The Process of Vertical Dis-integration

An Evolutionary Perspective on Outsourcing

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THE PROCESS OF VERTICAL DIS-INTEGRATION: AN EVOLUTIONARY PERSPECTIVE ON OUTSOURCING

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Abstract

It is argued that an evolutionary perspective on firm boundaries with its strong focus on knowledge, as well as processes of search, learning and capability development is instrumental in developing a theory of firm boundaries that is close to managerial concerns. Building on insights in evolutionary economics, propositions are developed regarding scope, speed, and switching costs in the process of vertical dis-integration of which outsourcing is a particular instance. Current theories of firm boundaries give indication why certain activities might be candidates for outsourcing by stressing efficiency gains in terms of transaction and production costs. They overlook, however, that 'technologically separable interface' between activities might be not available in codified form, and neglect learning dynamics that lead to strategic consequences in terms of capability development and adaptability in competitive environments of varying dynamics. An evolutionary perspective on vertical dis-integration recognises that firms make contractual commitments and partly tacit capabilities develop in a path dependent manner. The fact that the firm's past casts a shadow on current governance options and possibilities to realise them complicates the process of governance change and imposes switching costs that impact the scope and speed of vertical dis-integration. An evolutionary perspective on vertical dis-integration also suggests considering long-term consequences of outsourcing decisions on the dynamic capabilities of the firm.

Key words: evolutionary theory, switching costs, governance change

JEL classification: C21 D21 D23

1. Introduction

In the development and diffusion of innovative technology, the needs of users influence the evolution of knowledge production. Similarly, the users of theory influence the evolution of knowledge production in theoretical advance. Traditionally, research in the economic theory of the firm has focused on one main user group: other economists interested in the theory of the firm. Yet, as organisational economist increasingly migrate to business schools, they may also become (once again)[1] more exposed and aware of other users' needs, namely, managers in charge of managing the process of governance change (who happen to decide when and how to adapt the scope of a firm's activities). This paper is concerned with the process, context and strategic impact of vertical dis-integration – letting suppliers take over activities previously performed in-house[2]. It develops propositions regarding scope, speed, and switching costs in the process of vertical dis-integration based on evolutionary economics (Nelson and Winter, 1982; Dosi and Marengo, 1994).

Consider that the worldwide value of mergers and acquisitions (M&A) has reached an impressive volume of $3.5 trillion in 2000. At the same time companies have to an unprecedented degree vertically dis-aggregated, and refocused their activities. The worldwide outsourcing market size is estimated to rise from US$ 21.3 billion in 1997 to US$ 59.6 billion by 2005, with an annual growth rate of 14%. (Gartner Group, 2000; Holmström and Roberts, 1998; ZengerandHesterly, 1997). Clearly, choosing and changing the boundaries of the firm is of great strategic concern. Current economic theories addressing the vertical boundaries of the firm (e.g. transaction cost economics, resource-based view) provide indications why certain activities might be candidates for outsourcing by stressing efficiency gains in terms of transaction and production costs. Unfortunately, to know what activities might be outsourced and why is a far cry from knowing what processes are required for implementing efficiency gains both in the short and also in the long run?

[1] It is interesting to note that the *patron saint* of the theory of the firm, Ronald Coase, suggests that attention should be directed to 'what managers do' (1988).

[2] Note that this paper is concerned with *'outsourcing as a process of vertical dis-integration were external suppliers take over value chain activities (be they primary or support activities) previously performed inhouse'*. Other authors misleadingly, use outsourcing to denote *'external procurement of activities'* that were never performed in-house (e.g. the typical make of buy decision).

This paper argues that an evolutionary perspective on firm boundaries with its strong focus on knowledge, as well as processes of search, learning and capability development is particularly useful for developing a theory of firm boundaries that is close to managerial concerns. Building on insights in evolutionary economics, propositions are developed regarding scope, speed, and switching costs in the process of vertical dis-integration of which outsourcing is a particular instance. Current economic theories of firm boundaries are briefly reviewed and found remiss in respect the process aspects and long-term consequences of vertical dis-integration (*2. Outsourcing: A brief review*). Next, an evolutionary perspective on vertical dis-integration is introduced (*3. Evolutionary theory and vertical dis-integration*). It recognises that firms make contractual commitments and partly tacit capabilities develop in a path dependent manner. The fact that the firm's past casts a shadow on current governance options and the possibilities of realising them, complicates the process of governance change by imposing switching costs that impact the scope and speed of vertical dis-integration. Importantly, search processes involving articulation and codification of partly tacit interfaces among capabilities are made explicit (*3.1. Switching costs during governance change).* An evolutionary perspective on vertical dis-integration considers that outsourcing processes take place in a particular competitive context where changes in this context and learning responses to those changes are seen as key drivers of long term changes in the distribution of capability maintenance and development among firms (*3.2. Competitive dynamics and vertical dis-integration).* Finally, an evolutionary perspective on vertical dis-integration suggests considering long-term consequences of outsourcing processes on the dynamic capabilities of the firm - the ability of firms to integrate, build and re-configure internal and external competencies to address changing contexts (4. *Vertical dis-integration and dynamic capabilities).* Implications for advancing the theory of the firm follow (*5. Conclusions*).

2. Outsourcing: A brief review

Managers are increasingly challenged to navigate in a 'new competitive landscape' (Bettis and Hitt, 1995) characterised by decreasing transaction costs due to technological advance in, and standardization of communication technology (Coombs and Metcalfe, 2000), a need to integrate increasingly diverse technology and knowledge domains per product offering (Pavitt, 1999), and intensified competition due to deregulation and rapid technological change and diffusion (Clark and Wheelwright, 1993; D'Aveni, 1994). At a governance level, firms have responded to these challenges with an increasing degree of corporate dis-aggregation accompanied by relational forms of outsourcing (Day and Wendler, 1999; Hamel and Prahalad, 1994; Zenger and Hesterly, 1997). For example, because information can be shared instantly and inexpensively among many people in many locations, the value of centralized decision making and expensive bureaucracies decreases.

More generally, outsourcing may be regarded as an organizational response to knowledge-based competition: A need to compete based on focussed and integrative learning, accessing external specialized knowledge, and developing relational advantages through inter-firm cooperation. Outsourcing is not a new phenomenon, however. Smith (1976) argued long ago that the division of labour enhances focussed skill development, and also influences the growth of differentiated knowledge production to fuel economic development (Foss, 1997; Loasby, 2001).

While the question, why firms should outsource certain activities is an increasingly relevant question for business practitioners it is also a central question in the perhaps dominating theories of the firm: Modern transaction cost economics and the resource based view (Williamson, 1975, 1985, 1996; Peteraf, 1993, Wernerfeld, 1984, Prahalad and Conner, 1996). How do these theories of firm boundaries help those in charge of managing governance change to decide when to outsource and to steer their firms through the process of shifting activities from internal to external procurement?

2.1 TRANSACTION COST ECONOMICS AND VERTICAL DIS-INTEGRATION

Over the last 25 years, modern transaction cost theory has emerged as the most often used theory of vertical boundary choice. It is premised on the idea that high levels of three transaction attributes – uncertainty, frequency, and especially asset specificity – are positively related to internal procurement of activities.[3] TCE suggests that outsourcing entails transaction costs including searching, contracting, controlling, and recontracting and that supplier markets do entail some risks for buyers with respect to price, quality, and time. Thus, one can suggest that activities are good candidates for external procurement where such costs will be low. Transaction cost economics (Williamson, 1979; 1985; 1996) speak to the question what variables influence outsourcing decisions by concentrating on required incentives to make asset-specific investments in support of a given transaction (Klein, Crawford, and Alchian, 1978). Placing the ownership of the assets in a given transaction into the hands of a single party improves the incentives for making efficient transaction-specific investments when contracts are incomplete and the cost associated with a hold-up is significant (Grossman and Hart, 1986; Hart, 1995). Investment incentives may be diluted when parties to a transaction are exposed to hold up risk in contractual relations. Such risk may be attenuated, however, either by the acquisition of residual rights to asset usage (Hart, 1995) or, more generally, by hierarchical governance to make provision for flexible adaptation in incomplete contracts (Williamson, 1991).

In sum, transaction cost economics seems to suggest that managers may consider a shift from internal to external procurement if production costs reductions can be obtained through outsourcing and hold up risks are low (Williamson, 1975, 1985, 1996). This will be the case if activities (1) do not require investments in specific assets that invite hold up, (2) are not subject to a high degree of environmental uncertainty, and (3) are those on which the firm relies infrequently (Aubert et al, 1996). This would imply that companies outsource commodity services (e.g. catering, cleaning) that involve low degrees of asset specificity. Yet, companies increasingly outsource activities (logistics, HR functions, professional services) that are frequently used, exhibit substantial uncertainty, and involve substantial degrees of

[3] There is mounting doubt that a high level of asset specificity and associated hold-up risks are a sufficient condition to justify internal procurement (Coase, 1988, Walker & Poppo, 1991). Relational governance and reputation-based mechanisms may substitute for hierarchical governance at lower costs (Holmström & Roberts, 1998).

asset specific investments (PWC, 1998). On the other hand activities that exhibit low asset specificity are kept in-house. Consider relative well standardised PC platforms of companies consisting of hardware, operating system platform, local packages perhaps interfacing with group ware tools, and backed up by corporate networks. Each of these activities (e.g. software installations, mainframe maintenance and update, networking operations) taken individually are commodity services with low levels of asset specificity, but nonetheless many companies prefer to keep all services in-house because selective outsourcing of individual services is prevented by interdependencies among them.

TCE has been critisized because it blackboxes the historical context, the interrelationship among transaction, as well as long term consequences of boundary choices (Chandler, 1992, Argyres and Liebeskind, 1999; Langlois and Foss, 1999). For example, Langlois and Foss, (1999) note that transaction costs economics is not sensitive to the efficiency implication of capability maintenance and development. Others argue that a better understanding of boundary decisions requires the recognition that prior governance choices constrain current outsourcing decisions (e.g. Argyres and Liebeskind, 1999). As Walker and Poppo (1991, p. 66) correctly note, "... how the theory should be used as a predictor of shifts in the *current boundaries* of the corporation is unclear (*emphasis added*)."

The fact that the firm's past casts a shadow on current governance options and possibilities to realise them complicates the process of governance change by imposing switching costs that impact the scope and speed of vertical dis-integration. An additional problem of TCE is that managers who shift "current boundaries" often cannot assume "technologically separable interface" between activities, as Williamson (1985: 1, chaper 3) seems to suggest.[4] In sum then, not only does transaction cost theory side-step process issues of governance change. It is also ill equipped to provide sufficient guidance for managers that need to evaluate how outsourcing – the process of shifting firm boundaries - influences the dynamic capabilities of the firm.

[4] Transaction cost theory has been widely used and critisized (e.g. Dosi & Marengo, 2000). The purpose here, however, is not to repeat problems others have discussed, but to emphasis the theories lack of a process dimension.

2.2. THE RESOURCE BASED VIEW AND VERTICAL DIS-INTEGRATION

The resource-based view suggests that differential firm performance is related to differences in a firm's costs and strategic advantages obtained through building, using, and defending resource positions (Barney, 1991; Rumelt, 1984; Peteraf, 1994). Factors, which influence how resource positions are build, used, and maintained rather than structural industry features alone, determine how firms increase the wedge between the willingness of customers to pay for product/service offerings and the opportunity costs of production and supply (e.g. Wernerfelt, 1984; Rumelt, 1984). For example, Barney (1991: 6) argues that competitive advantage and the earning of 'above normal returns' can be associated with resources that are "(a) valuable, in the sense that it exploits opportunities and/or neutralizes threats in a firm's environment; (b) it must be rare among a firm's current and potential competitors; (c) it must be imperfectly imitable; and (d) there cannot be strategically equivalent substitutes for this resource." Building on this perspective, Quinn and Hilmer (1995) suggest that firms concentrate on resources and capabilities where they can achieve pre-eminence and provide unique value for customers, while simultaneously shift to external procurement where a firm has neither a critical strategic need nor special capabilities.

One problem with this approach is that strategic capabilities and resources are often hard to identify in practice so that at any particular moment in time, managers face difficulties in judging whether they are dealing with resources and capabilities of critical strategic need. For example, many IT based airline reservation/logistic systems are today seen as crucial to an airline's competitive advantage. But such systems began as automation initiatives to save clerical costs, before they were seen as optimisation systems in an airline's logistic and flight schedule programming, to later assume the additional function as platform for electronic distribution channels. In this context, Earl (1996) argues that much of such IT capabilities is experimental, and IT users learn about strategic importance of such capabilities only after they experimentally discover what is possible and as the business context and needs change. The IT outsourcing bandwagon is littered with examples were companies though to outsource commodity services just to discover that they have compromised their strategic capabilities only few years later.

By implication, what resources and capabilities are judged as strategically critical might have to do with top management's imagination as much as with current activity performance. As Penrose (1959) notes: "…the productive opportunity of a firm must he shown to be limited in any period. It is clear that this opportunity will be restricted to the extent to which a firm does not see opportunities for expansion, is unwilling to act upon them, or is unable to respond to them" (pp. 31-32). Moreover, exactly because strategically valuable capabilities are causally ambiguous and socially complex (Rumelt and Lippman, 1982, Peteraf, 1993) they are often richly interrelated with other complementary resources and capabilities that do not meet the criteria outlined by Barney (1991).

Nonetheless, combining resource based and transaction cost reasoning, Quinn and Hilmer (1995: 56) suggest to simultaneously consider the potential for competitive advantage (resource based view) and the degree of strategic vulnerability (transaction cost economics) to make decisions on whether to outsource a particular activity. They recommend managers to answer the following questions: First, what is the potential for obtaining competitive advantage in this activity, taking account of transaction costs? Second, what is the potential vulnerability that could arise from market failure if the activity is outsourced? Third, what can we do to alleviate our vulnerability by structuring arrangements with suppliers to afford appropriate controls yet provide for necessary flexibility in demand?"

While these are important questions that may contribute to guiding a firm's outsourcing decision, they do little to help managers understand switching costs during the process of vertical dis-integration, fail to relate the process of outsourcing to competitive dynamics, and downplay long term consequences on maintaining and developing the dynamic capabilities of the firm. Moreover, both transaction cost economics and the resource-based view make heroic assumptions about human cognition and managerial discretion.[5] But boundedly rational managers (Cyert and March, 1963) who happen to decide on outsourcing and who have to manage the process of governance change often do not have relevant information at hand to answer the above questions. Instead they engage in experimental search and learning while identifying and discovering possibilities to improve efficiency under conditions of uncertainty and ignorance while changing the boundaries of the firm.

[5] The role of "bounded rationality" in TCE is restricted to only one of its implications: The inability and/or costs of writing complete contracts. The role of bounded rationality in the RBV is restricted to link one resource property (causal ambiguity) to difficulties of other firms for imitation.

3. An evolutionary perspective on vertical dis-aggregation

Unlike transaction cost theory and the resource based view, evolutionary theory (Dosi and Marengo 1994, 2000; Kogut and Zander 1992, 1996; Nelson and Winter 1982; Nelson 1991; Teece, Pisano and Schuen 1998; Teece et al. 1994, Winter, 1988; 1982; Foss, 1993) provides the kernel of a process theory of economic organisation. Although, evolutionary theory has not focussed directly on the question of vertical dis-integration, evolutionary theory yields important insights relevant to the process of outsourcing. For example, Teece et al (1994) suggest that the boundaries of the corporation can be understood in terms of learning, path dependencies, and the firm's relative competitive position in terms of capability maintenance, integration and development. In particular, evolutionary theorists assume three central elements of evolutionary explanations:

(a) Boundedly rational actors are assumed (Cyert and March, 1963; Dosi and Egidi, 1993; Nelson and Winter, 1982);
(b) The central unit of analysis are search processes, problem solving procedures and path dependent learning in organizations (Nelson and Winter, 1982, Winter, 2000),
(c) Sensitivity to the contextual embededness of organisational capability maintenance and development is emphasised (Dosi and Marengo, 1994, Nelson and Winter, 1982).

"Bounded rationality" means that human actors involved in complex problem solving are limited in knowledge, skills and time (Cyert and March, 1963). By implication, managers involved in changing the boundaries of the firm may not be expected to be in a position of an omnipotent decision-maker facing well-defined governance options. Decision parameters, might not be obvious to actors involved and search efforts to discover them are constrained by existing capabilities and incentives. By implication, changes in firm boundaries are likely to proceed along a sequence of

process steps best thought of as experimental search and learning process to discover possibilities for improvements in efficiency – both in the short and long run.[6]

'Bounded rationality' also implies a need for cognitive specialization. Routinized co-ordination in collective problem solving is a response to this need (Cyert and March, 1963; March and Levinthal, 1993). Nelson and Winter (1982, chapter 4 and 5) picture the firm as a repository of unique routines. As Winter (1982) points out, "[t]he coordination displayed in the performance of organizational routines is, like that displayed in the exercise of individual skills, the fruit of practice...the learning experience is a shared experience of organization members" (Winter, 1982:76). Many routines are the results of past decisions and experimentation (Grandori, 2001). Because adaptation of routines is slow, they survive personal turnover (March and Simon, 1958) and give stability to organizations and direction to their re-current activities (Cyert and March, 1963). Collectively, routines present a firm's capability - a collection of interdependent routines that '…confer upon an organization's management a set of decision options for producing significant output of a particular type' (Winter, 2000: 983). Because interfaces between routines develop via partly tacit, path-dependent learning by doing, they may constrain governance change as causal relations and interfaces between them are often based on tacit knowledge rather than explicit understanding (Nelson and Winter, 1982).

A focus on search and learning processes during vertical dis-integration as the central unit of analysis (Nelson and Winter, 1982, Winter, 2000) suggests that changing the boundaries of the firm is about the identification and discovery of possibilities to improve incentives and to enhance, via learning in continued interaction, the firm's capacity for collective achievement (Nelson and Winter, 1982). This process of vertical dis-integration (as other processes of system de-composition too) is a learning process, involving conjecture, trial and error (Loasby, 1976; Simon, 1969). There are also costs in the process of governance change that depend on the nature of linkages between system elements – for example linkages between the routines and capabilities may vary in their degree of articulation and codification.

[6] Dosi & Coriat (1998) recently stated a need to more clearly address the linkages between capabilities and incentives as two co-evolving and complementary sources of differential efficiency: "Steps [need to be taken] towards an appreciation of the co-evolution of (incentive effects), on the one hand, and 'what a firm is able to do and to discover on the other" (p. 105).

Often interfaces between organizational routines are made explicit the first time when organizations consider outsourcing.

Finally, the nature of learning processes during vertical dis-integration is influenced 'by particular characteristics of the environment' to which the firm is subjected (Loasby, 1976: 33). An evolutionary perspective emphasizes sensitivity to the contextual embededness of organizational capability maintenance and development (Dosi and Marengo, 1994; Teece, Pisano, and Shuen, 1998): "The core concern of evolutionary theory is with the dynamic process by which firm behaviour patterns and market outcomes are jointly determined over time… (Nelson and Winter, 1982: 18). Thus there are external factors in the competitive environment of the firm that limits or facilitates the potential scope for vertical dis-integration including the extent of the market (Smith, 1776), the nature of innovation regimes (Chesborough and Teece, 1996), all well as imitation dynamics (Nelson and Winter, 1982). An evolutionary perspective on vertical dis-integration considers that outsourcing processes take place in a particular competitive context that provides the opportunity for vertical dis-integration. Changes in this context (e.g. growth, industry life cycles etc.) and adaptive responses by the firm to those changes are seen as key drivers of long term changes in the distribution of capability maintenance and development among firms. In the following I develop propositions about the scope, speed, and impact of vertical dis-integration based the applied principles of an evolutionary explanation to the question of vertical dis-integration. In particular, I consider switching costs during governance change in section (3.1), competitive dynamics and vertical dis-integration in section (3.2) and finally, the impact of vertical dis-integration on dynamic capabilities in section (3.3).

3.1. SWITCHING COSTS DURING GOVERNANCE CHANGE

Even if a company could reliably identify why certain activities should be outsourced, an evolutionary perspective on governance change suggests that there are at least two process complications that give cause to switching costs: Governance inseparability and complementarity of capabilities.[7] For example, during outsourcing services former internal staff may go work for a potential vendor but how fast will they be

[7] Other limits to outsourcing may occur because markets are incomplete or non-existent (Dierickx and Cool, 1989).

integrated in the supplier system to provide services to their original company? Will the outsourcer loose absorptive capacity to an extent so that he fails to be a demanding customer and informed buyer? What will be the impact on the remaining business activities that were prior to vertical integration serviced in house? If interfaces between activities are not specified, how much parallel effort will it take to train specialists from vendors? What disruptions should one expect and how long will they last?

The switching costs associated with these problems are neglected in conventional theories of the firm, but they become obvious in an evolutionary process perspective. They can be exemplified, by processes of knowledge codification in the specification of interfaces, loss of absorptive capacity, and complications associated with integrating capabilities in the suppliers system. Only a part of such switching costs are foreseeable *ex-ante* (e.g. those that rest on enforceable punishment of breach of commitments). But to a large extent, switching costs (e.g. those that are due to separating jointly developed capabilities) can be only discovered during the process of governance change.

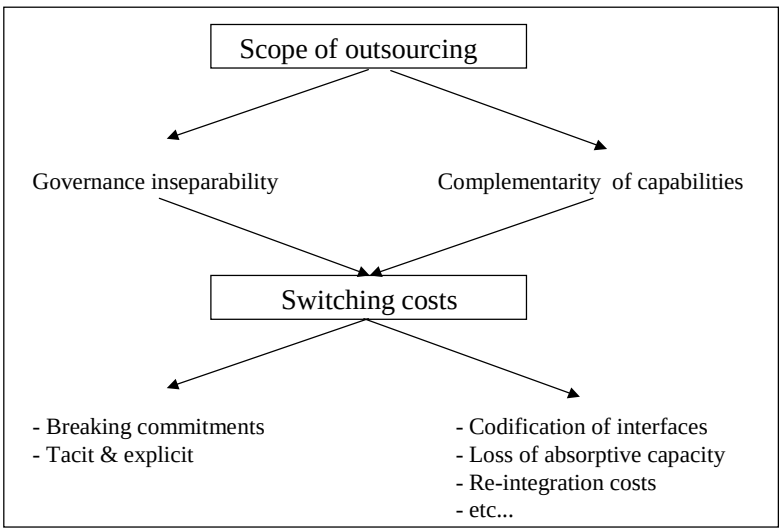

Figure 1: Governance change and switching costs

3.1.1. *Governance inseparability*

Argyres and Liebeskind (1999, 2000) recently suggested that prior contractual commitments made by a firm may limit its ability to differentiate or change its governance arrangements in the future. Rather than focussing on the characteristics of isolated transactions as in Williamson (1996) they argue that "…governance of any

new transaction in which a firm engages may become linked inseparably with the governance of other transactions in which the firm is already engaged." In essence, the authors assert that there are exit barriers on a governance level because a firm's past governance choices significantly influence the range and types of governance mechanisms that it can adopt in future periods. But the authors also introduce a crucial methodological point that bears resemblance to evolutionary reasoning (Argyres and Liebeskind, 2000: 238) since they point out that: "…focus on the transaction as the unit of analysis can obscure interdependencies between transactions."

To focus governance choice on individual transaction attributes may lead to inefficient choices because this overlooks possible impact on related transactions. In sum, firms cannot exist without making commitments (Kreps, 1990), but prior commitment presents limits to outsourcing. As a consequence, even when asset specific investments are not required for the efficient conduct of an activity, outsourcing options might be impeded by prior contractual commitments. Examples of related prior commitments include exclusive supplier or distributor arrangements, but also long-term employment contracts. Prior legal and psychological commitments with employees are an especially important factor influencing governance change. If a firm wishes to reduce employment levels during outsourcing, it might have to bear severance payments to laid off employees, suffer from declining reputation as a good employer, and/or deal with reduced morale among remaining employees (Matusik and Hill, 1998; Kreps, 1990). Thus, an evolutionary perspective on vertical dis-integration suggests the following refutable proposition:

P1: The scope of outsourcing will be lower with increasingly constrained labour markets and higher degrees of unionisation

3.1.2. *Complementary capabilities*

Complementarity of capabilities is the technical corollary of governance inseparability. It is an essential insight in the evolutionary literature that capabilities develop in a context-dependent and path-dependent matter (e.g. Nelson and Winter, 1982; Dosi and Marengo, 1994). Interactive learning steps taken in capability development involve tacit dimensions and causal ambiguity (Polanyi, 1966; Lippman and Rumel, 1982). Levitt and March (1988) suggest that learning of routines is often

local and interpretation of experience is difficult either because generalization are drawn from small samples in complex and changing environments or reflection is temporarily separated from action (Nelson and Winter, 1982). Capabilities are the harder to separate from each other the more linkages between them are based on experience based learning. Articulating such interfaces and combining capabilities within and between organizations is far from easy. Moreover, capabilities may not remain valuable to full extent detached from their context – the nexus of routines in which they have evolved and in which they are conducted.

Recent work in both organizational economics (e.g., Milgrom and Roberts 1990; 1995; Holmström and Milgrom 1991), the firm strategy literature (Dierickx and Cool 1989; Porter 1996) and the HRM literature (Becker and Gerhart 1996; Baron and Kreps 1999) has embraced this evolutionary insight to stress that activity systems are most effective when complementarities are manifest between their constituent elements. These interaction effects are the result of interactive, co-specialized, and partly tacit learning of members involved in capability maintenance and development.

Complementarity obtains between two activities (say IT support and airline logistics) when investing in one of these raises the return from investing in the other one and vice versa (Milgrom and Roberts, 1991). Such interaction effects between activities, lead to efficiency in executing capabilities. But this very effect also induces inertia (Rumelt, 1995) that impedes changes in complementary activity systems. Thus, the flip-side of this coin is that complementary activity systems can constrain outsourcing possibilities of particular activities. Because lost interaction effects and knowledge-spillovers between activities diminish the effectiveness of the remaining activity system, firms that outsource particular activities (be they core or not) may suffer something akin to ‘phantom limb pains’ well known from medical cases. At times, capabilities cannot be separated nor contracted out without compromising complementarity in existing activity systems. Thus, an evolutionary perspective on vertical dis-integration suggests:

P2: The scope of outsourcing will be lower the more capabilities are based on experience-based knowledge

In sum, switching costs obtain when there are costs to breaking prior commitment and separating capabilities through interfaces that are tacit, causal ambiguous, socially complex or taken for granted.

3.1.3. *Specifying interfaces, knowledge articulation, and codification*

Before outsourcing of activities becomes possible, explicit specifications of interfaces among routines and activities must be created to facilitate efficient contracting and coordination of activities. Domberger (1998: 40) agrees, when he argues "a successful transition from vertical integration to market contracting cannot take place without and explicit specification of inputs or outputs. When such a change in mode of supply takes place specifications are typically revised, enhanced, or sometimes even compiled for the very first time." Specifications maybe either qualitative-narrative, or quantitative or contain a mix of both qualitative and quantitative data (Nellore and Söderquist, 2000). Additionally, in the specification of interfaces among activity systems, there are also several degrees of comprehensiveness that vary with positively with the uniqueness and complexity of activities at hand. Possibilities range from scarce specifications of requirements to rich description of procedures and context information.

A lack of explicit *ex-ante* specification often leads to costly delays in the process of vertical dis-integration. Bartelemy (2001) finds in a study of outsourcing that companies often cannot quantify such switching costs, but often take the time that internal employees spend helping and teaching vendors as well as disruptions that stem from a vendor's inability to react appropriately as a proxy. Grover et al (1996) argues that some interfaces of IT functions (e.g. data centers and network management) are increasingly standardized. Others by contrast are signified by much lower degrees of standardization (e.g. application engineering). Moreover, even if interfaces are specified to some degree, they may require complementary tacit knowledge. For example, when Air Canada outsourced its IT-logistic system to IBM, the systems operation broke down for 5 days and remained interrupted for another 3 month, causing substantial losses despite substantial up-front planning.

If interface specification requires additional articulation and codification of interfaces, one of the key concerns in the process of interface specification is to make decisions regarding what knowledge to articulate, to codify, and to which extent knowledge should be codified at which costs (Liebeskind, 1997). Approvingly,

Nelson and Winter (1982: 82) argue: "…it should be emphasised that cost matter. Whether a particular bit of knowledge is in principle articulable or necessarily tacit is not the relevant question in most behavioural situations. Rather, the question is whether the costs associated with the obstacles to articulation are sufficiently high so that the knowledge in fact remains tacit." Thus it is important to note that that specification processes are often riddled by imperfection, that they are time consuming, and costly.

Cowen and Foray (1997:595) describe codification of knowledge as a production process that includes "model building, language creation and the writing of messages." These sub-processes are performed in practice through brainstorming sessions, discussions in teams, writing down memos, and exchange of thoughts to generate interface specifications. If articulation, codifying and making explicit interfaces between activity systems (e.g. logistics and other airline operation) impose costly delays during governance change, it is useful to distinguish two categories of associated costs: direct production costs and residual losses. While the former captures managerial time spent to seek and describe knowledge, detach it from initial use or users, and to embody it in some adequate form to make it accessible and useful for the specification of interfaces among activities, the later concerns losses that occur because tacit knowledge can only be imperfectly codified into explicit knowledge.

Direct costs in the process of knowledge-codification are influenced by several cost-drivers. First, codification costs are the higher, the less the production process is codified *ex ante*. Second, the thicker and detailed the required descriptions of activity interfaces are (e.g. contextual features are added to a codified process description), the more time will be used and the higher the efforts of codification. Finally, the more activities are interconnected with other activities, the less partial codification is self-contained and sufficiently useful in isolation (Winter, 1987).

Residual losses occur because the richness and nuances of tacit knowledge are partially lost in the process of codification. Since tacit knowledge can not be completely converted into explicit knowledge, attempts to codification involve simultaneously an element of reduction – that is, abstracting away nuances and details required for knowledge-based performances. For example, MacKenzie and Spinardi (1995) showed in the case of nuclear weapon production that, despite substantial efforts of codification, tacit knowledge could not be codified to full extent. Likewise, Polanyi (1966) has earlier argued that tacit knowledge and explicit knowledge are

complements rather than substitutes. While explicit and codified knowledge is instrumental to develop tacit knowledge (e.g. a cook book aids cooking, but does not contain the ability to cook of the one who wrote it), tacit knowledge can be at best imperfectly described and encoded. It is thus that attempts to codify knowledge in the specification of interfaces are the more limited the more complex such interfaces are. Thus, an evolutionary perspective on vertical dis-integration suggests:

P3: The speed of the outsourcing process will be slower, the less interfaces between activities are specified ex-ante, and the more complex outsourced activities are.

While articulation and codification processes have been regarded as essential for learning in organization (e.g., Nelson and Winter, 1982, Mahnke, 1998, Zollo and Winter, 2001), the speed of the process of vertical integration is additionally influenced by two factors: The relative absorptive capacity (Lane and Lubatkin, 1998) and motivation of participants involved in the process. To illustrate, it is helpful to describe knowledge codification as a production process through which prior tacit knowledge is transformed into codified artefacts, such as interfaces among activities:

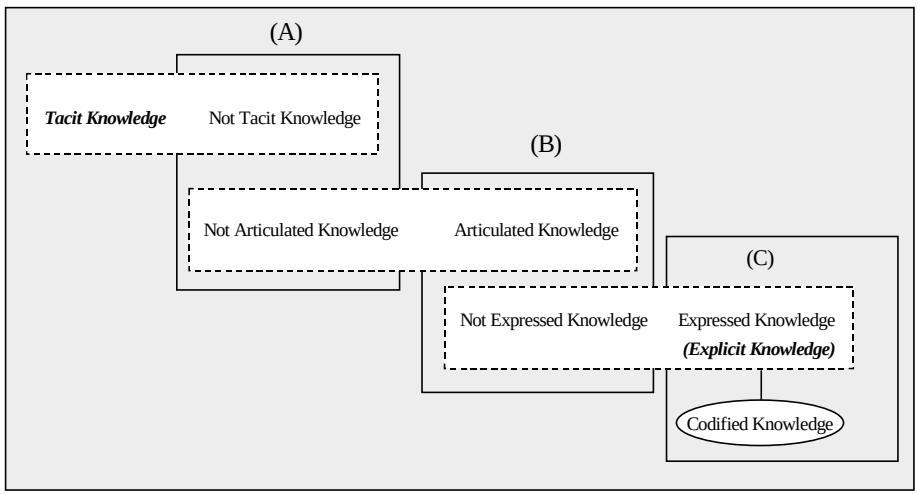

Figure 2: Knowledge codification as production process (Similar: Winter, 1987)

While Polanyi's (1966) distinction between tacit and explicit knowledge is integral to the more fine-grained distinctions made here (see also Winter, 1987), it is interesting to ask why some knowledge is not expressed to others? For knowledge to be codified it must be previously expressed. Calling for a realistic model of 'man',

Stein and Ridderstråle (1996) rightfully assert that individuals may not only know more than they can tell, they may also tell less than they know, and at times tell more than they know. Moreover, individuals may not articulate what they could articulate, and may not express to others what they articulate to themselves. For example, why should manager formulate particular knowledge about interfaces between activities, at least to himself, when there are obvious personal costs to do so while personal benefits are absent or hard to identify? When knowledge is articulated, at least in the mind of one person (e.g. conscious reason, internal speech), there arises the question whether it should be expressed to others and why this should be done? People may hideaway knowledge strategically to create dependencies (Pfeffer, 1982). They may hoard knowledge for later harvesting (Stein and Ridderstråle, 1996), or gain advantages in contractual exchange (Akerlof, 1970). Moreover, they may seek to avoid loss of face value by 'biting tongues' or 'swallowing pride' (Harre and DeCarlo, 1985), or circumvent political hazards or conflict in situations where people may know more than is legitimate to express (Goldhaber, 1993).

When one decides to keep knowledge to oneself, knowledge remains entirely personal, unexpressed and not displayed. When one decides to express knowledge to others, there is still no guarantee that those who receive this expression understand properly. This requires prior shared knowledge from which understanding and fast learning can proceed (Cohen and Levinthal, 1989). In sum, there are many reasons why people can know more than they tell and others understand, including a general impossibility to articulate, a cost/benefits analysis with negative results, a hoarding of articulated knowledge for strategic reasons, an inability of receivers to understand due to lacking shared codes (Kogut and Zander, 1992). To further complicate the picture, while there are many reasons why people know more than they can tell, want to tell, or are able to communicate, they may at times not only tell less than they could, they may also tell more (cf. Stein and Ridderstråle, 1996). For example, when they opportunistically distort and manipulate signals expressed to others (e.g. Williamson, 1996).

One reason for outsourcing is that external specialist are likely to be better specialists (Domberger, 1998). But no matter how good they are, they need to be able to communicate with internal staff and this depends on the motivation and ability of both parties involved in the process. If an activity has been badly managed internally due to a lack of specialist knowledge, will managers be any better at communicating

their need to external providers? Earl (1996) suggests that very often, a company needs to hire better specialists to ensure effective communication and also turn around internal performance before subcontracting to the marketplace: "In other words, to reduce initial risks in outsourcing, a company must be capable of managing … service first. Vendors may pull out at the first stage when they learn how weak the customer's … management is; they recognize that weak management is not an opportunity for profit taking but a recipe for conflict and dissatisfaction…[Additionally] if there are changes in the vendor's personnel or organization, the company has to invest in building new partnerships and understanding how things are done in the new regime" (p.27).

Some authors (e.g. Rebitzer and Taylor, 1991) argue that outsourcing is initiated to transform a resistant work force and slack activities in the organisation. However, when people fear to loose their job through outsourcing, how will this influence their motivation to make the process of vertical dis-integration work smoothly? Some employees may be kept in-house or be transferred to the external vendor to ensure some continuity of service. But the most capable employees with outside options in the labour markets will demand substantial mark-ups to stay with the prior company rather than seek opportunities elsewhere. In any case, motivating such employees to express and codify their knowledge will cost the outsourcer dearly be it in the form of higher vendor fees or internal motivation costs. Moreover, the departure of individuals will in any case compromise routines in which they are involved (Nelson, 1991; Simon, 1991). Thus one can suggest:

P4: The outsourcing process will slower and more costly, the less participants are capable and willing to articulate and share their knowledge with external vendors

In sum, the scope of activities that a firm can outsource at any point in time depends on prior contractual commitments and the consequences of breaking them, required articulation and codification of interface specification between activities that are intended to be transferred from internal to external procurement, as well as the capabilities and motivation of participants in the process of vertical dis-integration. Additionally, however, an evolutionary perspective on the process of vertical dis-integration considers that outsourcing processes take place in a particular competitive

context. As Langlois and Robertson (1995: 45) note, "…options for change at any given point are constrained by the nature of the environment at this point…dis-integration…depends on the existing distribution of capabilities."

3.2. VERTICAL DIS-INTEGRATION AND COMPETITIVE DYNAMCIS

Firms are not isolated entities; they are embedded in exchange and production relations (Granovetter, 1985). As a consequence, a firm's effort to maintain and develop capabilities is embedded in an external environment, which may be signified by either the industry in which it is active, the technology it applies or develops, or alternatively the wider institutional environment in which it is embedded. Thus there might be external factors in the competitive environment of the firm that limits or facilitates varying degrees of vertical dis-integration including the extent of the market (Smith, 1776; Stigler, 1951), the nature of innovation regimes (Chesborough and Teece, 1996), all well as imitation dynamics (Nelson and Winter, 1982).

3.2.1. The extent of the market

A first indication about the market context / vertical dis-integration relation can be derived from Adam Smith's (1776) argument that 'the division of labour is limited by the extent of the market'. For example, Young (1928) suggests that if firms in an industry are initially vertically integrated, an increasing division of labour becomes possible when output demand is large enough to support economies of scale in specialized production of intermediate products. Similar, Stigler (1951: 189) argues "that Smith's theorem suggests that vertical dis-integration is the typical development in growing industries, vertical integration in declining industries." In essence his argument rests on the assumption that the growth of a firm is constraint because it performs increasing and decreasing return activities simultaneously. It is only when the market for final output increases to sufficient degrees that increasing return activities may be beneficially vertically dis-integrated. However, while the extent of the output market may provide possibilities of specialization through vertical dis-integration, it is the distribution of capabilities in the competitive context of a firm that determines whether firms make use of possibilities of vertical dis-integration.

Schumpeter (1950) describes competitiveness of firms as the ability to carry out a range of competitive actions that are based on internally developed and externally accessed capabilities.[8] Whether or not capabilities can be successfully deployed depends, however, on how easy they can be imitated, protected, challenged by competitors, or, alternatively supported by complementors. In other words, they depend on the capability configuration of the competitive and institutional environment in which the focal firm operates; to which it responds; which it may try to shape, and on which it draws. Thus one can suggest:

P5: The greater the extent of the output-market the greater possibilities for vertical dis-integration of intermediate products; but the greater the competitive risk of knowledge imitation associated with outsourcing the less will firms outsource intermediate products.

3.2.2. Imitation dynamics

Firms engaged in outsourcing face a critical tension: successful outsourcing often requires putting valuable knowledge assets at risk. While vertical dis-integration may help companies to access capabilities that they cannot build in a reasonable time frame themselves outsourcing also gives vendors a window to valuable knowledge that they may leak to other clients including competitors. Despite valuable knowledge that leaks to competitors may be often hard to exactly imitate, leaking knowledge may also lead to innovative substitution that are based on a combination of leaked knowledge and complementary knowledge that is already in possession of competitors (Schumpeter, 1950). A particularly important aspect with respect to assess the risk of knowledge leakage is to what degree and how fast a firm's knowledge becomes outdated and obsolete through learning by others? By implication, whether or not increasing degrees of vertical dis-integration are associated with increasing imitation risk depends, *inter alia*, on the technology development path that characterises the environment in which the firm is embedded.

One way to describe technological dynamics, is to distinguish between technologies signified by (a) knowledge accumulation or (b) creative destruction (e.g.

[8] Such activities are performed based on the firm's current capability configuration and may include the generation of certain product qualities at particular cost levels, absorbing knowledge or integrating technologies, cooperating and exchanging knowledge with suppliers, reacting to competitive moves or launching innovative products.

Nelson and Winter, 1982; Langlois and Robertson, 1995; Malerba and Orsiengo, 1994). Building on Nelson and Winter's (1982) notion of 'technological regimes', Malerba and Orsiengo (1994) offer two specific patterns of technology development: Schumpeter I and Schumpeter II.[9]

Schumpeter-(I)-patterns of technology development are characterised by 'creative destruction' in the sense that technological advance rapidly substitutes for old technology. As the authors note: "New entrepreneurs enter an industry with new ideas and innovations, launch new enterprises which challenge established firms, and continuously disrupt the current ways of production, organization and distribution, thus wiping out the quasi rents associated with previous technological advantages" (Malerba and Orsiengo, 1994: 85). By implication, Schumpeter-(I) patterns of environmental dynamics stress the need to constantly access new technologies and constantly upgrade capabilities, while risk concerns regarding knowledge leakage might be of less relevance due to rapid obsolescence of capabilities. In other words: A more dynamic environment (e.g. creative destruction) de-emphasise competitive risks related to rapid imitation dynamics but instead stresses access to external knowledge and learning speed.

By contrast, Schumpeter-(II)- technologies are characterised by knowledge-accumulation in the sense that technological advance builds on and gradually complements existing technology. In such contexts, private firm knowledge is far less exposed to rapid obsolescence by technological advance made by other firms. Simultaneously, however, protection against knowledge leakage becomes relatively more important because competitors are more likely to command requisite absorptive capacity (Cohen and Levinthal, 1989) that makes imitation a viable competitive threat. Thus, an evolutionary perspective on vertical dis-integration yields the following refutable proposition:

P6: The degree of vertical dis-integration will be lower in firms operating in Schumpeter-(II) technological regimes than in firms operating in Schumpeter-(I) technological regimes.

[9] For a possible operationalization of technological regimes see Malerba & Orsiengo, (1994).

3.2.3 Innovation regime

With regard to Schumpeter (I) environments, Chesbrough and Teece (1996) suggest that degrees of vertical dis-integration might be additionally influenced by the nature of technological innovation in question. Increasingly diverse technology and knowledge domains per product offering (Pavitt, 1999) may lead to failure in companies to continue developing all technologies internally that they require for innovative product offering. But outsourcing innovative activities can be complicated to the extent that one innovative activity depends on simultaneous development of another. While autonomous innovation can be pursued independently from other innovations, the benefits of systemic innovation can be realized only in conjunction with related, complementary innovations. If innovation are of the systemic type in the sense that simultaneous innovation in a related technology are required, then coordinated adjustment and information flows between development efforts are required because R&D managers must absorb each others research findings and follow product experiments. If this is the case, on can propose that

P6: Degrees of vertical dis-integration among innovating firms will be lower the more they are engaged in systemic innovations

In sum then, as a consequence of the arguments presented above this paper has argued based on principles of evolutionary explanations that the scope of vertical dis-integration will be lower if firms operate (a) in constrained labour markets; (b) in Schumpeter-(II) technological regimes; (c) with higher degrees of unionisation; and (d) when they are engaged in the development of systemic innovations. Furthermore, the process of vertical dis-integration will be slower and more costly, the (e) more capabilities are based on experience-based knowledge; (f) the less interfaces between activities are specified ex-ante, the more complex outsourced activities are, and (g) the less participants involved in the process of governance change are capable and willing to articulate and share their knowledge with external vendors.

4. Vertical dis-aggregation and dynamic capabilities

Much of the current literature on outsourcing stresses the short-term impact of outsourcing on procurement costs as well as flexibility to reduce and expand productive capacity to address changing patterns of demand (Domberger, 1998). An evolutionary perspective on firm boundaries adds to this that the most significant impact of vertical dis-integration concerns the influence of firm boundaries on the dynamic capabilities of the firm - the ability of firms to integrate, build and re-configure internal and external competencies to address changing contexts (Teece, Pisano, Shuen, 1998).

There is increasing consensus that firms as institutions are neither exclusively loci of problem solving, via capabilities or loci of conflict resolution via incentive structures – they are both (Foss, 1993; Dosi and Coriat, 1998; Dosi and Marengo, 2000). As Nelson and Winter (1982: 108) argue: "…some sort of stable accommodation between the requirements of organizational functioning and the motivation of … organizational members is a necessary concomitants of routine operation." Thus incentives and capabilities are interrelated, and both underpin the dynamic capabilities of the firm. A central question then becomes how increasing degrees of dis-aggregation change incentives on the one hand, and the ability to access, maintain and develop capabilities on the other.

First, organizations are often constrained in differentiating their incentives, which may impede their ability to adapt to changing environments. This is mainly because a shift to high-powered incentives (Williamson, 1985) could break prior contractual commitment (Argyres and Liebeskind, 1998), may be regarded as unfair (Pfeffer and Langton, 1993), or else, is simply incredible (Kreps, 1990; Williamson, 1985). For example, implicit contracts between divisions and corporate headquarters usually incorporate a sharing rule to carve up corporate profits (Argyres and Liebeskind, 1999). Would top management decide that an internal venture requires more high-powered incentives (e.g. stock-options) to spur intrapreneurship, this could violate prior implicit contracts concerning profit sharing rules among divisions. At other times, providing high-powered incentives in firms faces limits due to pay comparison within organizations. Employees may reduce their effort when they perceive pay differences as inequitable (Pfeffer and Langton, 1993). With these difficulties present, it is not surprising that undifferentiated incentives are the rule rather than the

exceptions in firms (Holmstrom and Milgrom, 1991; Williamson, 1985). Increasing degrees of outsourcing can contribute to differentiate incentives because it makes top management's commitment to high-powered incentives more credible and social comparison issues might be relaxed when boundedly rational agents compare incentives more strongly within the boundaries of their firm rather than across it.

Secondly, Smith (1976) argued that the division of labour enhances skill development, and by implication, influences the costs of knowledge production. A greater division of labour increases productivity because the time spent on tasks is usually more productive to specialized firms that concentrate on a narrow range of capabilities. Similarly, Prahalad and Hamel, (1994) suggest that corporate dis-aggregation facilitates specialized learning. Empirical studies associate such work conditions with the attraction of talent and innovation (Zenger, 1994; Kamien and Schwartz, 1982). When interaction frequency increases (Demsetz, 1988) in a smaller subset of relations between actors, cooperation is facilitated (Axelrod, 1984), shared specialized codes, language, and coordination routines (Cohen and Bacadayan, 1994) emerge that facilitate knowledge combination (Kogut and Zander, 1992).

While specialized knowledge production has its advantages, an outsourcing firm has to consider that tapping into specialization gains of others is a complex process that spans across the outsourcer's and outsourcee's activity systems. When it is possible to dissect capabilities on the outsourcer's side there is no guarantee that efficiency gains are realized because the supplier need to re-integrate outsourced activities. Independently of how an integration of outsourced activities is achieved on the supplier side, it is well known from the literature on post-merger integration that such processes come with complications (Haspeslagh and Jemison, 1991, Jemison and Sitkin, 1986). Potential synergies (e.g. economies of scale and scope in various parts of the entire value chain) between new and prior performed activities might be available on the supplier's side. But integrating activities may also require substantial investments in, for example, transition teams, re-arranging knowledge and material flows, establishing advice networks, and encouraging cooperation (Hamel, 1991; Levinthal and March, 1993; Lawrence and Lorsch, 1967; Lyles and Stalk, 1996; Grant, 1996). Moreover, employees that are transferred from one to another company might react negatively to the new employer, see their career prospects compromised, or may reject a new working culture. Not in all cases do such integrative problems

occur, but when they do, associated activities impose process costs of governance change, which require consideration.

Increasing degrees of outsourcing may also establish a greater dependence for accessing external knowledge in the form of contingent work (Matusik and Hill, 1998) embedded in specialized supplies (Demsetz, 1988) or, else through inter-firm learning (e.g. Dyer and Nobeoka, 2000). But in a world where costs of knowledge production including learning and coordinating knowledge stocks are positive, new opportunities for using resources (Schumpeter, 1952) are easier to discover, know and act on for some relative to others. While the process of outsourcing can stimulate the creation of new knowledge by focussing learning in a narrower scope of activities, vertical dis-aggregation may compromise a firm's dynamic capabilities by loosing absorptive capacity (Cohen and Levinthal, 1989) that is crucial for further knowledge development. If loss of absorptive capacity impedes possibilities to take advantage of external knowledge sources and increases search costs to find specialised production partners, vertical dis-aggregation reduces the ability of the firm to access, integrate, and develop capabilities to address changing competitive environments. Thus, reaping specialisation gains through focused learning in a focal firm is limited by reduced absorptive capacity that prevents tapping into and taking advantage of external knowledge sources of suppliers. When outsourcing reduces absorptive capacity, long-term adaptability might be compromised, which imposes a long-term opportunity cost of experimental learning in exploring new competencies as a consequence of governance change.

On the other hand, if required absorptive capacity is not undermined to an extent that it impedes accessing and utilising external knowledge, increasing degrees of outsourcing may contribute to cure the learning trap of over-exploitative learning. Adaptation of capabilities requires exploitation and exploration of capabilities (March, 1991; March and Levinthal, 1993). However, while adaptation requires a balance between both, firms face difficulties to maintain this balance because successful routines tend to be reinforcing while incentives for selecting new initiatives are limited in variety. Competence traps (Levinthal and March, 1993) result from positive feed back between experience and competence. Firms engage in activities more frequently, in which they are competent, thus, exploiting past learning for further refinement rather than engaging in risky exploration. One implication of a competence trap is that costs of experimenting in areas outside current competence

increases the more remote such experimental learning is from the current competence base. To the extent that a firm becomes increasingly removed from relevant bases of experience and knowledge, the more vulnerable to changes in the environment it becomes (Levinthal and March, 1993; Tushman and Andersen, 1986). In such a context, increasing degrees of vertical dis-integration can contribute to break competence traps because firms are exposed to a greater variety of learning experience at a larger number of organisational interfaces.

To summarize, this section argued that vertical dis-integration can contribute to a firm's dynamic capability through focussed learning in the outsourcing firm, overcoming competence traps, and by limiting the risk of experimentation in the exploration of new competence. Outsourcing can also sharpen incentives to learn through re-drawing implicit contracts, relaxing social comparison issues and, by making credible commitments to high-powered incentives. On the other hand, outsourcing can have a negative impact on dynamic capabilities by undermining absorptive capacity, hollowing out current capability endowments, and increasing search costs in vendor selection.

5. Conclusions

This paper has argued that an evolutionary process perspective on firm boundaries with its strong focus on knowledge, as well as processes of search, learning and capability development is instrumental in developing a theory of firm boundaries that is close to managerial concerns. Building on insights in evolutionary economics, refutable propositions have been developed regarding scope, speed, and switching costs in the process of vertical dis-integration of which outsourcing is a particular instance. This paper has argued that the scope of vertical dis-integration will be lower if firms operate in constrained labour markets; in Schumpeter-(II) technological regimes; with higher degrees of unionisation; and when they are engaged in the development of systemic innovations. These propositions are not obvious in current theories addressing firm boundaries. Nonetheless they are of crucial managerial concern.

Current theories of firm boundaries give indication why certain activities might be candidates for outsourcing by stressing efficiency gains in terms of transaction and production costs. They overlook, however, that 'technologically

separable interface' between activities might be not available in codified form, and neglect learning dynamics that lead to strategic consequences in terms of capability development and adaptability in competitive environments of varying dynamics. An evolutionary perspective on vertical dis-integration suggests that the process of vertical dis-integration will be slower and more costly, the more capabilities are based on experience-based knowledge; the less interfaces between activities are specified ex-ante; the more complex outsourced activities are, and the less participants involved in the process of governance change are capable and willing to articulate and share their knowledge with external vendors. Thus, an evolutionary perspective on vertical dis-integration recognises that firms make contractual commitments and partly tacit capabilities develop in a path dependent manner. In addition an evolutionary perspective contributes to the literature by making explicit switching costs that impact the scope and speed of the process of vertical dis-integration. Finally, as far as managers are concerned, the evolutionary perspective on vertical dis-integration suggests considering long-term consequences of outsourcing processes on the dynamic capabilities of the firm. A managerial focus on allegedly easy to obtain short-term efficiency gains obscures the complexity that reflective practitioners have to deal with when changing the boundaries of the firm.

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