

Transaction Characteristics		**Asset specificity**		
		Nonspecific	Mixed	Highly specific
Frequency	Occasional	Classical contracting (Market governance)	Neoclassical contracting (Trilateral governance)	
	Recurrent	-//-	Relational contracting (Bilateral governance)	(Unified governance)

Figure 3. Optimal governance structures or contract formats for different types of transactions depending on the level of asset specificity and their frequency. Uncertainty is assumed to be present to a high degree. At a more general level, bounded rationality and opportunism are assumed to be present. The contract format therefore forms a legal, economic and organizational envelope for carrying out the transaction.

Zagnoli (1988) has extended Williamson's contractual continuum to study inter-firm agreements in high technology sectors. Such inter-firm cooperation[14] falls between market contracting and internalization and is called "hybrid form" (Williamson, 1991a). Such cooperative agreements include activities such as joint research and development, know-how or manufacturing integration and joint marketing and distribution between firms. Hybrids are associated with a reciprocal, relatively high level of asset specificity whereby both partners need to make an effort to carry out the transaction successfully. Hybrids are therefore efficient for transactions where both parties need to make longer-term mutual commitments and where the level of uncertainty or complexity is relatively high. As an increasing function of asset specificity, hybrids sequentially follow markets before hierarchy (Williamson, 1991a).

The efficiency of the three governance structures can be viewed as a function of asset specificity and associated governance costs[15]. Williamson (1991a) identifies incentives and administrative control as the attributes to explain the differencies in governance

[14]Cooperation is understood here as "similar or complementary coordinated actions taken by firms in interdependent relationships to achieve mutual outcomes or singular outcomes with expected reciprocation over time" (Anderson and Narus, 1990, p. 45). For other definitions, see e.g., Ouchi (1980), Axelrod (1984), and Contractor and Lorange (1988), Kotabe and Swan (1995), Beamish and Killing (1997).

[15]Governance costs are added contract execution costs due to contractual contingencies which are difficult to agree upon ex-ante (see Riordan and Williamson, 1985). In his article (1991a), Williamson distinquishes the three different governance structures by their level of adaptibility, incentive intensity, administrative controls and contract law features. He also studies their efficiency using the rate of transactional disturbances as a measure.

structures. Incentives are the drivers of both organizational and market efficiency; in the market incentives drive to produce more efficiently (Hayek, 1945) whereas in an organization it can improve performance (Barnard, 1938). Administrative controls refer to the monitoring of career rewards and penalties and contract law to the mapping of the different governance structures (see Figure 2.3).

The distinguishing attributes are presented in Figure 4 (modified after Williamson, 1991a, Table 1) and the governance structure costs as a function of asset specificity in Figure 5 (after Williamson, 1991a, Figure 1). The initial governance costs are lowest for market transactions because of low asset specificity. As the asset specificity rises, the hybrid form becomes more optimal for the transactions. Finally, as the level of asset specificity becomes very high, internalization is the optimal solution for the transactions in question. This results from the fact that administrative controls are a less significant source of governance costs than in either the market or hybrid structures.

	Governance structure		
Attributes	Market	Hybrid	Hierarchy
Incentive intensity	++	+	0
Administrative controls	0	+	++
Contract law	++	+	0

Figure 4. Distinguishing attributes of market, hybrid and hierarchy governance structures. ++ stands for "strong", + for "semi-strong" and 0 for "weak". When the level of asset specificity increases, the hybrid form becomes the optimal contractual format. As the level of asset specificity becomes very high, internalization becomes the optimal solution.

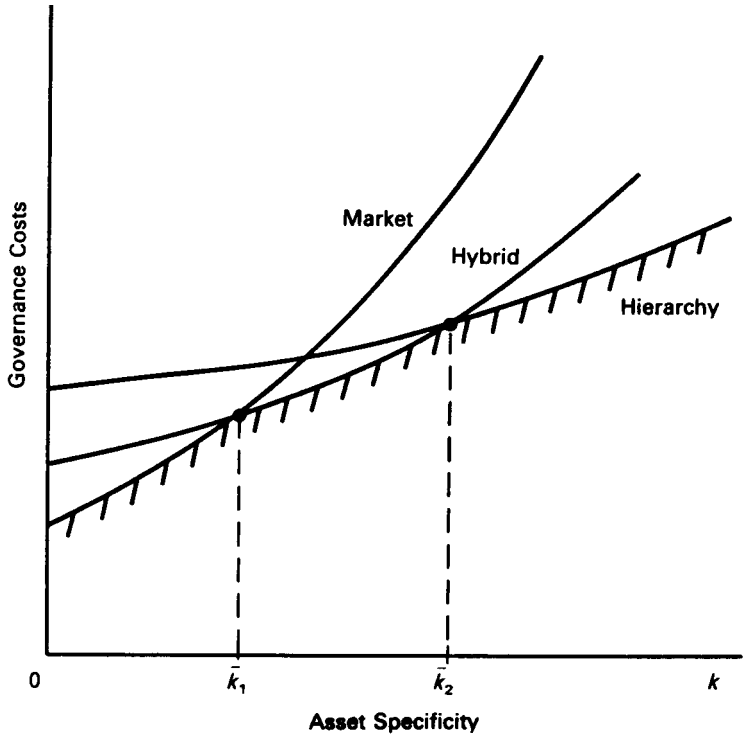

Figure 5. The different governance costs (additional contract execution costs) as a function of asset specificity. The hybrid form is the optimal contractual framework within a certain range of asset specificity.

In this study we are trying to define the optimal contractual format and supplier benefits for transactions where the cost-driven, high-tech buyer organization has institutional boundaries (namely, it cannot internalize transactions at free will), where technological uncertainties are high and where markets in most cases cannot provide standard, off-the shelf products but instead where both the byuer and supplier need to make an effort to carry out the transaction successfully. Based on the literature review above, transaction cost analysis would suggest the hybrid form as the optimal contractual format for longer term, high-asset specificity transactions.

Despite Williamson's important contribution and the recent developments in the theory of transaction cost economics (Williamson, 1991a; 1996), the combined analysis of transaction costs and longer term buyer-supplier benefits resulting from collaborative behavior has received very little attention in the research literature[16]. This aspect, which is of crucial interest in this study, is considered in the following sections.

3. Strategic management of capabilities and competitive advantage

Strategic management deals with managing change. Teece (1984, p. 87) sees it as managing the need of the firm "to match its capabilities to an ever-changing environment if it is to attain its best performance". The pattern of decisions aimed at achieving a given goal is related to both strategy formulation and implementation and its effectiveness should be assessed over a longer period of time (Andrews, 1971).

[16] Some recent attempts include Zajac and Olsen (1993) and Dyer (1997).

Strategic management can therefore be understood as coordinating a set of actions over time which hopefully will lead to an optimal benefit-cost ratio[17]. These actions can be either intentional or unintentional[18].

Two major schools of thought dominate the present literature of strategic management, namely the competitive forces approach and the resource-based view of a firm (Teece, Pisano, Shuen, 1997). The primary purpose of the review below is to study buyer-supplier linkages and their impact on supplier core competences.

The concept of responding to the different competitive forces in a given industry or environment was developed by Porter (1980) following the structuralist paradigm tradition of Mason (1949) and Bain (1959). The competitive position of a firm depends on how well the company can defend itself against five competitive forces in the relevant industry. These five forces are competitors (competition in the industry), potential entrants (threat of new entrants), buyers (bargaining power of buyers), substitutes (threat of substitute products or services) and suppliers (bargaining power of suppliers)[19].

Based on this framework, the firm is capable of analyzing both the structure of the industry and its competitors. The areas of competitor capabilities (both strengths and weaknesses) can be in the products, distribution, marketing and selling, operations, research and engineering, overall costs, financial strength, organization, general managerial ability, corporate portfolio, personnel structure, government relations and so on. From analyzing these, the competitive strategy[20] of the firm follows.

Porter (1985) provides an in-depth guide to implement the strategies of cost leadership, differentiation and focus to gain competitive advantage. Porter introduces the concept of value chain to understand the sources of cost reduction and differentiation within a firm. The value chain consists of strategically important company functions or activities which create both costs and customer value. The structure of the value chain differs between companies and industries. It is the optimization of the collective actions and the minimization of total costs in the value chain in comparison to competitors which creates a competitive advantage. Porter calls these activities primary and support activities.

Primary activities include inbound logistics (material handling, warehousing, inventory control, vehicle scheduling and returns to suppliers), operations (machining, packaging, assembly, equipment maintenance, testing, printing and facility operations),

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[17]The cost-benefit analysis is understood here in broader terms than just as a quantitative "decisional balance-sheet" (Janis and Mann, 1971), namely as an approach to limit the number of strategic choices (Ghemawat, 1991).

[18]In fact, de Bono (1984, p. 143) sees strategy as "good luck rationalized in hindsight". Similarly, Mintzberg (1985; 1988) regards strategy as a stream of actions or decisions which originally could have been unintended. The realized strategy would therefore result from either a deliberate or an emergent strategy, the latter referring to set of actions which simply took place, perhaps unrecognized at the time.

[19]In the structuralist paradigm, buyer and supplier conduct (which, in turn, depends on the structure of the relevant market) affect company performance. Porter (1980) further elaborates on the strategic significance of buyer selection or the choice of target customers. The selection criteria include considering the purchasing needs versus company (supplier) capabilities, growth potential, the structural position of the buyer and the cost of serving this buyer. In turn, the key issues in an efficient purchasing policy are stability and competitiveness of the supplier pool, the optimal degree of vertical integration, the allocation of purchases among qualified suppliers and the creation of maximum leverage with chosen suppliers. In another context, Ford and Farmer (1986) link make-or-buy decisions (which are related to vertical integration/disintegration) to the company policy, cost or business approach considering them key strategic issues. See also Venkatesan (1992) for identifying core product components and strategic outsourcing.

[20]For a general comparison of generic versus competitive strategy, see Rumelt (1980).

outbound logistics (finished goods warehousing, material handling, delivery vehicle operation, order processing and scheduling), marketing and sales (advertising, promotion, sales force, quoting, channel selection, channel relations and pricing) and service (installation, repair, training, parts supply, and product adjustment).

Support activities instead include procurement (function of purchasing inputs), technology development (supporting technologies embodied in value activities), human resource management (recruiting, hiring, training and compensating of all types of personnel) and firm infastructure (general management, planning, finance, accounting, legal, government affairs and quality management).
The support activities represent the principal trading interface with external partners in terms of managerial, administrative and legal involvement. Porter points out (1985, p. 48) that "the value chain is not a collection of independent activities but a system of interdependent activities". In addition to linkages within the company value chain, there are also linkages between the company and supplier and channel value chains. The concept of the value chain can be used to study the benefits and costs of coalitions in global strategies (Porter and Fuller, 1986) and the structure of industries to identify the competitive advantage of nations (Porter, 1990). The value chain is shown in Figure 6 (after Porter, 1985, Figure 2-2.).

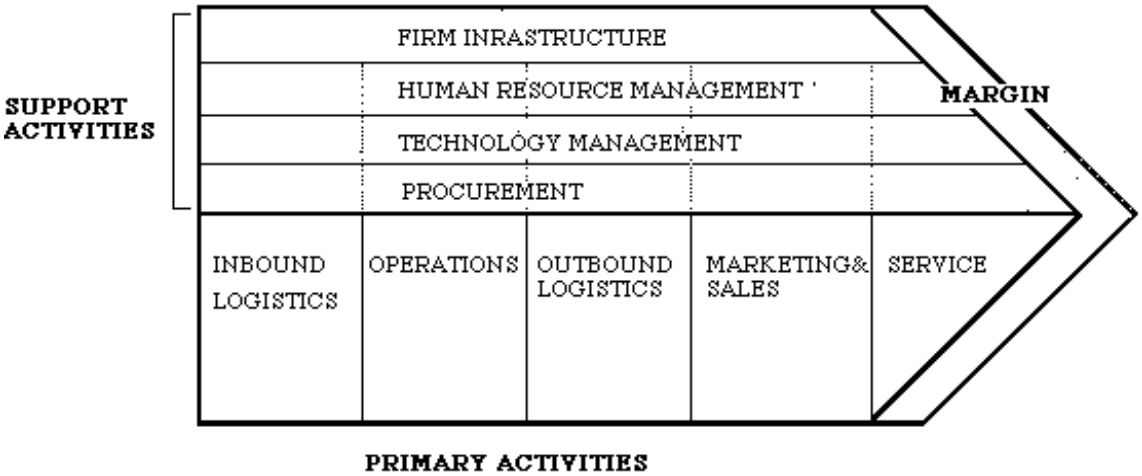

Figure 6. The value chain links company functions or activities to the strategy of the firm. Depending on the structure of the relevant market, the company functions need to be optimized accordingly, creating the competitive advantage of the firm.

In contrast, the resource-based perspective on strategy is based on the notion that from its strenghts and weaknesses, the organization creates over time a set of truly distinctive competences which transforms into superior economic performance (Penrose 1959; Learned et al., 1969; Wernerfelt, 1984; Cool and Schendel, 1988; Peteraf, 1993, Hamel and Prahalad, 1994; Hamel, 1996). These are called the core competences of the firm.

The core competences of the firm have three specific characteristics. First, they enable firms to develop new products and participate in diverse businesses. Second, they are difficult to imitate by competitors. Third, core competences should contribute to perceived customer benefits. Developing these core competences within the organization takes a long time and is a complex process (Dierickx and Cool, 1989). This implies that these capabilities cannot be simply purchased on the market (e.g., by vertical integration or diversification) but instead that they can only develop in a context of learning (Hamel, 1991; Slocum et al., 1994). Companies can therefore seldom quickly shift from one attractive industry to another and be successful. Instead, they position themselves in a given industry structure and move incrementally based on their firm-specific assets (Hayes, 1985).

The theoretical foundations of the resource-based perspective lie in evolutionary theories of both innovation (Schumpeter, 1934; 1942) and organizational behaviour of learning or "routines" (Nelson and Winter, 1982), the transaction cost framework of capability-related specific assets (Williamson, 1975; 1985; 1996) and the selection of strategic choices based on both complementary assets and technological opportunities (Teece, 1986; 1988; Dosi et al. ,1988).

Teece (1986) discusses the strategic use of contracts as opposed to vertical integration to obtain access to complementary assets. Focusing on technological innovation, Teece argues that imitators and followers can outperform the original innovator in successfully commercializing a new product if they are able to establish an appropriate control structure over necessary assets outside the company. These assets can be for instance competitive manufacturing, complementary technologies, service or specialized distribution channels[21]. Depending on the type of required complementary assets, strategic contractual partnering can be an ideal solution when the core technology or know-how is well protected and the complementary assets are readily available on the market. In order to keep imitators and followers - possibly existing partners - at bay, one needs to identify, strengthen and keep the core technological know-how inside the company (Teece, 1991).

The issue of complementary assets is a central theme in the literature on cooperative strategies (Hagedoorn and Schakenraad, 1990). Companies engage in cooperative agreements to achieve foreseen benefits through technological complementarity and technology transfer (Mariti and Smiley, 1983) and hybrids (Blois, 1972; 1980)[22]. These interactions, being either formal or informal, can be viewed as an industrial networks approach on the basis of e.g., technology, country or focal organization (Håkansson, 1987; 1989; Håkansson and Johanson, 1988). The industrial network develops over time and contains the history of the interactions within it. The companies therefore need to develop and maintain a strategic identity in the network in order to belong to it.

The concept of network (see e.g., Evan 1966, Schermerhorn 1975; Van de Ven, 1976; Aldrich and Whetten, 1981; Fombrun, 1982; Milward, 1982; Provan, 1983) was originally applied to study inter-organizational relationships within non-profit organizations but is also used in a wider context as a substitute for hybrids (Thorelli, 1986). Jarillo (1988) further developed this concept and views networks as a mode of organization where companies form a relationship with a long-term point of view, consisting of relatively unstructured tasks and unspecified contracts.

The strategic network provides complementary assets to which the associated companies can get access in an economical way and protects them against competitors which are outside the network. The participating companies need not necessarily link all their internal activities to the network. The concept of value chain can be used to

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[21] In spite of Teece's (1986) contribution, the literature on the strategic management of core competences is more vague about the market feedback and driving mechanisms (e.g., the role of marketing and sales), as compared to R&D or technical skills in the process of enhancing longer-term competitive advantage. Porter (1992) makes a similar comment, warning against adopting a too dominantly technology-driven perspective, while trying to achieve competitive advantage.

[22] Hybrids are understood here as vertical quasi-integration which is a form of governance structure between complete vertical integration and out-sourcing. The partners contribute by providing complementary inputs. Other reasons for setting up cooperative agreements (not necessarily based on complementary assets) are to reduce the risks associated with projects, to gain from economies of scale and production rationalization, co-opt or block competition by defensive moves, overcome trade barriers and/or government-mandated investements, or to facilitate initial international expansion (Contractor and Lorange 1988). Cooperative arrangements are not only made by partners, but increasingly by competitors, as well (Fusfeld and Haklisch 1985; Hamel, Doz and Prahalad 1989; Jarillo and Stevenson 1991).

distinguish those company activities that are part of the strategic network[23] and those which can be farmed out. The network may be run by a "hub firm" as the centre of activity, introducing a cost discipline. The sustainability of the network (or low transaction costs) is based on building trust among the members to prevent opportunistic behaviour.

The buyer-supplier relationship in cooperative strategies is seen more as a longer-term partnership where the buyer narrows the vendor set to potential partners which have unique complementary skills and share conflict-resolving management skills (Spekman, 1988). Conversely, the supplier can benefit from such a long-term collaboration (Kalawani and Narayandas, 1995). Communication and information sharing form the backbone of the relationship (Konsynski and McFarlan, 1990). In this context, a partnership should be viewed as a dynamic relationship and not as a one-time agreement; it requires a specific governance structure (Doz, 1988). For the partners, the benefits need not be symmetrical (Axelrod, 1984).

We conclude our literature review on strategic management with the following observations. First, the literature recognizes the link between longer term effects of firm actions on company functions, capabilities and competitive advantage. Second, the literature also recognizes the value of cooperative relationships, like enhanced firm-specific capabilities or performance in a network of collaborating companies. However, these actions resulting in longer term company-specific benefits are viewed in terms of intentional, self-interest seeking behavior. But in the spirit of Mintzberg (1988), the buyer-supplier relationship, the very core of this study, could also lead to outcomes or supplier benefits that simply emerge, not being anticipated or precisely predicted beforehand but which just realize over in time and can be utilized at a later stage by the supplier. The question then is whether such longer term spillover effects do indeed result from actions carried out by research and technology-intensive organizations[24]. To answer this question, we need to turn to literature on the impacts of research and development.

4. Supplier impact of R&D-intensive organizations

The literature on the impact of research and development (R&D) can be divided into two segments: one that studies the impact of industrial R&D and one that assesses the effects of government funded R&D[25]. Both micro- and macro-economic methods have been used to assess these effects . Due to the scope of this study, the focus will be on the literature of the economic impact of government-funded R&D-intensive organizations on their suppliers.

The impact of non-defense R&D on industry is generally related to basic and applied research and development work carried out by universities and national research laboratories, some of them in collaboration with the industry[26]. Nelson (1959) has

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[23]In a strategic network, behaviour is assumed to be intentional and a conscious effort is required to keep the network active. But networks need not be understood only as governance structures between markets and hierarchies but instead as structures emerging from and being governed by transactions themselves, these being either intentional or unintentional (Nordberg and Verbeke, 1996).

[24]Such organizations are assumed not only be interested in buying products or services but in parallel to transfer knowledge and technology to its collaborating companies. A firm may therefore be able to benefit from other research and development work carried out outside the specific transaction.

[25]Obviously, these two effects are closely connected to each other since industrial R&D is also funded by governments.

[26]The National Science Foundation (1990, p. 34) classifies R&D into basic research (directed towards increases in knowledge), applied research (knowledge on how specific needs may be met) and development (systematic use of the knowledge gained from research). For the relationships between basic and applied research in innovation, see e.g., Gibbons and Johnston (1974). For a view of R&D

identified basic research as the source of significant advances and as a prerequisite to maintain an enterprise based economy. Lederman (1984) has identified profound impacts on society in general, resulting from basic research. Utterback (1971) has found evidence that ideas and successful innovations of new products are most frequently need-stimulated by the scientific community or users, i.e. initiated by the recognition of a need or technical problem rather than by the recognition of exploitable technical information or opportunities.

Von Hippel (1976; 1988) has reported supporting findings concluding that successful innovations in scientific instruments are highly user-dominated processes whereby the university or research institute has been involved in the invention, prototyping, related information distribution and pre-commercial replication of the scientific instrument. The manufacturer, who often is already in that specific market, is often "pushed" by the scientific users to enter a new product line[27].

Rosenberg (1991) has observed that the emergence and diffusion of new technologies of scientific instruments are central to economic growth. He has identified the importance of transfer of scientific instruments among academic disciplines and interdisciplinary collaboration and movement of scientists in the process of generating benefits. This effect can be seen strongly in transfers from fields such as physics and chemistry to fields such as biology, clinical medicine and health care delivery. Rosenberg has also argued that in the absence of university research capabilities both the rate and direction of technological change would have had a smaller economic impact, rather than just causing a time delay in the commercial introduction of new products.

Lederman and Carrigan (1987) have identified transistors, computers, lasers, television, nuclear energy and biotechnology instrumentation as the most important technologies which have resulted from quantum physics research and conclude that these developments have contributed to about 23% of the present U.S. Gross National Product.

Areas where the secondary economic impact of research has been studied periodically are space research and high energy physics, with a focus on the leading centres in these fields[28]. Evans (1975) estimated that increasing the level of NASA's (National Aeronautics and Space Administration) annual expenditures by $1 billion from 1975 onwards would have resulted in an increase of $22 billion in U.S Gross National Product in 1984 and would have created 1.1 million new jobs by that year. Mathematica (1976) measured the transfer of technology from NASA using case studies in cryogenics, integrated circuits, propulsion and software development. This study reported new product developments and substantial cost reductions.

Mathtech (1977) studied a number of innovations resulting from NASA technology and estimated, e.g., a benefit/cost-ratio[29] of 4 for pace-makers intended for cardiac patients. Midwest (1988), concluded that NASA R&D expenditures of $148 billion (in 1982 dollars) have generated an integrated return of more than $ 950 billion to the U.S.

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as a function or process, see e.g., Merten and Ryu (1983). For literature on the transfer of knowledge from universities and research laboratories to the industry, see e.g., Reimers (1980); Roberts (1981); Stankiewicz (1986); Dorf (1988); Godkin (1988).

[27]The scientific instruments in question (gas cromatography, nuclear magnetic resonance spectrometry, UV spectrophotometry, transmission electron microscopy) were commercialially introduced between the years 1939 and 1954. Von Hippel (1982; 1988) suggests similar user-developed product strategies for both consumer and industrial markets, as well.

[28]However, most of these studies suffer to some degree of ill-defined research methodologies and inconsistent terminology.

[29]This was defined as the ratio between the generated secondary sales of the new product in a given market divided by the expenditure by NASA for that product.

economy during the period 1960 - 1986, based on calculations of economic gains of R&D in general in the United States and on an earlier study made in 1971.

Chapman et al. (1989) studied the economic impact of NASA spin-offs, the secondary use of major research and development efforts. Excluding direct NASA-furnished technology amounting to about $12 billion in sales, Chapman et al. report that sales and savings derived from NASA-spin-offs resulted in about $22 billion in total, in addition to roughly 352 000 jobs created or maintained between the years 1978 and 1986. Interviews of 400 suppliers and studies of 441 separate instances of NASA-sponsored or NASA-provided technology led to the conclusion that 83% of the cases resulted in benefits in terms of savings or sales. The highest impacts were in transportation (46% of total sales and savings generated, mostly in aviation), industrial manufacturing and processes (27% of total sales and savings) and medical applications (9%). In about 15% of all cases, a product, process or an entire company would not have come into existence without NASA-furnished technology.

The products having the highest direct sales or savings impact out of 72 technical applications were products such as medical instruments (33% of total sales and savings), musical instruments (15%) and special foams (12%)[30]. In addition to benefits of direct commercial use of NASA-technology in products or processes, Chapman et al. (1989) identified enhanced markets for other similar products, accelerated product commercialization, distribution or transfer of technology and technical information to other public agencies and users and creation of new companies.

Bezdek and Wendling (1992), using input-output analysis (Leontief, 1966) to measure and analyze the interdependence of all industries in an economy, also included the indirect benefits in their study of economic benefits of NASA. They were thus able to take into account the benefits flowing from the second-, third-, and fourth rounds[31] of subsequent industry purchases from NASA procurement which had been neglected in previous studies (see e.g., National Academy, 1988). Bezdek and Wendling report an input-output multiplier effect[32] of 2.1 on NASA procurement of $8.6 billion in 1987, generating $17.8 billion in total industry sales, $2.9 billion in business profits, $5.6 billion in tax revenues and 209, 000 private-sector jobs in that year. The authors also concluded that the total employment created in various industries does not necessarily correlate with the corresponding sales volume.

The literature on the macro-economic impact of expenditures of R&D-intensive organizations would therefore suggest that there are benefits to the participating industries. The next question is how these benefits relate to enhancing firm-specific core competences and the value chain functions.

BETA (1980; 1988a) has studied the indirect micro-economic effects of the expenditures by ESA (European Space Agency) for the periods 1964-1976 and 1977-1986. Based on supplier sample sizes of 128 and 67, respectively, BETA concluded that the ratio of indirect benefits (defined as added value and intermediate consumptions) to estimated ESA-payments to the contractors was 2.9 in the first study

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[30] It is perhaps interesting to note that products such as Teflon (special coating material), Velcro (adhesive tape) and Tang (breakfast drink), generally attributed to the Apollo-space program, were not spinoffs of the space programs but were developed between 12 and 30 years before the first lunar landing (Alic et al., 1992). For periodical reviews on spinoffs from NASA, see e.g., NASA (1990).

[31] These included the indirect, pervasive effects generated by the NASA expenditures (e.g., through cumulative purchases and subcontracting) throughout the country.

[32] This is the ratio between total output and direct output. Total output is the sum of direct and indirect output requirements. Direct output requirement is an industry-specific estimate which indicates the volume of purchases needed to produce one unit of output as defined by the NASA expenditures. The direct output requirements generate subsequent rounds of indirect requirements that can have even fourth-order effects down the supply chain.

and 3.2 in the second one[33]. The indirect benefits were divided into four categories: technological, commercial, work factor and organization and methods benefits.

Technological benefits included diversification, new ESA-products and sales of modified or new products based on ESA-technology. Commercial benefits included possible market expansion, the use of the ESA-reference and commercial collaboration with new companies or research institutes. Work factor or labour-related benefits included maintaining qualified personnel ("critical mass" to preserve the necessary technological know-how). Organization and methods benefits included improvements in production methods, quality control, cost savings and in management techniques.

In the later study, the most important effect appeared to be in the area of technological benefits (43% of all indirect benefits), followed by work factor benefits (41%), commercial benefits (9%) and organization and methods benefits (7%). The indirect benefits amounted to 12, 680 million ESA-accounting units[34] (AUs, in 1986 prices), including the sales projections up to 1991. The corresponding cumulative expenditure was 3, 900 million AUs (in 1986 prices) up to 1988. Of the generated indirect benefits, 79% remained in the space sector (mostly in propulsion and telecommunications technologies and in ground facilities) whereas the remaining 21% fell outside space-related activities (mostly in aeronautics and defense).

The contributing technologies in the latter category were onboard electronics, production and test equipment and power supplies. Following the methodology of the first study, a time lag up to five years was assumed before the benefits were fully generated. The findings of the later study confirmed that this assumption was valid. The benefits were highest for equipment developers (benefit-cost-ratio of 3.9), followed by system developers (2.3), prime contractors (2.0) and service providers (1.8) The countries with the highest spinoff coefficient were Sweden (9.8), Denmark (4.5) and Germany (4.4). The countries with the lowest benefit-cost-ratio were Great Britain (1.7) and Italy (2.5)[35].

BETA (1989) reported similar findings for the impact of ESA contracts on Canadian suppliers, as well. Shachar and Zuscovitch (1990) studied in more detail 44 ESA-suppliers from the BETA-sample (1988a) and found that when the companies were seen as members of a technological network, clear learning patterns over a longer time span could be identified.

Schmied (1975; 1977) and Schmied et al. (1984) studied the secondary micro-economic impact of CERN (European Laboratory for Particle Physics) expenditures during the periods 1955-1973 and 1973-1982. The supplier sample sizes were 127 and 160, respectively. Using a similar methodology as BETA for the ESA-expenditures, benefit-cost-ratios[36] of 4.2 and 3.5 were reported, respectively. Since the two CERN-studies differed to some extent (interviewing techniques, team composition, target groups etc.), one cannot draw conclusions about the apparent decrease in the figures.

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[33]The benefit-cost-ratio is calculated here by estimating the impact of the awarded ESA-contracts based on the past and projected company sales, divided by the estimated ESA-payments to the contractors. For literature on the origin of the methodology, see e.g., Schmied (1977; 1987), Balthasar et al. (1978), BETA (1988b).

[34]An ESA-accounting unit (AU) is linked to the ECU and equals roughly to 1.2 U.S dollars in 1990 prices.

[35]It appeared that the impact was higher for industries applying generic technologies in non-space sectors than for industries operating primarly in the space sector (BETA, 1988a).

[36]In the CERN-studies, these are called utility/sales to CERN-ratios. Economic utility is interpreted here as the sum of increased turnover and cost savings which differs slightly from that of BETA (1988a) where utility is understood as the value added expressed in terms of company sales, excluding effects in terms of cost reductions .

Schmied (1984, 1987) gives a corrected coefficient of 3.7 (using 1977 constant prices) for the first study.

Both studies identified following types of benefits: turnover increases, new companies created, the use of CERN as a product test-bed, maintaining production capacity, inter-company collaboration, cost savings, product innovations, quality improvements and the use of the CERN-reference for marketing purposes. The distribution of these benefits was not quantified but in the later study they were expected to have a cumulative magnitude of 3, 100 million Swiss Francs[37] by the year 1987 (in 1982 prices). The purchasing expenditures of CERN between 1973 and 1982 amounted to a total of 750 million Swiss Francs (in 1982 prices).

The industrial category of electronics, optics and computers had the highest impact (benefit-cost-ratio of 6.1), followed by steel and welding (5.3), vacuum, cryogenics and superconductivity (3.0), electrical equipment (2.1) and precision mechanics (2.1). It appeared that 76% of CERN-generated utility spread over diverse commercial and industrial markets, notably in the electrical industry, railways, computers and telecommunications. Of the 160 companies interviewed, 55 reported no utility.

Schmied (1982; 1987) has compared the indirect economic benefits generated by CERN and ESA. Schmied's primary conclusion is that the total utility factors are very close to each other, in spite of the different contract policies. However, at the industrial sector level, the differences in contract policies may have an impact, as is the case in computing, where the utility factor is much higher for CERN[38]. Secondly, in the case of CERN, a major part of the utility is directed outside the physics research market whereas with ESA the major part tends to remain in the space market. Thirdly, CERN's new accelerator projects always become, after their completion, an integral part of the laboratory's existing infrastructure. They need to be operated and maintained for decades to_come whereas ESA's space crafts are not accessible to suppliers for repair and maintenance. Fourthly, CERN is geared more towards component-purchasing than ESA, which typically places contracts for complete systems. Since ESA-contracts can be 10 or even 100 times larger than CERN contracts, ESA clearly has a bigger impact on project coordination, management and training benefits. The major differences in the types of benefits generated by ESA and CERN, based on the latter findings above by BETA and Schmied, are summarized in Table 2.1.

[37] One Swiss Franc equals about 0.7 U.S dollars in 1990 prices. Schmied (1982) gives the breakdown of the types of benefits reported in the first CERN-study. Here 46% of the net utility consisted of technological benefits, 45% of commercial benefits and the remaining 9% of cost savings (or organization and methods benefits) and the maintaining of production capabilities (or work factor benefits). On average, it took less than three years to generate the secondary effects.

[38] According to Schmied (1982), this is because CERN, as opposed to ESA, does not have geographical purchasing restrictions and whenever CERN places an order with a European supplier based on the best price/quality ratio, this will have a considerable impact on future sales.

Table 2.1 Differences in the types of benefits or utility the European Space Agency and CERN generate for their suppliers.

Characteristics of benefits	Research organization	
	ESA	CERN
Volume of expenditure[a] (in million AU[d])	3, 900	625
Volume of indirect benefits generated by the suppliers[b] (in million AU)	≥ 12, 680	≥ 2, 200
Benefit-cost- ratio	≥ 3.2	≥ 3.5
Major areas of benefits	Technological, work factor	Technological, commercial[c]
Type of technology having a major impact, in volume of benefits	Propulsion, telecommunications	Electronics, optics, computers, electrical equipment
Time-lag in benefits (in years)	≤ 5	≤ 3[c]
Type of market undergoing a high impact, in volume of benefits	Space market	Diverse commercial and industrial markets
Main type of contracts generating the benefits, in volume	System and subsystem deliveries	Component manufacturing

a) European Space Agency 1977-1986 (1986 prices), CERN 1973-1982 (1982 prices).
b) European Space Agency 1977-1991 (1986 prices), CERN 1973-1987 (1982 prices).
c) This data is from the first CERN study but is assumed to apply to the second study, as well.
d) AU refers to European Space Agency Accounting Units (1 AU equals to roughly 1.2 Swiss Francs in 1982 prices).

Given the literature review on the impact of expenditures of R&D-intensive public organizations on suppliers , the following observations can be made.

First, it appears that technology-related purchases have an economic, multi-industrial impact.

Second, it appears that purchases by an R&D-intensive public organization have an impact on supplier value chain functions, notably on technology development, operations and on marketing. Moreover, the impact appears to be higher in cases where the products in question are linked to the core products of the supplier. The fact that the products are nevertheless buyer-specific, suggests that the supplier has been able to tap into some complementary assets provided by the buying organization. This would therefore lead to the conclusion that this process of utilizing complementary assets through vertical linkages further enhances supplier core competences and the long-term economic performance of the suppliers.

5. Conclusions and summary

This paper set out to answer two questions. First, given the institutional boundaries of a high tech-driven governmental organization, what is the optimal governance structure for technology-intensive supplier contracts? Second, what impact could such contracts have on supplier core competences?

The literature on transaction cost analysis was discussed to answer the first question. It identified high asset specificity as the reason why both the buyer and the supplier may need to make an effort to faciliate the exchange in a satisfactory way. Furthermore, it identified the hybrid form with a longer-term time perpective as the most suitable governance structure to surround transactions in a cost- and technology driven environment, given the institutional boundaries facing the buyer organization.

The literature on strategic management was then examined to answer the second question. The scope was extended beyond individual transactions. The literature acknowledged self-interest seeking behaviour resulting in creating a competitive

advantage by optimizing the value chain functions and by enhancing the core competences of the firm. However, the literature but did not describe the nature of these benefits.

Instead, the empirical research literature on industrial benefits of R&D-intensive public research centres gave a description of the benefits technology-driven customers can generate to their suppliers. It appeared that purchases by a R&D-intensive public organization has an impact on supplier value chain functions, notably on technology development, human resource management and on marketing. Moreover, the impact appeared to be higher in cases where the supplier was able to utilize the complementary assets offered by the customer to meet the buyer-specific requirements. Such vertical linkages could therefore further enhance the core competences of the suppliers.

REFERENCES

Alchian, A., Demsetz, H. (1972),"Production, Information Costs and Economic Organization", American Economic Review, 62(5):777-795

Aldrich, H., Whetten, D.A. (1981),"Organization-sets, action-sets and networks", in Handbook of Organizational Design, Nystrom, P.C., Starbuck, W.H. (eds.), Oxford: Oxford University Press

Alic, J.A., Branscomb, L.M., Brooks, H., Carter, A.B., Epstein, G.L. (1992), Beyond Spinoff: Military and Commercial technologies in a Changing World, Boston: Harvard Business School Press

Anderson, J., Narus, J. (1990),"A Model of Distribution Firm and Manufacturing Firm Working Partnerships", Journal of Marketing, 54:42-58

Anderson, J., Narus, J. (1996), “Rethinking Distribution: Adaptive Channels”, Harvard Business Review, (July-August): 112-120

Andrews, K.R. (1971), The Concept of Corporate Strategy, New York: Dow Jones-Irwin

Armour, H.O, Teece, D.J. (1980),"Vertical Integration and Technological Innovation", Review of Economics and Statistics, 62:470-474

Arrow. K.J., (1969), "The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Nonmarket Allocation", The Analysis and Evaluation of Public Expenditure: The PPB System. Joint Economic Committee, 91st Cong., 1st Sess., pp. 59-73

Axelrod, R. (1984), The Evolution of Cooperation, New York: Basic Books

Bain, J.S. (1959), Industrial Organization, New York: John Wiley

Balakrishnan, S., Wernerfelt, B. (1986),"Technical Change, Competition and Vertical Integration", Strategic Management Journal, 7:347-359

Balthasar, H.U., Boschi, R.A., Menke, M.M. (1978),"Calling the Shots in R&D", Harvard Business Review, (May-June):151-160

Barnard, C. (1938), The Functions of the Executive, Cambridge:Harvard University Press

Baumol, W.J., Panzer, J., Willig, R. (1982), Contestable Markets, New York: Harcourt Brace Jovanovich

Beamish P W, Killing J P (1997), Cooperative Strategies, Vol. 1-3, San Francisco: New Lexington Press

BETA (1980), The Economic Effects of ESA Contracts, Strasbourg: Universite Louis Pasteur, Bureau D'Economie Theoretique et Appliquee

BETA (1988a), Study of the Economic Effects of European Space Expenditure Vol. I: Results, Strasbourg: Universite Louis Pasteur, Bureau D'Economie Theoretique et Appliquee

BETA (1988b), Study of the Economic Effects of European Space Expenditure Vol. II: Report on Investigation Theory and Methodology, Strasbourg: Universite Louis Pasteur, Bureau D'Economie Theoretique et Appliquee

BETA (1989), Indirect Economic Effects of ESA Contracts on the Canadian Economy, Strasbourg: Universite Louis Pasteur, Bureau D'Economie Theoretique et Appliquee

Bezdek, R.H., Wendling, R.M. (1992), "Sharing Out NASA's Spoils", Nature, 355 (January 9):105-106

Blois, K.J. (1972),"Vertical Quasi-Integration", Journal of Industrial Economics, 20:253-272

Blois, K.J. (1980), "Quasi-Integration as a Mechanism for Controlling External Dependencies", Management Decision, 18:55-63

Bonoma, T.V (1982),"Major Sales: Who Really Does The Buying?", Harvard Business Review, (May-June):111-119

Boone, C., Verbeke, A. (1991),"Strategic Management and Vertical Disintegration: A Transction Cost Approach", in Microeconomic Contributions to Strategic Management, Thepot, J., Thietart, R.A. (eds.), Amsterdam:Elsevier Science Publishers B.V.

Cardozo, R.N. (1983),"Modelling Organizational Buying as a Sequence of Decisions", Industrial Marketing Management, XII:75-81

Casson, M. (1986), "Vertical Integration in the Shipping Industry", Journal of Transport Economics and Policy", XX,1 (January):7-29

Chapman, R.L., Lohman, L.C., Chapman, M.J. (1989), An Exploration of Benefits from NASA "Spinoff" (under NASA Contract 88-01 with NERAC Inc.), Littleton Co.: Chapman Research Group Inc.

Coase, R.H. (1937), "The Nature of the Firm", Economica N.S. 1937, 4:386-405

Commons, J.R. (1934), Institutional Economics, Madison:University of Wisconsin Press

Contractor, F.J, Lorange, P. (1988), Cooperative Strategies in International Business: Joint Ventures and Technology Partnerships between Firms, Lexington Mass.: Lexington Books/D.C. Heath and Company

Contractor, F.J, Lorange, P. (1988), "Why Should Firms Cooperate? The Strategy and Economics Basis for Cooperative Ventures", in Cooperative Strategies in International Business: Joint Ventures and Technology Partnerships between Firms, Contractor, F.J, Lorange, P. (eds.), Lexington Mass.: Lexington Books/D.C. Heath and Company

Cool, K. and Schendel, D. (1988),"Performance Differences among Strategic Group Members", Strategic Management Journal,9:207-224

Cunningham, M.T. (1980), "International Marketing and Purchasing of Industrial Goods - Features of a European Research Project", European Journal of Marketing, 14 (5/6):322-338

Dierickx, I., Cool, K. (1989),"Asset Stock Accumulation and Sustainability of Competitive Advantage", Management Science,35:12 (December), 1504-1511

De Bono, E. (1984),Tactics: The Art and Science of Success, Boston: Little, Brown

DeBruicker, F.S., Summe, G.L. (1985),"Make Sure Your Customers Keep Coming Back", Harvard Business Review, (January-February):92-98

Demsetz, H. (1988), "The Theory of the Firm Revisited", Law, Economics and Organization, 4,1:141-161

Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (1988), Technical Change and Economic Theory, London:Pinter

Dorf, R.C. (1988),"Model for Technology Transfer from Universities and Research Laboratories", Technology Management Publication, TM 1:302-312

Doz, Y.L. (1988),"Technology Partnership Between Larger and Smaller Firms: Some Critical Issues", in Cooperative Strategies in International Business: Joint Ventures and Technology Partnerships between Firms, Contractor, F.J, Lorange, P. (eds.), Lexington Mass.: Lexington Books/D.C. Heath and Company

Dyer, J. H. (1997), “Effective Interfirm Collaboration: How Firms Minimize Transaction Costs and Maximize Transaction Value”, Strategic Management Journal, 18:535-556

Evan, W.M. (1966),"The Organization Set: Towards a Theory of Interorganizational Relations", in Approaches to Organizational Design, Thomson, J. (ed.), Pittsburgh: Pittsburgh Press

Evans, M.K. (1975), Economic Impact of NASA R&D Spending, Bala-Cynwyd, Pa.: Chase Econometric Associates

Fama, E.F. (1980),"Agency Problems and The Theory of The Firm", Journal of Political Economy, 88:288-307

Fombrun, C.J. (1982),"Strategies for Network Research in Organizations", Academy of Management Review,7(2):280-291

Ford, D. (1980),"The Development of Buyer-Seller Relationships in Industrial Markets", European Journal of Marketing, 14 (5/6):339-353

Ford, D, Farmer, D. (1986), Make or Buy - A Key Strategic Issue. Long Range Planning. Volume 19(5): 54 - 62

Fusfeld, H.I., Haklisch, C.S. (1985),"Cooperative R&D for Competitors", Harvard Business Review, (November-December):60-76

Ghemawat, P. (1991), Commitment: The Dynamic of Strategy, New York: The Free Press

Gibbons, M., Johnston, R. (1974),"The Roles of Science in Technological Innovation", Research Policy, (November):

Godkin, L. (1988),"University's Role in Technology Transfer", Technology Management Publication TM 1:313-323

Goffman, I. (1969), Strategic Interaction, Philadlephia: University of Pennsylvania Press

Grossman, S., Hart, O. (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration", Journal of Political Economy, 94:691-719

Hagedoorn, J., Schakenraad, J. (1990), "Strategic Partnering and Technological Co-operation", in Perspectives in Industrial Organization, Dankbaar, B., Schenk, H. (eds.), Dordrecht: Kluwer Academic Publishers

Hamel, G. (1991), “Competition for Competence and Inter-Partner Learning Within International Strategic Alliances”, Strategic Management Journal. Winter Special Issue, 12: 83 - 104

Hamel, G. (1996), “Strategy as Revolution”, Harvard Business Review, (July-August): 69 - 82.

Hamel, G, Doz, Y L, Prahalad, C K. (1989), “ Collaborate With Your Competitors - and Win”, Harvard Business Review, (January-February): 133 - 139

Hamel, G, Prahalad, C K. (1994), Competing for the Future. Boston, Massachusetts, Harvard Business Books

Hayek, F. (1945),"The Use of Knowledge in Society", American Economic Review, 35: 519-530

Hayes, R.H. (1985),"Strategic Planning - Forward in Reverse", Harvard Business Review,(November-December):111-119

Hayes, R., Wheelwright, S. (1984), Restoring Our Competitive Edge: Competing Through Manufacturing, New York: Wiley

Hennart, J.F. (1988),"Upstream Vertical Integration in the Aluminium and Tin Industries", Journal of Economic Behavior and Organization,9:281

Håkansson, H. (1987), Industrial Technological Development: A Network Approach, Kent: Croom Helm

Håkansson, H. (1989), Corporate Technological Behavior: Co-operation and Networks, London: Routledge

Håkansson, H., Johanson, J. (1988),"Formal and Informal Cooperation Strategies in International Industrial Networks", in Cooperative Strategies in International Business: Joint Ventures and Technology Partnerships between Firms, Contractor, F.J., Lorange, P. (eds.), Lexington Mass.: Lexington Books/D.C. Heath and Company

Jackson, B.B. (1985),"Build Customer Relationship That Last", Harvard Business Review, (November-December):120-128

Janis, I.L., Mann, L. (1977), Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment, New York: The Free Press

Jarillo, J. C. (1988),"On Strategic Networks", Strategic Management Journal, 9:31-41

Jarillo, J. C., Stevenson , H.H. (1991),"Co-operative Strategies - The Payoffs and the Pitfalls", Long Range Planning, 24(1): 64-70

Jensen, M., Meckling W. (1976), "Theory of the Firm: Managerial Behavior, Agency Costs, and Capital Structure", Journal of Financial Economics, 3: 305-360

Kalawani, M, Narayandas, N. (1995), “Long-term Manufacturer-Supplier Relationship: Do They Pay off for Supplier Firms?”, Journal of Marketing, 59 (1): 1-16

Klein, B, Crawford, R G, Alchian, A A. (1978), “Vertical Integration, Appropriable Rents, And The Competitive Contracting process”, The Journal of Law and Economics, 21: 297 - 326

Konsynski, B.R., McFarlan, F.W. (1990),"Information Partnerships - Shared Data, Shared Scale", Harvard Business Review, (September-October): 114-120

Kotabe, M, Swan, K S. (1995), “High-technology New Product Development”, Strategic Management Journal, 16 (8): 621 - 636.

Kreps, D.M. (1990a),"Corporate Culture and Economic Theory", in Perspectives on Postive Political Economy, Alt,J.E, Shepsle, K.A. (eds.), New York: Cambridge University Press

Kreps, D.M. (1990a), A Course in Microeconomic Theory, Princeton: Princeton University Press

Learned, E., Christiansen, C., Andrews, K., Guth, W. (1969), Business Policy: Text and Cases, Homewood, IL: R. Irwin

Lederman, L.M. (1984), "The Value of Fundamental Science", Scientific American, 251(5), (November):

Lederman, L.M., Carrigan, A. (1987),"What Fraction of the U.S. GNP Makes Use of Devices Invented as a Result of the Success of the Quantum Theory of the Atom?", in Fermilab Industrial Affiliates Program, Annual Round Table Discussions, Batavia Ill.: National Fermi Laboratory

Leontief, W. (1966), Input-Output Economics. New York, Oxford University Press.

Llewellyn, K. (1931), "What Price Contract? An Essay in Perspective", Yale Law Journal, 40 (May): 704-51

Lyons, T.F., Krachenberg, A.R., Henke, J.W. (1990),"Mixed Motive Marriages: What's Next for Buyer-Supplier Relations?", Sloan Management Review, (Spring):29-36

MacMillan, I.C., Hambrick, D.C., Pennings, J.M. (1986), "Uncertainty Reduction and the Threat of Supplier Relatiation: Two Views of the Backward Integration Decision", Organization Studies, 7(3):263-278

Macneil, I.R. (1978),"Contracts: Adjustments of long-term economic relations under classical, neoclassical, and relational contract law", Northwestern University Law Review, 72: 854-906

Mariti, P., Smiley, R.H. (1983),"Co-operative Agreements and the Organization of the Industry", The Journal of Industrial Economics, 31:437-451

Mason, E. (1949),"The Current State of the Monopoly Problem in the U.S.", Harvard Law Review (June)

Mathech Inc. (1977), A Cost Benefit Analysis of Selected Technology Utilization Office Programs, Washington D.C.: NASA

Mathematica Inc. (1976), Quantifying the Benefits to the National Economy from Secondary Application of NASA Technology, Washington D.C.: NASA

Midwest Research Institute (1988), Economic Impact of NASA R&D Expenditures, for The National Academy of Public Administration, Washington D.C

Milgrom, P., Roberts, J. (1988), "An Economic Approach to Influence Activities in Organizations", American Journal of Sociology, 94:S154-79

Milgrom, P., Roberts, J. (1990)," Bargaining Costs, Influence Costs, and the Organization of Economic Activity", in Positive Perspectives on Political Economy, Alt, J., Shepsle, K. (eds), Cambridge: Cambridge University Press

Merten, U., Ryu, S.M. (1983),"What Does the R&D Function Actually Accomplish?", Harvard Business Review, (July-August): 24-26

Milward, B.H. (1982), "Interorganizational Policy System and Research on Public Organizations", Administration and Society: 457-478

Mintzberg, H. (1985), Of Strategies, Deliberate and Emergent. Strategic Management Journal. Volume 6. Pages 257 - 272

Mintzberg, H. (1988),"Opening Up The Definition of Strategy", in The Strategy Process: Concepts, Contexts, and Cases, Quinn, J.B., Mintzberg, H., James, R.M. (eds.), New York: Prentice-Hall

NASA (1990), NASA Spinoffs, Washington D.C.: NASA

National Academy of Public Administration. (1988). Economic Impact and Technological Progress of NASA Research and Development Expenditures. Washington D C, National Academy of Public Administration.

National Science Foundation (1990), National Patterns of R&D Resources: 1990, NSF 90-316, Washington D.C.: U.S. GPO

Nelson, R. (1959), "The Simple Economics of Basic Scientific Research", Journal of Political Economy, (June): 297-306

Nelson, R., Winter, S. (1982), An Evolutionary Theory of Economic Change, Cambridge: Belknap/Harvard University Press

Nordberg, M., Verbeke, A. (1996), Linking Competitive Advantage to Market Structure I: Transaction Networks and Exchange of Complementary Assets, Working Paper, Free University of Brussels

Ouchi, W G. (1980), “Markets, Bureaucracies and Clans”, Administrative Science Quarterly, 25 (March): 129 - 141

Penrose, E. (1959), The Theory of the Growth of the Firm, London: Basic Blackwell

Peteraf, M A. (1993), “The Cornerstone of Competitive Advantage: A Resource-Based View”, Strategic Management Journal, 14: 179 - 191

Porter, M. E. (1980), Competitive Strategy, New York: The Free Press

Porter, M.E. (1985), Competitive Advantage, New York: The Free Press

Porter, M.E., Fuller, M.B. (1986),"Coalitions and Global Strategy", in Competition in Global Industries, Porter, M.E. (ed.), Boston, Mass:Harvard Business School Press

Porter, M.E. (1990), The Competitive Advantage of Nations, London:MacMillan Press

Porter, M.E. (1992), Private discussions, May, Boston, Massachusetts

Prahalad, C.K., Hamel, G. (1990),"The Core Competence of the Corporation", Harvard Business Review (May-June):79-91

Provan, K.G. (1983),"The Federation as an Interorganizational Linkage Network", Academy of Management Review:79-89

Reichard, C.J. (1985),"Industrial Selling: Beyond Price and Persistance", Harvard Business Review, (March-April): 127-133

Reimers, N. (1980),"Survey of Directed Mechanisms for Innovation of University Research", Les Nouvelles, XV (2), June:79-88

Riordan, M.H., Williamson, O.E. (1985), "Asset Specificity and Economic Organization", International Journal of Industrial Organization, 3:365-378

Roberts, E.B. (1981), "Commercial Innovation from University Faculty", Research Policy, 10 (2), April:

Rosenberg, N. (1991), Scientific Instrumentation and University Research, CEPR Publication No. 262, Stanford C.A.: Stanford University

Rugman, A M. (1986), “New Theories of the Multinational Enterprise: An Assessment of Internationalization Theory”, Bulletin of Economic Research, 38 (2) May: 101 - 118

Rumelt, R. (1980),"The Evaluation of Business Strategy", in Business Policy and Strategic Management, 3rd ed., W.F. Glueck (ed.), New York: McGraw Hill Company

Schermerhorn, J.R. (1975), "Determinants of Interorganizationa Cooperation", Academy of Management Journal, 18:846-856

Schmied, H. (1975), A Study of Economic utility Resulting from CERN Contracts, CERN 75-5 DG, Geneva: CERN

Schmied, H. (1977), "A Study of Economic Utility Resulting from CERN Contracts", IEEE Transactions of Engineering Management, EM-24(4):125-138

Schmied, H. (1982),"Results of Attempts to Quantify the Secondary Economic Effects Generated by Big Research Centres", IEEE Transactions on Engineering Management, EM-29(4 November):154-165

Schmied, H. et al. (1984), Economic Utility Resulting From CERN Contracts (Second Study), CERN 84-14, Geneva: CERN

Schmied, H. (1987), "About the Quantification of the Economic Impact of Public Investments into Scientific Research", International Journal of Technology Management,
2(5/6):711-729

Schumpeter, J.A. (1934), The Theory of Economic Development, Cambridge Mass: Harvard University Press

Schumpeter, J.A. (1942), Capitalism, Socialism, and Democracy, New York:Harper

Schelling, T.C. (1960), The Strategy of Conflict, Cambridge: Harvard University Press

Shachar, J., Zuscovitch, E. (1990), "Learning Patterns Within a Technological Network", in Perspectives in Industrial Organization, Dankbaar, B., Groenewegen, J., Schenk, H. (eds.), Dordrecht: Kluwer Academic Publishers

Sheth, J.N. (1973),"A Model of Industrial Buyer Behavior", Journal of Marketing, 37 (October):50-56

Simon, H.A. (1972), "Theories of Bounded Rationality" in Decision and Organization, McGuire, C., Radner, R. (eds.), Amsterdam: North Holland Publishing Company

Slocum, J M, McGill, M, Lei, D. (1994), “The New Learning Strategy: Anytime, Anything, Anywhere”, Organizational Dynamics, (Autumn): 33 - 47

Spekman, R E. (1988), “Strategic Supplier Selection: Understanding Long-Term Buyer Relationships”, Business Horizons, 31: 75 - 81

Spekman, R.E., Johnston, W.J. (1986),"Relationship Management: Managing the Selling and the Buying Interface", Journal of Business Research 14:519-531

Stankiewicz, R. (1986), Academics and Entrepreneurs, Developing University-Industry Relations, London: Frances Printer Ltd.

Teece, D.J. (1984),"Economic Analysis and Strategic Management", California Management Review, XXVI (3) Spring:87-110

Teece, D.J. (1986), "Profiting from technological innovation; Implications for integration, collaboration, licensing and public policy", Research Policy, 15:285-305

Teece, D.J. (1988), "Technological Change and the Nature of the Firm", in Technical Change and Economic Theory, Dosi, G. (eds.), New York: Pinter Publishers

Teece, D J. (1991), Private discussions, November. Berkeley, California.

Teece, D.J., Pisano, G., Shuen, A. (1997),"Dynamic Capabilities and Strategic Management”, Strategic Management Journal, 18:509-533

Thorelli, H.B. (1986), "Networks: Between Markets and Hierarchies", Strategic Management Journal, 7:37-51

Utterback, J.M. (1971), "The Process of Innovation: A Study of the Organization and Development of Ideas for New Scientific Instruments", IEEE Transactions on Engineering Management, EM18(4), November:124-131

Van den Ven, A.H. (1976), "On the Nature, Formation and Maintenance of Relations Among Organizations", Academy of Management Review 1:24-36

Venkatesan, R. (1992),"Strategic Sourcing:To Make or Not to Make", Harvard Business Review, (November-December):98-107

Von Hippel, E. (1976),"The Dominat Role of Users in the Scientific Instrument Innovation Process", Research Policy, 5:212-239

Von Hippel, E, (1982), "Get New products From Customers", Harvard Business Review (March-April):117-122

Von Hippel, E. (1988), The Sources of Innovation, New York: Oxford University Press

Webster, F.E., Wind, Y. (1972), Organizational Buying Behavior, Englewood Cliffs, N.J: Prentice-Hall

Wernerfelt, B. (1984),"A Resource-Based View of the Firm", Strategic Management Journal, 5:171-180

Williamson, O.E. (1975), Markets and Hierarchies: Analysis and Antitrust Implications, New York: The Free Press

Williamson, O.E. (1979), "Transaction Cost Economics: The Governance of Contractual Relations", The Journal of Law and Economics, 22:233-261

Williamson, O.E. (1984),"The Incentive Limits of Firms: A Comparative Institutional Assessment of Bureaucracy", Weltwirtschaftliches Archiv 120:737-763

Williamson, O.E. (1985), The Economic Institutions of Capitalism, New York: The Free Press

Williamson, O.E. (1991a), "Comparative Economic Organization:The Analysis of Discrete Structural Alternatives", Administrative Science Quarterly, (June) 36:269-296

Williamson, O.E. (1991b), Private discussions , November, Berkeley, California

Williamson, O.E. (1996), The Mechanisms of Governance, New York: Oxford University Press

Zagnoli, P. (1988), Inter-Firm High Technology Agreements: A Transaction Cost Explanation, Working Paper, European University Institute, Firenze, Italy

Zajac, E J, Olsen, C P. (1993), “From Transaction Cost To Transactional Value Analysis: Implications for the Study of Interorganizational Strategies”, Journal of Management Studies, 30(1): 131 - 145