KNOWLEDGE AND THE BOUNDARIES OF THE FIRM: DESIGN AND PERMEABILITY[1]

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ABSTRACT: Organisational boundaries can be analysed via a variety of lenses – organisational design principles, transaction cost economics, property rights and agency theory, amongst others. We review these before taking a knowledge-based perspective to firstly explain how the boundaries of the firm are determined by the knowledge resources present, and second, to highlight how conceptualising the drivers of competitive advantage in terms of knowledge and learning create a backdrop for understanding the move towards intermediate or hybrid organisational forms most commonly characterised by strategic alliances. We subsequently propose that the exact location of these naturally more fluid boundaries of the firm that exist in conjunction with strategic alliances are not as important as the level of permeability of the organisational boundaries. Permeable organisational boundaries allow for more efficient use of key knowledge resources; for firms to make and buy the same activity simultaneously and for learning to occur – a key driver of competitive advantage for those that subscribe to the knowledge-based view or the dynamic capabilities view of competitive advantage.

Keywords: Cross-boundary knowledge transfer, agency theory, resource-based view, transaction cost economics, knowledge-based view of the firm

The determination of organisational boundaries is a classic theme of organisational theory and strategic management (Dunbar & Starbuck 2006; March 2007; Rumelt, Schendel & Teece 1994). Theories dealing with organisational boundaries range from organisational theories concerned with tasks and activities (Katz & Kahn 1966; Lawrence & Lorsch 1967; Thompson 1967), to theories of economic organisation focused on property rights and transaction costs (Alchian & Demsetz 1972; Grossman & Hart 1986; Jensen & Meckling 1976; Williamson 1975), and strategic theories of resources, capabilities and knowledge (Barney 1995; Foss 2002; McGee 2003; Teece, Pisano & Shuen 1997). Each of these perspectives tends to approach the question of organisational boundaries from a different perspective: task interdependency, residual property rights, transaction costs, dynamic capabilities, and so on. In doing so, each perspective provides valuable insights. These perspectives do involve some overlap, but they approach the boundaries of the firm question from different vantage points, using different units of analysis and methods. In doing so, these theories tend to recommend different rules for designing organisations and their boundaries, leading to potentially inconsistent design rules and prescriptions and thus possibly to poor organisational performance. In this paper, we review leading theories of organisation in relation to the design of organisational boundaries, and we highlight the benefits of an integrative perspective based on knowledge as a foundation for organisation theory. The major contribution of the knowledge perspective is a reconceptualisation of organisational boundaries in which alliances and other hybrid models can be explained. We go further to suggest that the nature of the organisational boundary in terms of permeability matters as much – if not more – as compared to where it is drawn.

We begin with a review of theories of organisations and boundaries in rough historical order, starting with functionalist, task-based theories. We then review the contributions of theories of economic

organisation (mainly property rights, agency, and transaction-cost economics). Strategic theories of organisation based on resources and capabilities are then presented.

In the third section of the paper, we discuss how emerging knowledge-based theories can be used to renew the analysis of organisational boundaries by integrating the question of where to draw the boundaries with that of managing their permeability.

TRADITIONAL THEORIES OF ORGANISATIONAL BOUNDARIES

Early theories of organisations (March 2007) conceived organisations as semi-open systems in interaction with their environments (Katz & Kahn 1966) where organisational design is contingent on environmental conditions (Lawrence & Lorsch 1967). These theories provided two broad sets of principles for drawing the boundaries between organisations and environments. The first principle concerns the size of the organisation: the existence of unused managerial services (Penrose 1959) stimulates organisational growth and enables economies of scale and scope (Chandler 1962). However, organisational growth itself also generates bureaucratic costs of administration and control (Pugh, Hickson, Hinings & Turner 1968), leading to diseconomies of complexity. The balancing effects of economies of scale and scope and diseconomies of complexity generate a self-regulating mechanism which automatically determines an optimal organisational size (Blau & Schoenherr 1971). This maximum size of the organisation thus determines how many activities and departments can be located within the boundaries of the organisation.

The second principle is based on the nature of the technology of the firm (Woodward 1965) and the type of task interdependency that exists (Thompson 1967). Thompson (1967) recommends that activities should be grouped together based on their degree of interdependency: pooled, sequential, reciprocal (in order of increasing intensity). Activities that are reciprocally interdependent should be located within the same organisational sub-unit, sequentially interdependent activities should be located next to one another, whilst activities that are merely part of the same organisational pool – say, payroll and R&D – can be quite distant from one another. This perspective leads to thinking about organisations as ‘loosely-coupled systems’ (Orton & Weick 1990). This contingent approach to organisational design based on the nature of interdependencies was primarily based on studies of manufacturing organisations, and predicated on facilitating a smooth flow of the manufacturing process. The perspective of semi-open systems indicates that the organisation exchanges inputs and outputs with its environment, through some well-specified interfaces. But outside of these ‘gates’ the boundaries of the organisation are not permeable. Therefore, such an approach does have its limitations: for example, it would not be capable of accounting for the externalisation of activities that are tightly coupled, as in the Toyota Production System (Womack, Jones & Roos 1990).

Theories of economic organisation acknowledge the importance of operational interdependencies and their impact on system efficiency, but argue that these are superseded by considerations of 'first-order economising' (Williamson 1991a) which involves the governance of asset residual rights, incentive structures, and transaction costs. According to Coase (1937) the boundaries of the firm are not determined by considerations of process interdependencies and production system efficiency, but by the relative costs of market transactions relative to entrepreneurial coordination within the organisation. Williamson (1975; Williamson 1991a) develops this line of theorisation by proposing that economic governance covers more than the market/firm (hierarchy) dichotomy to encompass hybrid forms, depending on the degree of asset specificity, the risk of opportunistic behaviour between contractants, and the frequency of transactions. Thus organisational boundaries depend on the ability of managers to draw up contracts covering the contingencies of their transactions: high asset specificity and high exposure to opportunistic behaviour lead to the internalisation of the activity within the boundaries of the firm.

Agency theory (Jensen & Meckling 1976) takes Coase's arguments in a slightly different direction. Instead of opposing managerial 'fiat' (Williamson 1975) and market contracting, agency theory conceives of the firm as a nexus of contracts, within and beyond its boundaries. In this perspective, organisational boundaries are not drawn based on the costs of transacting, but according to the costs of monitoring the execution of contracts. Market-based transactions are based on relatively easily defined terms (price, quantity, specification, delivery date, and so on), whilst internalised transactions involve ill-defined terms (such as levels of service), require the monitoring of behaviour and require the institution of incentive structures to align the interests of agents (managers and employees) with those of principals (shareholders). Thus, in the perspective of agency theory, the boundaries of the firm are determined by agency costs and the ability of principals to monitor the behaviour of their agents.

Grossman & Hart (1986) develop a theory of property rights which goes some way towards providing a synthesis between transaction costs and agency costs. They suggest that the scope of the firm is determined by residual rights, or those rights over assets that cannot be easily specified *ex-ante*. The theory of residual rights thus explains vertical (dis–) integration in terms of the differential incentive structures afforded by market transactions versus managerial authority.

The limitations of these theories of economic organisations have been widely noted: they assume quasi-substantive rationality on the part of principals and agents (Tsang 2006), they are predicated upon situations of market equilibrium and thus are ill-equipped to account for the evolution of structures over time (Rumelt et al. 1994), they embody assumptions about human behaviour that are

extreme and not borne by empirical evidence (Bromiley 2005; Tsang 2006) and it is argued that they to lead to self-fulfilling prophecies (Ghoshal & Moran 1996).

Perhaps most significantly, the boundaries of a firm in terms of what is completed internally versus what is undertaken via market-based contracts tends to treat boundaries as absolute. That is, either an activity is undertaken internally or externally and that by considering all of the activities completed by a firm, it is possible to draw some activity boundaries around a firm. The problem, as Harrigan (1985) notes, is that firms may both make and buy a particular input. For example, a firm may 'buy' recruiting services for some of its positions and it may 'make' the same activities for other positions. Bradach and Eccles (1989) suggest that it therefore necessary to consider the whole organisational structure rather than just individual transactions one at a time. In this respect, the knowledge-based perspective with its ability to easily account for alliances and its focus on the knowledge underpinning routines central to an organisation's operations provides a useful approach for furthering this field.

KNOWLEDGE-BASED PERSPECTIVE: BOUNDARIES AND PERMEABILITY

Firms are far more than transactional vehicles: they provide the basis for generating, sharing and applying knowledge (Kogut and Zander 1996) – something that is not well accounted for within the economic theories concerning organisational boundaries. In this sense, knowledge and resource driven theories of firm provide not only an alternative perspective for understanding firm boundaries, but they do not divorce the boundaries of the organisation question from the value creation question (whereas transaction cost economics and agency theory are best utilised at the corporate strategy rather than the business strategy level).

The knowledge-based theory of the firm has emerged from the resource-based view of the firm (Grant 1996; Spender 1996) and is antithetical to established theories of the firm in that it shifts the focus from value appropriation to value creation (Ghoshal & Moran 1996). A knowledge-based perspective suggests that organisations which have superior knowledge resources are able to coordinate and combine their traditional resources and capabilities in new and distinctive ways (Teece et al. 1997). Furthermore, the knowledge-based view of the firm challenges traditional views of organisational structure. According to Grant (1996) this requires changes to hierarchy and decision making, especially regards shareholder resolution of agency problems through financial incentives. Possessing knowledge relevant to key activities within an organisation is one argument for using hierarchies rather than markets. In essence the potential for this knowledge to be exploited as part of attaining a competitive advantage or to further develop and build on this knowledge via learning is a central reason for relying upon hierarchies (Kogut & Zander 1996; Langley 1999).

Paradoxically however, when organisations have this knowledge is also the best time to use markets because they are well positioned to 'select capable suppliers, effectively monitor their progress, and effectively share knowledge with them' (Mayer & Salomon 2006: 943). In these situations, by knowing more, organisations can coordinate loosely coupled networks of suppliers of equipment, components and specialised knowledge and maintain capabilities for systems integration (Brusoni, Prencipe & Pavitt 2001) – enhancing the potential for competitive advantage. Creating networks enables the organisation to benefit from integration and specialisation in a manner that is most likely more difficult to replicate than if the knowledge was simply held internally. Thus knowledge specialisation has profound implications for the evolution of an organisation's cognitive and coordination mechanisms, and the relationship between the organisation's production and knowledge boundaries (Brusoni et al. 2001). Thus the boundaries of the firm are determined by the limits of the knowledge held.

As an organisation grows and develops, and the people within the organisation grow their knowledge and move in and out of the organisation, there is never a perfect congruence between the activity boundaries of the firm and the knowledge boundaries of the firm. Furthermore, people are boundedly rational and have incomplete or imperfect information, fragmentary knowledge of consequences and do not systematically compare all alternatives (Simon 1957). Thus the idea of individual knowledge boundaries defined by mental models, shaped by experience and the ability to learn/unlearn, adds another layer of complexity to the question of where exactly the knowledge boundaries of the firm are located.

As the knowledge boundaries of the firm and the activity boundaries often fail to align, opportunities exist for alliances or other forms of intermediate or hybrid organisational structures. From a transaction cost perspective, inter firm collaboration, both in its bilateral and network forms, has been viewed as an intermediate organisational form (Grant & Baden-Fuller 1995). Under certain circumstances these hybrid modes can be superior to either market transactions or internal governance (Grant & Baden-Fuller 1995; 2004; Williamson 1991b). While thinking in ideal types can be a powerful sorting schema, in reality the boundaries of the firm have always been problematic. Boundaries were never as discrete as theorised because organisational structure is contingent on and adaptive to economic and environmental variables such as complexity, uncertainty and technology (Child 1975; Granovetter 1985; Pugh 1973; Quinn 1978). Thus the firm boundaries are not necessarily clearly drawn (Weick 1979) and interlocked behaviours extend beyond firm boundaries to encompass its supply chain partners, allies and stakeholders in strategic networks (Gulati, Nohria & Zaheer 2000).

In these hybrid forms, firms have pulled back their corporate boundaries through outsourcing and divestment of core activities. As a result, they have increasingly cooperated with other organisations to

engage in activities and access resources, including knowledge, outside their own boundaries (Grant & Baden-Fuller 2004). Essentially such firms are using contractual structures, especially strategic alliances, to replicate the vertical integration which previously existed internally (Williamson 1991b). While the knowledge-based view does provide a clear basis for the existence of alliances (imperfect alignment of an organisation's operational and knowledge boundaries) it does not address how the knowledge actually flows between organisations and instead implicitly treats knowledge like other tradeable assets without delving into the practical complexities of transferring knowledge across organisational boundaries (Grant 1996; Grant & Baden-Fuller 2004).

ORGANISATIONAL BOUNDARIES AND PERMEABILITY

To date, we have reviewed the principle theories concerning organisational boundaries. The result is that there is a variety of perspectives that when applied to organisations would yield different results in terms of the practical establishment of organisational boundaries. For example, in an organisation that is responsible for road design, building and maintenance, the reciprocal interdependency of the various activities would suggest that all such activities should be completed within the organisation. Using a transaction cost economics approach, the relatively low transaction costs, lack of specialised assets (and therefore low probability of opportunistic behaviour) would suggest that many of these activities are undertaken through market-based transaction. And finally, an appreciation of the knowledge base of most state-based road authorities would also suggest that the knowledge leakage from such organisations in recent years and the existence of only partial knowledge concerning many of the activities would lead to a hybrid model of organisational structure with strategic alliances being utilised extensively.

Does it matter that these different approaches to drawing organisational boundaries produce different results? Certainly we view the perfect alignment between the activity boundaries of a firm, the administrative or legal boundaries of a firm and the knowledge boundaries of the firm as improbable and certainly temporary in nature if ever observed. What all of these theories do, is highlight the need to move the discussion towards an integration of organisational boundaries and value creation. In this respect, the knowledge-based view of the firm and related knowledge driven theory concerning competitive advantage provide the best opportunity for moving this field forward in terms of the way that knowledge generation, sharing and application directly affects organisational structures.

Perhaps most importantly, we propose that the exact location of organisational boundaries are not as important as the nature of these boundaries – and in this respect we propose that the permeability of the boundary is a critical dimension. Jacobides and Billinger (2006) introduce the notion of permeable organisational boundaries to explain how markets and hierarchies can be used simultaneously for the

same activity as permeability allows for inputs and outputs, and most importantly knowledge, of move relatively freely into and out of the organisation.

As permeability is a central concept for us in terms of better understanding the way that organisational boundaries are configured relative to operational boundaries and the necessary subsequent transfer of knowledge, we build on existing concepts in management as well as referring to biology – the original source of such concepts. To begin with, to explain how knowledge is transferred between (and within) organisations, we build on the 'collaborative membrane' metaphor used by Hamel (1991) – and borrowed from biology. We then make the 'semantic leap' (Cornelissen 2005) by articulating knowledge boundaries and processes through incorporating the other associated biologically-related concepts of permeability, and related terminology such as absorption, diffusion and solubility.

In biology, permeability refers to the rate at which a penetrant – liquid or gas – diffuses through a boundary (Massey 2003). Permeability is dependent on solubility, which refers to the penetrant and the structural characteristics of the barrier. There are few substances (only gases such as oxygen, nitrogen and carbon dioxide), which enjoy the ability of free or simple diffusion, i.e. the ability to move spontaneously across a barrier (Bolsover et al. 2004). In other cases the rate of passage of substances through a membrane are determined by temperature, concentration and pressure. Just as these factors are required to push molecules through a membrane, so the rate of knowledge flow between organisations is determined by factors such as criticality, strategic intent, transparency and receptivity or absorptive capacity.

In knowledge transfer terms the solubility analogy reflects how the complexity of the knowledge, i.e. the degree of explicitness or codification versus tacitness or embeddedness impacts its ability to move between organisations. While highly explicit knowledge may move freely across boundaries, tacit knowledge takes considerable time and effort to transfer, if it is able to be transferred at all.

Extra-organisational, as well as intra-organisational, boundaries can be conceptualised as semi- or selectively permeable membranes in the way that biological membranes are not equally permeable for all substances, but are selectively permeable, i.e. membranes can be permeated by a substance A but not by a substance B. For example, the GORE-TEX® membrane contains over 9 billion microscopic pores per square inch. These pores are 20,000 times smaller than a water droplet, but 700 times larger than a water vapour molecule, which makes the GORE-TEX® membrane completely waterproof from the outside, while allowing perspiration to escape from the inside (W. L. Gore & Associates 2007).

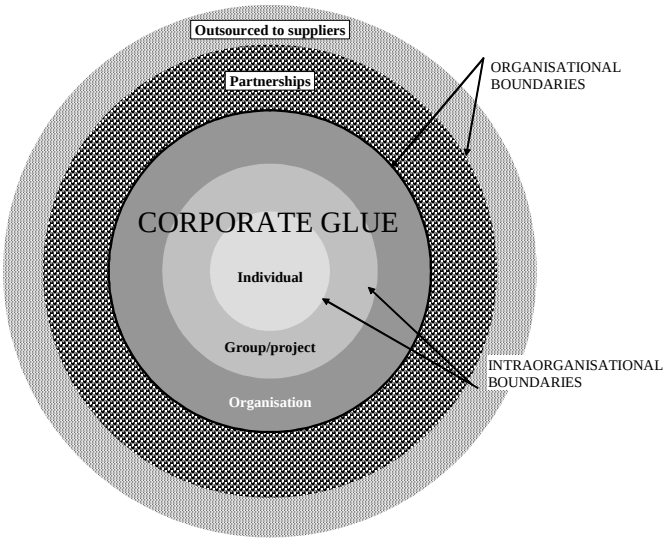
Using the GORE-TEX® example we are able to conceptualise why it easier for small amounts of simple or explicit knowledge which are easily understood by both partners to permeate through the

boundary. However, if you try and push something major through like a new system or something foreign and unknown, it becomes harder to understand, accept and assimilate. This situation can potential destabilise the whole system and the knowledge will either be rejected completely or if the boundary is permeable enough to take it there will have to be adaptation on the receiving end. In this way, organisations and their need to absorb new knowledge may be likened to cells which depend on balancing water uptake and loss and can burst if they take on too much water and collapse if they lose too much (Bell 2007). The GORE-TEX® example also explains how knowledge can be asymmetrically permeable. For example if one organisation values tacit knowledge and the partner in knowledge transfer values explicit knowledge and the membrane is designed to only allow for the flow of explicit knowledge then the knowledge flow with be asymmetrical. This raises the issue of compatibility when forming strategic alliances, as evidenced in the early years of General Motors' NUMMI alliance with Toyota. While NUMMI was outperforming comparable GM plants, early attempts to transfer knowledge from NUMMI to GM were unsuccessful because GM advisors did not have the capacity to absorb the knowledge (Inkpen 2005).

Absorptive capacity in the organisational context reflects the counterintuitive nature of knowledge processes. In biological terms diffusion is the movement of a substance from an area of high concentration to an area of low concentration until equilibrium is reached. Cohen and Levinthal (1990) term "absorptive capacity" as an organisation's ability to recognise the value of new, external knowledge, assimilate it and apply it to commercial ends (Cohen and Levinthal 1990). Absorptive capacity is linked to an organisation's prior related knowledge (Cohen and Levinthal 1990). Potentially, organisations with greater prior knowledge have a greater capacity to learn and absorb new knowledge.

Criticality refers to how urgent the task is, how core is it to the business and how much will it affect the bottom line. Furthermore, it is not enough to create knowledge, there must be an intent to use and share it, i.e. it must be translated into action before it is of worth (Macklup 1980, Dixon 2000, Inkpen 2005). As in biology, where few substances can freely diffuse, organisations do not spontaneously create knowledge out of experience – it takes intention for this to happen (Dixon 2000). The factors that determine transparency in a relationship between two partners include the degree to which one partner can penetrate the social context which surrounds the other partner and the organisations attitude towards outsiders (Hamel 1991). Critical to transparency and closeness between partners in knowledge transfer are relationships (Inkpen 2005) based on trust and value congruency, whether at an individual and organisational level (Aadne, von Krogh, and Roos 1996).

Figure 1: Organisational Boundaries and their Relative Permeability to Knowledge Transfer



Once it is understood how knowledge may move across boundaries, it is necessary to consider how firms might conceptualise their structure to facilitate this process. Based on the idea that the value chain might be dispersed across different owners but that they are controlled in economic terms through the operation of core competencies (McGee, Thomas & Wilson 2005), McGee (2003) develops the notion of the knowledge web which replaces the activity sets of the value chain with knowledge concepts – as shown in Figure 1. At the centre is what McGee (2003) refers to as the corporate glue, which is the organisationally embedded tacit knowledge (Badaracco 1991) or what Spender (1996) calls the collective knowledge. This corporate glue supports and is supported by core competencies, which in turn are buttressed by closely held partnerships (McGee et al. 2005). Subcontracting relationships for which market contracting in sufficient are more remotely managed (McGee et al. 2005). This blurring of the boundaries between markets and hierarchies indicates that they are more permeable than suggested by the economics of organisation (Foss 2002). Hamel (1991) proffers the useful analogy of a collaborative membrane to describe the permeability of this boundary. The extent to which the membrane is permeable and the direction/s in which it is permeable determine the capacity of knowledge flow and thus relative learning (Hamel 1991). At the heart of this permeability is the fluid nature of knowledge, rather than issues of structure – legal, governance or task (Hamel 1991).

Conceiving of an interorganisational relationship as a collaborative membrane suggests that access to people, facilities, documents and other forms of knowledge is traded or shared between partners in an ongoing process of collaborative exchange (Hamel 1991). By sharing skills and knowledge firms engage in learning – something that fundamentally affects where future organisational boundaries may lie.

In Jacobides and Billinger's (2006) longitudinal study of a fashion company they highlighted how opening up the firm's boundaries to manage different activities allowed them to leverage select capabilities within the value chain whilst simultaneously accessing external capabilities where necessary. The permeability of the organisational boundary enabled the 'more effective use of resources and capacities, better matching of capabilities with market needs, and benchmarking to improve efficiency' (Jacobides & Billinger 2006: 249) along with buffering the organisation against various cyclical risks.

In essence, whilst choosing where to be active in a value chain and what to make versus what to buy is still important, our work, along with that of Hamel (1991) and Jacobides and Billinger (2006) would suggest that it is the nature of the organisational boundary rather than the location of the organisational boundary that is most important. At the heart of the organisation is the core knowledge that forms the corporate glue that provides the organising logic for the firm. Outside of this there is a constant tension between the knowledge that an organisation has to complete a particular set of tasks and the constantly shifting knowledge boundaries of the firm. Permeability of organisational boundaries provides an effective way of interfacing with other organisations to benefit from their knowledge as well as effectively leveraging one's own knowledge base. Permeable organisational boundaries provides flexibility in respect of where organisational boundaries as various activities may be undertaken internally, externally or via an alliance as different points in time, or even at the same time. But fundamentally, permeability allows for organisational learning and potentially even transformational activities (as per Teece Pisano & Shuen 1997) to occur – providing the basis for sustainable competitive advantage as per dynamic capabilities theory.

CONCLUSION

This paper has outlined the problematic nature of the existing literature concerning establishing the boundaries of the firm – illustrating how different approaches yield different results concerning the theoretically optimal firm boundaries. Taking inspiration from the knowledge-based theories of Grant (1996) and Spender (1996) we suggest that this emerging view provides a clear lens through which we can explain the boundaries of the firm question – particularly the existence of strategic alliances. But more than this, the knowledge-based theories suggest a need for permeability in respect of firm boundaries (or what Hamel (1991) entitles a collective membrane) to allow for efficient use of knowledge resources (Jacobides & Billinger 2006).

Where an organisation has a surplus of knowledge relative to what is required for their activities, they may work with another organisation with specialised or complementary knowledge via an alliance to

assist them should they be deficient in this area. Similarly, areas of deficiencies can be filled via alliances with other parties to assist in that area. While these excesses and gaps could theoretically be filled via market-based arrangements, Grant (1996) posits that these are poor alternative due to the fact that the incentives in a one-off contract to provide a valuable (knowledge) resource are limited, as this will preclude further contracts and thus imperfect knowledge transfer is the likely best outcome. The ideal is to benefit from a two-way flow of information, knowledge and resources – the heart of the permeability concept.

These hybrid forms of organisations with less rigidly defined organisational boundaries are starting to work their way into the literature from a variety of perspectives. Key motives for such alliance structures are seen in transaction costs, competitive positioning and organisational learning (Davenport & Prusak 1998). From a transaction cost economic perspective, the governance of transactions, which involves contracting, control and incentive systems, is influenced by three factors: bounded rationality, opportunistic behaviour and asset specificity (Williamson 1981; 1991a). The knowledge-based view of the firm offers advantages over the traditional transaction cost perspective in understanding the drivers of collaboration (Grant 1996; Spender 1996). Certainly, the flow of knowledge, enabled by information and communication technology, is changing the way individuals and organisations interact and work, both within organisations and with those outside the boundaries of the organisation such as suppliers, consultants and contractors (Dixon 2000; Galbreath 2002).

In many instances these new organisational forms have seen the boundaries of the firm radically transformed, not only by increasing moves to outsourcing and other forms of relational contracting and networks, but because of the implications of the fluid nature of knowledge capital versus the relatively static nature of physical capital (Foss 2002; 2007; Galbreath 2002). Galbreath (2002) speaks of ‘extended enterprises’ and suggests that knowledge in the form of intangible ‘relationship assets’ may come to represent an organisation’s most strategic asset, ushering in what he terms the relationship age. In any case, it is necessary for academics to move beyond strict methods of determining organisational boundaries and instead move towards understanding that these boundaries will regularly change; that they may be messy due to the fact that firms make and buy the same activities simultaneously; and that the key issue is not so much where the boundary lies, but its characteristics in terms of permeability such that the organisation can effectively leverage its core knowledge and engage in organisational learning.

We have therefore proposed that knowledge transfer be conceptualised using the metaphors of permeability and other associated biologically-related concepts of permeability, and related terminology such as absorption, diffusion and solubility. In biology, permeability is determined by temperature, concentration and pressure. Just as these factors are required to push molecules through

a membrane, so the rate of knowledge flow between organisations is determined by factors such as criticality, strategic intent, transparency and receptivity or absorptive capacity. At the heart of the organisation is the core knowledge that forms the corporate glue that provides the organising logic for the firm. The challenges of imperfect information, transaction costs and the constantly shifting knowledge boundaries of the firm then create the conditions for forming alliances with external providers. There is therefore a need for permeability in respect of organisational boundaries such that there is an effective interfacing with other organisations to benefit from their knowledge as well as effectively leveraging one's own knowledge base. Permeable organisational boundaries provides flexibility in respect of where various activities may be undertaken in respect of organisational boundaries – internally, externally or via an alliance. And most importantly, permeability allows for organisational learning and potentially even transformational activities (as per Teece Pisano & Shuen 1997) to occur – providing a potential basis for sustainable competitive advantage.

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