

# **THE EVOLUTION OF CO-OPERATION**

**Neil M. Kay**

Economics Department,  
100 Cathedral St,  
University of Strathclyde,  
Glasgow, G4 OLN,  
UK

Tel: 0141-552-4400  
Fax: 0141-552-5589  
E-Mail: [n.m.kay@strath.ac.uk](mailto:n.m.kay@strath.ac.uk)

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## ABSTRACT

In this paper we develop an approach that may be helpful in analysing a variety of issues related to the evolution of corporate activity. We analyse the firm as an integrated system concerned with the management and organisation of internal and external linkages between businesses. It is argued that such a perspective can help illuminate a number of topics relating to the theory of the firm, including its boundaries and the mode of co-ordination of economic activity, particularly the choice between merger and co-operative modes. It is also suggested that the basic approach developed here may be extended to examine other phenomena related to the setting of firm boundaries and inter-firm relationships such as alliances, networks, and the role of small firms in co-operative activity.

# THE EVOLUTION OF CO-OPERATION

## 1. INTRODUCTION

In this paper we develop an approach that may assist in the analysis of a number of issues related to the evolution of corporate activity. The paper builds on the work of Kay (1997) and extends many of the arguments and findings of the earlier work within the approach developed here. However, the present approach is also able to integrate and extend some of the earlier arguments within a simplified and unified framework.

There has been a considerable literature on the nature and determinants of co-operative activity in a variety of literatures, often from different perspectives within the same discipline. Child and Faulkner (1998, pp.17-44) note that there have been different theoretical approaches to co-operative activity within economics (including market power, transaction cost, agency, and increasing returns approaches), as well as game theoretic, strategic management, and organisation theory approaches (the latter including resource dependence, organization of alliances, and trust approaches).

In turn, there has been a considerable amount of analysis on the possible motives for co-operative behaviour building on these perspectives, and Child and Faulkner devote a chapter to this topic and discuss the most important contributions (pp.65-83). This includes Aiken and Hage (1968) who saw co-operative behaviour in the form of joint ventures as driven by the need for resources<sup>1</sup>, and Kogut (1988) who saw joint ventures as opportunities to lower transaction costs, improve a strategic position and/or foster organisation learning<sup>2</sup>. They also cite Contractor and Lorange (1988a) who argue that seven objectives underlay various types of co-operative behaviour, namely; (1) risk reduction (2) economies of scale / rationalization, (3) technology exchanges (4) co-opting /blocking competition (5) overcoming government trade or investment barriers, (6) acquiring experience (7) vertical quasi-integration<sup>3</sup>.

Child and Faulkner also identify perspectives that see co-operative behaviour as being stimulated by external challenges, with companies responding to an internal corporate need that is best met by seeking a relationship with a another company (e.g. Nelson, 1995)<sup>4</sup> and perspectives that see internal stimuli as the source of co-operative behaviour such as alliances<sup>5</sup>. In this latter context, they draw upon a number of studies whose alleged motives for merger include resource deficiencies, learning opportunities, risk spreading, market access, access to R&D, reduction in transaction costs, and remedying poor performance. So to a large extent these studies tend to echo, and in some cases explore more deeply, the alleged motives for co-operative behaviour identified above in the Aiken and Hage, Kogut, and Contractor and Lorange studies.

However, there is a single, overarching problem with the motives for co-operative behaviour identified in all these studies. Replace “co-operative behaviour” (or “alliances” or “joint ventures”) with “internal expansion” (or “merger” or “acquisition”) in these last two paragraphs, and we would have a summary of generally cited motives for in-house alternatives to co-operative options<sup>6</sup>. In short, despite the considerable

volume of research and scholarship in this area in recent years, there would seem to be nothing substantive to distinguish potential motives for co-operation from potential motives for merger and acquisition. Indeed, it is tempting to suggest that it would have saved a great deal of time, effort and journal space had these studies taken an indicative checklist of reasons for merger and supporting analysis, and simply crossed out “merger” and replaced it with “co-operative behaviour”. More seriously, after all these studies into alleged motives for co-operative behaviour, we appear no closer to answering the basic underlying motive behind the question; “why co-operate rather than do-it-yourself?”<sup>7</sup>

The reason for this close convergence of motives across disparate modes is simple and straightforward. All of the above studies are mainly concerned with the question of the intended outcome of particular acts of co-operation, not the question of why that mode was chosen in the first place. In fact, if the motives for merger, acquisition, and various forms of co-operative behaviour did not coincide, we would have to conclude that there was something wrong or missing in the analysis since each of these modes are simply different ways of doing essentially the same thing, which is to combine and integrate what would otherwise be separate value chains. Indeed, what seems at first sight to be a disparate and varied set of apparent motives for each mode can essentially be reduced to at most three basic motives; (1) market power, (2) sharing or accessing resources (3) spreading risk. Each mode is an alternative way of achieving one or more of these three objectives, and it is really no more complicated than that. But the studies cited above of motives of collaborative activity tend not to reveal anything new about expected gains from integrating value chains that had not been revealed by earlier studies of merger and acquisition activity, and they typically do not reveal what motive might underlie adopting a collaborative arrangement rather than merger or acquisition alternatives. In turn, this means that potentially more complex questions (such as why joint ventures, alliances and networks have apparently only proliferated in recent years) are not even raised, or are at best subjected to ad hoc and unsatisfactory treatment.

In this paper, we pursue an agenda similar to that set out in transaction cost economics (Williamson, 1975, 1985 and 1996) in that we are largely concerned with questions relating to governance structures and the setting of the boundaries of the firm. However, the theoretical and empirical focus in transaction cost economics has been dominated by questions relating to vertical relations, especially the make-or-buy decision in production<sup>8</sup>. In this paper we deal with a wider range of issues<sup>9</sup>. In particular, the paper considers how the approach developed here may help to;

(1): Show why earlier corporate diversification may precede and trigger subsequent bursts of co-operative activity.

(2): Explain why firms involved in co-operative arrangements tend to be large and diversified.

(3): Show why merger waves may be a precursor to co-operative activity.

These points are all pursued in Sections 5 and 6 with the help of a simple model. In a further paper (Kay, 2005) we build on the approach developed here to look at further implications, with particular reference to the evolution of alliances and networks.

In the next section, we shall first of all set out the resource-based foundation of the approach developed here before considering the role and relevance of co-ordination costs to our analysis in Section 3. Section 4 sets out the basic assumptions to be used in the approach and discusses the purpose and reasonableness of each assumption. In Section 5 we develop the approach to show how different strategies are triggered and emerge at different stages in firm and sectoral development. Section 6 looks at the implications of the preceding analysis for a number of issues in the growth and expansion of firms. We finish with a short concluding section.

## **2. LINKS AND ECONOMIES OF SCOPE**

The role of *resources* in influencing the direction of expansion and the setting of firm boundaries has become an important area of study in both the theory of the firm and strategic management in recent years. Following the seminal work of Penrose (1959) in this area, a number of works have explored how a resource-based approach can contribute to an understanding of corporate growth and development<sup>10</sup>, and some have gone on to identify particular types or combinations of resources in the form of core or distinctive competencies or capabilities that may contribute to competitive advantage<sup>11</sup>. However, in the analysis that follows here, we shall take a broad-based interpretation of resources to refer to all assets of the firm, not just those that may be regarded as unique or distinctive. We shall start by looking at the role of links in generating economies of scope across value chains associated with different businesses. A *link* or linkage is established where similarities in the nature of resources associated with two or more value chains permit economies of scope to be achieved through some combination of shared resources. Figure 1 is adapted from Fig 4.2 in Kay (1997, p.62) and identifies some broad categories of resources that may be at least partially shared between the value chains associated with two business units selling two different products (for simplicity, we assume there is a single product associated with individual business units). The sources of economies of scope due to resource sharing actually lie at still lower levels than is illustrated in Figure 1, that is at the level of individual assets or resources. Economies may be obtained when a salesman represents two products rather than one, when products can share a single truck, when a tool can be applied to more than one type of output, when an R&D finding can be shared between products, and so on.

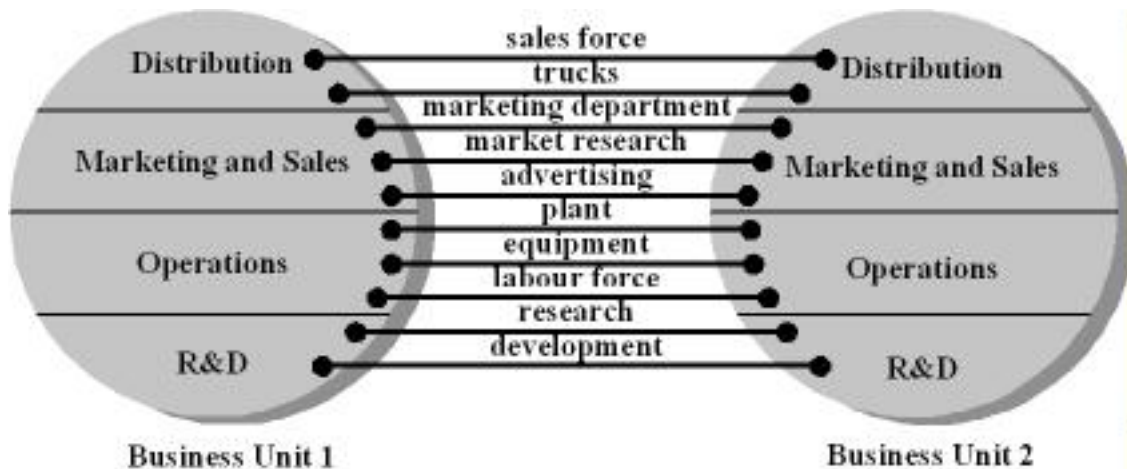


Figure 1: Some possible links between business units

Links between business units may vary from rich to poor. Where much physical and human capital is shareable between business units, economies of scope may be strong. On the other hand, where there is a high degree of asset specificity at the level of the product, economies of scope may be weak or absent altogether.

Clearly, linkages may be important in the context of *whether* the firm should expand the scope of its activities. There is also the issue of *how* the firm should expand, and this adds a further dimension to the expansion issue. In principle, there are a variety of ways (or modes) that a firm or firms may decide to create and/or exploit potential linkages between business units; these include internal expansion, merger, acquisition, joint venture, licensing and franchising. Each mode may have its particular advantages and disadvantages in a particular case. What we can say with a degree of confidence is that releasing economies of scope is unlikely to be a free good in any of these cases; release will have to be organised by the firms (or firms, in the case of co-operative arrangements). Such organisation is likely to absorb resources, especially managerial time.

In this paper we shall try to focus on the question of the choice of mode by making some simplifying assumptions. Merger will result in the combination of two firms in order to exploit a link or series of links, and a link itself is exploited between a pair of businesses within the firm. Co-operation can be subjected to a wider range of interpretations than merger, but here we will define it as the creation of a formal or informal contract between two firms to exploit a link or series of links. We shall assume that the only choice of mode for expansion purposes is between merger and co-operation, and we assume that each business is integrated to the same extent up and down its value chain.

Having restricted choice to these two modes and horizontal expansion, the next issue we shall look at in Section 3 is the relative efficiency of these modes in particular cases. Transaction cost economics (Williamson, 1975, 1985 and 1996) offers a framework for comparing the relative attractiveness of intra-firm mechanisms (such as merger) and

inter-firm mechanisms (such as co-operative agreements). A central premise of transaction cost economics is that asset specificity (assets specialised by use or user) is an essential pre-condition for market solutions to face transactional difficulties. However, the cases we are interested in all involve situations where assets are by definition not specialised by use or user; links signify that assets can be shared by different businesses, and in the case of co-operation, different users. At the same time, some arguments from transaction cost economics analysis of governance will prove useful later in this paper.

### 3. CO-ORDINATION COSTS

The conduct of economic activity requires co-ordination of the allocation of resources. Co-ordination is required both because some resources cannot direct themselves (e.g. plant, equipment, raw materials) or because some resources (labour, managers) might not align their efforts (decisions and actions) to fully coincide with enhancing the value of specified activities in the absence of some form of intervention. This latter problem leads to a number of issues discussed in principal-agent analysis particularly in terms of superior-subordinate control issues and the design of optimal incentive schemes<sup>12</sup>.

However, the managerial co-ordination problem involving misaligned decisions and actions is wider than the design of incentive schemes. In some cases interests and incentives may be irrevocably misaligned and indeed this misalignment may be both tolerated and desirable; for example, within a division an R&D scientist may be focused on innovative activity and a marketing specialist on sales promotion. Here the co-ordination problem does not involve applying devices to align the incentives and actions of these two individuals, but instead may involve deciding explicit directions, constraints on actions, compromises and trade-offs, given the irreconcilable objectives and goals of the different managers. Further, the firm may be faced with different areas or levels of managerial co-ordination and so there may be co-ordination costs associated with each level.

This echoes the notion of dynamic transaction costs (Langlois, 1991 and Langlois and Robertson (1995, p.35). Dynamic transaction (or governance) costs are “costs of persuading, co-ordinating and teaching” (Langlois and Robertson, p. 35). While the concept was introduced and applied to costs involved in relation to outside suppliers to the firm, Langlois and Robertson also recognise and explore ways in which it may be relevant to internal governance issues. Such issues go beyond the narrower interpretation of governance or co-ordination costs in Williamson (1985 and 1996) which tends to be largely concerned with the nature of assets and the extent to which they are specialised by use or user (asset specificity). Consequently, we use the term co-ordination costs here to distinguish these governance costs from the narrower interpretation of governance costs in transaction cost economics.

We shall argue that there three major levels at which co-ordination costs are likely to be encountered within the firm. (1) *Business-level co-ordination*: This involves value chain management by co-ordinating various R&D, operations, marketing, and distribution resources for a particular business. (2) *Link-level co-ordination*: This involves co-

ordinating the shared resources associated with a particular link in order to generate economies of scope. (3) *Firm-level co-ordination*: This involves co-ordinating the strategy of the firm overall, its direction, and the composition of business units within the firm.

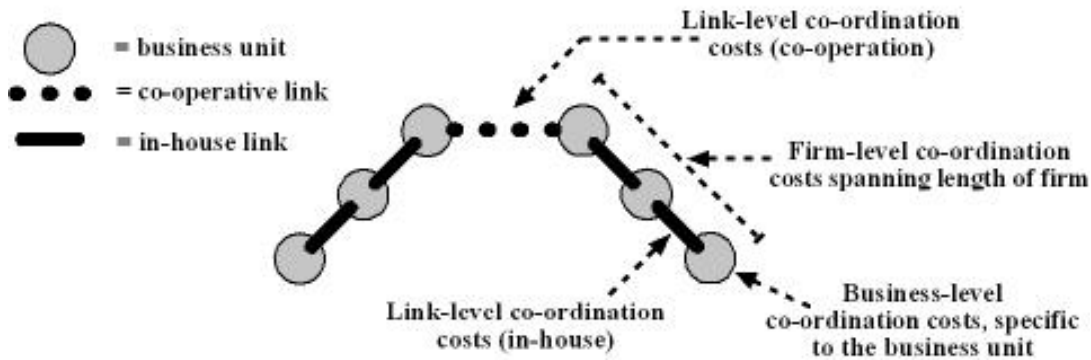


Figure 2: Levels of co-ordination costs

Each of these levels will absorb managerial time and attention and incur co-ordination costs, costs which will be exacerbated to the extent there are inconsistent interests amongst the parties involved in co-ordinating the relevant activity or activities. We can illustrate these aspects with the help of Figure 2. Figure 1 showed two business units with a number of possible categories of shared resources between them and in Figure 2 we show two firms exploiting particular linkages. The two firms both exploit links between pairs of businesses, and there is a further link exploited between the respective firms that is exploited through a co-operative arrangement. Thus, the two firms in Figure 2 are both composed of three businesses joined by in-house (solid) links.

Our firms have three potential sources of co-ordination costs, each associated with each of our three different levels of analysis. Firstly, there has to be *business level co-ordination*. Value chains do not organise themselves, and, as noted above, specialists may have very different agenda depending on their individual interests and their functional allegiances. Resources have to be expended at business unit level to integrate the complementarities to be found at this level and to resolve potential conflicts. If this business unit is a division, such efforts will be focused in the office of the divisional manager. Such business-level co-ordination costs will be incurred for each of the six business units shown in Figure 2.

Secondly, there has to be *link-level co-ordination*. Resources do not float around in some amorphous ether but instead have allocated homes within the firm. Usually, though not exclusively, these homes are business units<sup>13</sup> and the major purpose of resources within a business unit is to add value to the output of that unit. When a resource such as a sales force can add value through linkages, this adds a further level of co-ordination problems. For example, the sales forces associated with the two business units in Figure 1 may have partially overlapping territories and so there could be potential economies of scope from eliminating duplicated representation over the domain of the overlap. However, since



sales forces are likely to have first loyalty to their own business unit, such co-ordination may be difficult to achieve. Thus, in order to achieve gains in the form of economies of scope, co-ordination costs will typically be incurred at link level.

Figure 2 shows two forms of link-level co-ordination, in-house and co-operative. As discussed above, co-ordination costs are liable to be greater for co-operative arrangements between firms than in the case of in-house management since managerial allegiances to different firms are liable to force further inconsistencies in managerial intentions than would be the case if the management simply came from different business units within the same firm.

Finally, there has to be *firm-level co-ordination*, at headquarters level in the firm. Otherwise there would no direction for the firm in terms of instructions about whether and where to expand or contract activities. Such co-ordination will incur firm-level co-ordination costs expressed in the ability of management to process information and formulate strategy. Williamson (1975, pp.132-54 and 1985, pp.279-84, following Chandler, 1966) discusses how growth and diversification helps create control loss and strategy formulating problems in the case of functionally organised (U-form) firms. While the adoption of divisionalized (M-form) organisational structures may mitigate such co-ordination problems, it is assumed here that it will not eliminate them. We shall discuss in some detail in Section 4.2 how we might expect such firm-level co-ordination costs to change as a consequence of firm expansion.

Therefore, our firms may encounter three distinctive (though complementary) co-ordination problems in seeking to add value through their various activities. While we are discussing them in the abstract here, in practice actual patterns of deployment of managerial time and resources may indicate the existence of the different kinds of co-ordination problems. In some cases there may be a particular manager or managerial team allocated responsibility for dealing with a specific co-ordination problem, e.g. Divisional Manager (business-level co-ordination), Group Marketing (link-level co-ordination) and Board of Directors (firm-level co-ordination).

Having established our three levels of co-ordination costs, we can summarise the situation for the firms in Figure 2 as follows; both will incur business level co-ordination costs for three businesses each, and firm-level co-ordination costs as a consequence of running 3-business enterprises. Both also incur co-ordination costs for two in-house links and share co-ordination costs for one co-operative link. In the next section we shall build on these points to develop an approach that may be applied to problems of corporate growth and strategy.

#### **4: AN APPROACH TO EXPANSION OPPORTUNITIES**

Let us suppose we have identified a group of firms and that we are interested in exploring the efficiency implications of alternative methods of link co-ordination (and associated release of economies of scope) for the firms in this group. Figure 2 already shows one example of a group in which the two firms both exploit two links each in-house, and co-

operate in the organisation of a fifth link. However, the configuration shown in Figure 2 is not the only possible arrangement; for example the firms could merge and exploit all the links in-house within one large firm, or they could decide to break up the existing firms and convert in-house links into co-operative ones. It may even transpire that co-ordination costs exceed the benefits of link economies of scope whatever the mode of co-ordination, in which case the links should be abandoned. The important point is that each configuration of link co-ordination has alternatives, and efficient choice of mode of organisation requires that the opportunity cost of alternative configurations be taken into account.

This gives us the basic starting point from which we can start to analyse a variety of problems related to firm expansion, the setting of firm boundaries, and choice of mode of economic organisation for any given group of firms. To carry the analysis a stage further, we shall make a number of assumptions relevant to firms' expansion opportunities and then immediately discuss the purpose of each assumption.

#### 4.1: Assumptions

For a group composed of  $j$  firms we assume;

1. All businesses of firms in the group have equal value, growth prospects and levels of integration when considered as independent businesses.
2. Links between pairs of businesses in the group may be exploited through merger of firms or through co-operation.
3. At any particular stage, the ability of firms in the group to seek value enhancing link opportunities are subject to a constraint on the managerial resources available to explore such opportunities such that firms can add a maximum of one new link at any stage.
4. Links may vary in terms of their potential for generating economies of scope from the combination of resources
5. Business-level co-ordination costs at stage  $t$  for the group =  $aW_t$  ( $a > 0$ )

where  $W$  is the number of businesses operated by the group.

6. Firm-level co-ordination costs at stage  $t$  for the  $i$ 'th firm in the group operating  $W$  businesses =  $bX_{i,t}^k$  ( $i = 1 \dots j$ ;  $b > 1, k > 1$ )

where  $X$  is the total number of businesses operated by a specific firm and so total firm-level costs for the  $j$  firms in our group are;

$$\sum_{i=1}^j bX_{i,t}^k = b \sum_{i=1}^j X_{i,t}^k$$

7. For the  $Y_t$  links between businesses at stage  $t$  that are co-ordinated *within* firms, the total link-level co-ordination costs for the firms in our group are  $= cY_t$  ( $c > 0$ )
8. For the  $Z_t$  links between businesses at stage  $t$  that are co-ordinated *between* firms, the total link-level co-ordination costs for the firms in our group  $= dZ_t$  ( $d > c$ )

#### 4.2: Discussion of assumptions

Some of these assumptions lie at the heart of the arguments of this paper; the notion that link-level co-ordination costs are greater if exploited through co-operation rather than in-house (and so  $d > c$  in Assumption 8) is a case in point. Other assumptions are there simply to simplify the analysis; *Assumption 1* is an example of this. In practice, business-level considerations are important and indeed this is the level on which traditional Industrial Organization (IO) analysis has concentrated<sup>14</sup>. Here Assumption 1 means we hold this level constant, which allows us to concentrate on the implications of combining resources (and firms in the case of the merger option). Also, as we noted earlier we are not interested in vertical integration in this context and so are holding these aspects constant. *Assumption 2* means we can express the choice of mode in opportunity cost terms; if merger is adopted to exploit links, the opportunity cost is the value of the move had the opportunity been exploited using a co-operative arrangement, and vice versa. *Assumption 3* means that there are managerial limits to growth (Penrose, 1959) and has the implication that management will have to draw up a rank ordering of preferred links that they can pursue, one link at a time, as managerial resources available for expansion are released; *Assumption 4* allows for this hit list to be ordered along value-enhancing lines.

*Assumption 5* means that business level co-ordination costs are directly related to the number of businesses in the group. Assumptions 6, 7 and 8 can be seen as setting out a penalty points system for expansion in terms of co-ordination costs incurred by alternative modes. Firms seek value-enhancing opportunities, which in this context means economies of scope. The gains are reflected in economies of scope (Assumption 4), but modes differ in the losses they incur in the form of co-ordination costs in achieving these gains.

*Assumption 6* invites more detailed examination. Here we are arguing that increasing co-ordination cost are automatically incurred as firm size increases ( $k > 1$ ), such that always;

$$\varpi(f_1, f_2) > \varpi(f_1, 0) + \varpi(0, f_2)$$

Where  $\varpi(f_1, 0) + \varpi(0, f_2)$  are the firm-level co-ordination costs associated with firms  $f_1$  and  $f_2$  respectively if they are independent firms, and  $\varpi(f_1, f_2)$  are the firm level co-ordination costs incurred if the two firms were to merge.

Our assumption about firm-level co-ordination costs means that both firms in Figure 2 would reduce firm-level co-ordination costs by breaking up into their constituent

businesses. This is broadly consistent with Williamson (1975 and 1985) who discussed how increasing the scale and diversity of the firm could create strategy formulating and control loss problems for U-form firms<sup>15</sup>. We assume here that the M-form<sup>16</sup> structure may mitigate but not eliminate such problems.

So why should any firm expand if there are these automatic penalties in the form of firm-level co-ordination costs to be incurred? In fact it will be rational to do so as long as value-adding gains at link-level more than compensate for penalties from firm-level co-ordination costs to be incurred from expansion, and providing that in-house co-ordination allows economies of scope to be released more cheaply than would be the case with a co-operative arrangement

We have chosen a simple non-linear relation to express these points in Assumption 6, with costs of co-ordination being assumed to increase faster than the number of businesses operated by the firm.

*Assumptions 7 and 8* are based on the earlier argument that the co-ordination of resources is more problematic between firms than within firms because of the greater inconsistency of interests likely to be encountered in the former case. Thus, merger reduces *link*-level co-ordination costs relative to the co-operative option (since  $d > c$ ). Accordingly, it is the co-operative option which faces the higher co-ordination costs at this level. The most systematically studied form of inter-firm co-operation is joint venture, and Assumptions 7 and 8 are consistent with observations made in the managerial literature that joint venture generates contractual, control and appropriability problems compared to single firm alternatives (Kay 1992, and Kay 1997, pp.179-89). These problems can each be directly attributed to severely inconsistent intentions where managers co-operating in the venture may owe allegiances to different firms. In turn, each of these problems may exacerbate co-ordination costs. While the form and extent of these co-ordination cost issues may vary according to the type of co-operative activity, the impact of inconsistent intentions in such cases should be in the same direction as in joint venture and so should tend to exacerbate co-ordination costs relative to single firm alternatives.

For simplicity, while we allow the value of links to vary, the co-ordination costs associated with exploiting any single link is constant for any given mode of co-ordination ( $c$  from merger and  $d$  from co-operative agreements); we shall vary this assumption later.

Our firms are rather myopic entities that do not see beyond next period's merge/co-operate choice, and they neither learn nor innovate. In the next section we shall go further and specify actual values for  $b$ ,  $k$ ,  $c$  and  $d$ . While this may seem restrictive, it does not differ greatly in this respect from much of traditional production and cost theory. For example, a great deal of production theory is built on the CES production function where the elasticity of substitution between inputs is assumed to be constant for all pairs of inputs, and the even more restrictive Cobb-Douglas production function where it is assumed to be equal to one. Such restrictions enabled traditional IO theory to push its technical analysis further than would otherwise have been the case. Here we place restrictions on our co-ordination cost relations for similar reasons and we would argue

that this may be justified given the exploratory nature of our analysis. Future analyses could explore the sensitivity of our conclusions to different functional specifications.

With these points in mind, we can now identify the total co-ordination costs  $M_t$  for our group of firms at stage  $t$  as;

$$M_t = aW_t + b \sum_{i=1}^j X_{i,t}^k + cY_t + dZ_t$$

If we wish to find  $\Delta M_t$  (where  $\Delta M_t = M_{t+1} - M_t$ ), then;

$$\Delta M_t = a(W_{t+1} - W_t) + b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + c(Y_{t+1} - Y_t) + d(Z_{t+1} - Z_t)$$

In other words, change in co-ordination costs from one period to the next is the sum of changes in business-, firm- and link-level costs. In the next section we shall examine the possible implications of these relationships in practice.

## 5: OPPORTUNITY COSTS, EFFICIENCY, AND MODES OF ORGANISATION

Now suppose that there are two options for exploiting a given link or links and the resulting economies of scope. This can be accomplished through merger or through a co-operative link between two firms. If the merger option is chosen, the increase in coordination costs,  $\Delta M_t$  is denoted by  $\Delta R_t$ , while if the co-operative option is chosen,  $\Delta M_t$  is denoted by  $\Delta S_t$ .

We are interested in how choice of option will affect coordination costs and whether one or other option will be identifiable as the more efficient choice. Therefore, we define:

$$\phi = \Delta R_t - \Delta S_t$$

If  $\phi$  is positive, then the coordination costs of exploiting the link or linkages through merger will be more than the coordination associated with co-operation and the latter would be the more efficient method of coordinating linkages. On the other hand, if  $\phi$  is negative, merger would be the relatively lower cost option compared to co-operation.

We can demonstrate possible implications and applications with an example. Bearing in mind from Assumptions 6, 7 and 8 that  $b > 0$ ,  $k > 1$  and  $d > c > 0$ , suppose  $k = 2$ ,  $b = 1$ ,  $c = 2$  and  $d = 12$ . Suppose also that firms in Figure 2 had no link between them in Stage 1 but get together to form their co-operative link in Stage 2. What are the increased coordination costs,  $\Delta M_t$ , from having formed a co-operative link?

In exploiting this new co-operative link, the number of businesses operated by the two firms are unchanged from Stage 1 to 2 at six (so  $W_{t+1} = W_t$ ) and the number of in-house

links exploited is also unchanged (so  $Y_{t+1} = Y_t$ ). Consequently  $a(W_{t+1} - W_t) = c(Y_{t+1} - Y_t) = 0$  in calculating  $\Delta S_t$ ,

This means that here  $\Delta S_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + d(Z_{t+1} - Z_t)$

If  $k = 2$ , then before the co-operative link is formed between the firms,

$$\sum_{i=1}^j X_{i,t}^k = 3^2 + 3^2 = 18$$

since  $X = 3$  for both firms. However, the only change in Stage 2 is to form the co-operative link, so  $b \sum_{i=1}^j X_{i,t+1}^k = b \sum_{i=1}^j X_{i,t}^k = 18$ , which means the term  $b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) = 0$

Consequently,  $\Delta S_t = d(Z_{t+1} - Z_t) = 12(1 - 0) = 12$

However, suppose instead that our firms had *merged* to exploit the fifth link instead of using a co-operative arrangement. What would be the co-ordination costs associated with the merger option,  $\Delta R_t$ ? The arguments here are the same as for  $\Delta S_t$ , except that  $c(Y_{t+1} - Y_t)$  replaces  $d(Z_{t+1} - Z_t)$  in the calculation (change in in-house links replacing change in co-operative links) and there is a potential change in firm-level co-ordination costs since both the number and size of firms have altered.

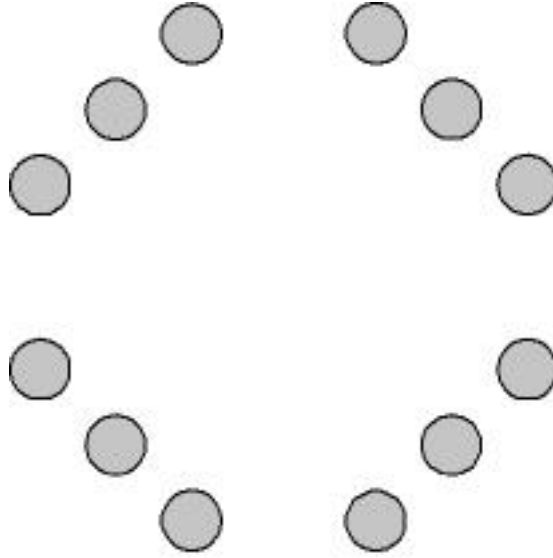
So,

$$\Delta R_t = b \left( \sum_{i=1}^j X_{i,t+1}^2 - \sum_{i=1}^j X_{i,t}^2 \right) + 2(Y_{t+1} - Y_t) = (6^2 - \{3^2 + 3^2\}) + 2(1 - 0) = 20$$

And,

$$\phi = \Delta R_t - \Delta S_t = 8$$

Therefore if merger was chosen to exploit the link opportunity, the overall increase in coordination costs would be greater than if a co-operative option was chosen for this purpose. Clearly it would be more efficient to co-operate than to merge in this case. While the link-level co-ordination costs are much lower for the merger option, these considerations are swamped by the increased firm-level co-ordination costs in the merger case and which are avoided in the co-operative option.



**Figure 3: Stage 1 - specialisation**

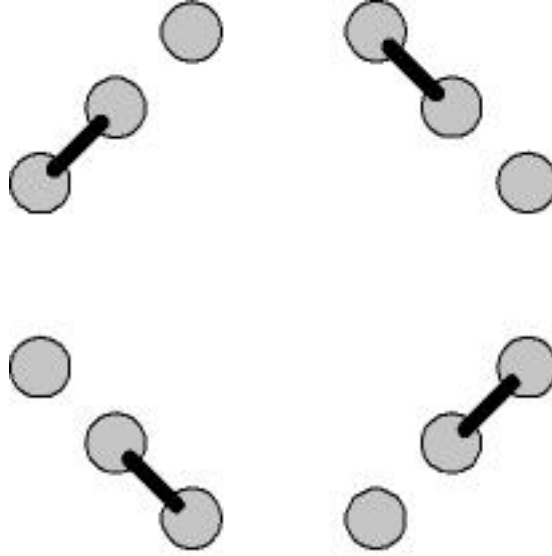
We can extend our approach by applying it to a set of twelve businesses and explore how  $\phi$  changes as the segment evolves. Figure 3 illustrates the starting position in Stage 1 (specialisation) with all twelve firms operating independently and no links being exploited. Now, suppose the possible exploitation of four linkages between four different pairs of businesses is currently being explored by some of the firms in Figure 3. At this stage, should the links be exploited by merger or co-operative arrangement?

We could look at the problem at the level of individual firms, at the level of pairs of firms considering how to exploit the link, or from the perspective of the group as whole. To retain consistency with later analysis, we will take the latter route

From the perspective of the group as whole;

$$\Delta R_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + c(Y_{t+1} - Y_t) = 8 + 8 = 16$$

That is, if the merger route is chosen, firm-level coordination costs increase by 8 (eight firm merge to become four two-business firm, four single-business firms remain unaffected) and the four new inhouse links mean link-level coordination costs increase by  $4 \times 2$  or 8.



**Figure 4: Stage 2 - related-constrained**

By contrast, if the co-operation route is chosen for the four links, the size of all firms in the group remain the same so firm-level costs are unaffected, but there are four new co-operative links so those link-level increase by  $4 \times 12$  such that:

$$\Delta S_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + d(Z_{t+1} - Z_t) = 0 + 48 = 48$$

This means that:

$$\phi = \Delta R_t - \Delta S_t = -32$$

Clearly this means that the merger option will incur less additional co-ordination costs than would the co-operative option. Accordingly, the four pairs of businesses merge and form the four new two-business firms shown in Figure 4. This diversification pattern associated with exploiting a single link throughout the firm was described as related-constrained by Rumelt (1986), with cases involving a series of links defined as related-linked.

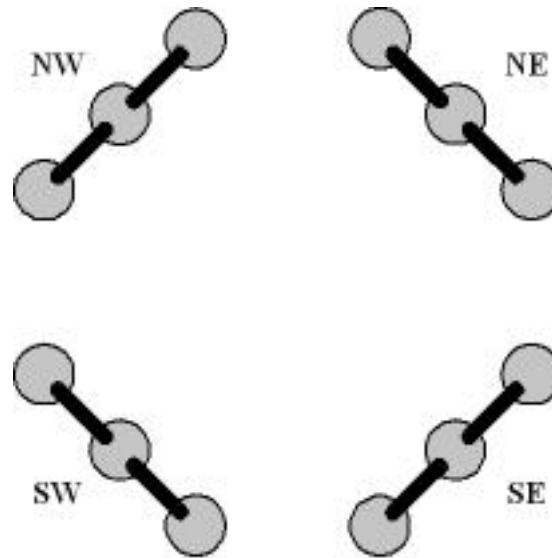
In the next stage, each of the remaining single-business firms are now considering co-ordinating the exploitation of a potential link with one of the larger two-business firms in Figure 4. For simplicity, we shall rebase our new time period  $t+1$  as  $t$  and follow this rebasing convention for each of our new stages.

Now, for the group as whole,

$$\Delta R_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + c(Y_{t+1} - Y_t) = 16 + 8 = 24$$



Firm-level costs have increased because four 2-business and four 1-business firms have been replaced by four 3-business firms (i.e.  $36 - 20$ ), while inhouse link costs increase by  $4 \times 2 = 8$  again.



**Figure 5: Stage 3 - related-linked**

If the co-operative option was chosen to exploit these linkages, then:

$$\Delta S_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + d(Z_{t+1} - Z_t) = 0 + 48 = 48$$

Again, with four co-operative links there is no change in size of firm and co-operative link-level costs are  $4 \times 12$  as in our earlier stage.

And here,

$$\phi = \Delta R_t - \Delta S_t = -24$$

Again, merger adds less to co-ordination costs than does merger and the result is the merger of all four pairings to create the three-business firms in Figure 5. Although all businesses within the respective firms are at least indirectly linked, the link between businesses may vary. Rumelt (1986) described such a chaining pattern of linkages as related-linked diversification. The emergent three-business firms are labelled NW, NE, SW and SE in Figure 5.

However, our firms in Figure 5 have run out of small fry to merge with if they want to use this route to co-ordinate new linkages. Any new links exploited between firms in this segment must involve two three-business firms. If the prospect of exploiting a link is explored by say NW and SW, then;

$$\Delta R_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + c(Y_{t+1} - Y_t) = 18 + 2 = 20$$

If the co-operative option was chosen to exploit these linkages, then:

$$\Delta S_t = b \left( \sum_{i=1}^j X_{i,t+1}^k - \sum_{i=1}^j X_{i,t}^k \right) + d(Z_{t+1} - Z_t) = 0 + 12 = 12$$

And here,

$$\phi = \Delta R_t - \Delta S_t = 8$$

Now the additional co-ordination costs attributable to merger exceed the additional co-ordination costs from co-operation. As in the two previous stages there is the standard link-level penalty from choosing to co-operate rather than merge. However, in this case firm-level costs would swamp this link-level penalty if merger doubled firm size to six-business units. Accordingly, co-operation is the cheaper option and this is shown for NW and SW in Figure 6. This stage sees the emergence of co-operation for the first time as an efficient alternative to merger for the exploitation of new opportunities.

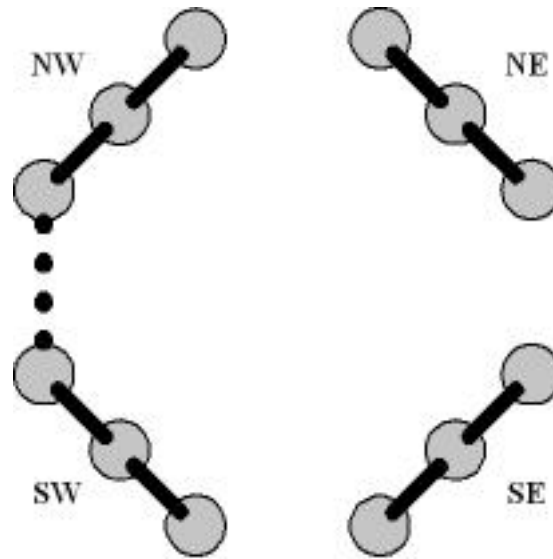
The process being described is one in which the group as whole adopt the cheapest coordination cost option when faced with alternative methods of organising a link or set of links. This may be thought to be assuming too much, especially when we have not explicitly specified objective functions and decision making criteria at the level of the firm, a criticism which, incidentally, can also be made of some other approaches in this area, such as Williamson (1975). The defence here is one of reasonableness, in that if the firms collectively do not agree the least cost method of organising a new link, then there exists an alternative set of Pareto-improving organisational arrangements compared to that presently agreed. That being the case, it will be the interests of the firm or firms associated with the link to organise a distribution of gains from moving to the least cost arrangements that makes everybody directly associated with the link better off.

## 6: IMPLICATIONS

There are a number of implications that follow from the analysis above. In our approach, we assume firms first move from the specialisation stage through related-constrained diversification to related-linked diversification. It is what happens after this initial stage of diversification that is of particular interest in our analysis.

*(1): Diversification preceding and triggering co-operation.*

In the approach outlined in the previous section, co-operative activity emerges in Stage 4 (Figure 6) as a direct consequence of the *previous* expansion and diversification of the parties involved. The reason firms co-operate to exploit a new linkage rather than resorting to merger is because additional firm-level costs from merger would now swamp the link-specific costs of the co-operative alternative.



**Figure 6: Stage 4 - co-operative venture**

This may help to explain why co-operative activity has only recently appeared as a major issue in corporate strategy. Rumelt's (1986) analysis of the development of corporate strategies in the *Fortune 500* shows that most of the changes in strategic categories had been accomplished by the early Seventies, and that in the last period studied (1969-74) there was little change in the proportion of firms in the 500 characterised as diversifiers and little change in the proportions in each of the three diversification categories (p. vi). However, if the early-Seventies marks the end-point of this period of rapid and extensive diversification, the same period tends to mark the starting point for the major growth in co-operative activity which subsequently helped transform many corporate strategies, especially in the high technology sectors (Hagedoorn and Schakenraad 1990, Figure 1). This is precisely what we would expect from our argument of the previous section, with merger pushing up firm-level costs and triggering co-operative activity once firm expansion passes a critical level as shown in Figure 6 above.

It should be noted that this makes the emergence of co-operative behaviour an endogenous feature of growing systems. On the other hand, many conventional analyses of co-operative relations between firms have tended to invoke *dei ex machinae* type explanations for the relatively recent proliferation of these agreements. These explanations typically refer to some apparent qualitative or quantitative change in the character of the activities undertaken by firms that encourages or forces the firm(s) to consider co-operative strategies. These alleged forces include increasing complexity, higher levels of uncertainty, increasing R&D costs, trends towards globalization, and shortening product life cycles. Some of these alleged influences tend to be asserted as self-evident when in fact they are not (Kay, 1997, p.228), while none really explains why co-operation can achieve gains that could not also be achieved swiftly through merger or acquisition

A similar point holds with respect to the transaction cost explanation of the evolution of co-operative activity which sees it as reflecting conditions of intermediate asset specificity<sup>17</sup>. Even if we were to accept such arguments, they still do not explain why co-operative agreements have suddenly proliferated in recent years. By way of contrast, the emergence of co-operative relations in our analysis is a natural endogenous feature of the growth and diversification of firms and the passage of time.

*(2): Large diversified firm involvement in co-operative arrangements.*

The previous point referred to the timing and evolution of co-operative activity, but there is a point that follows from this that relates to the nature of the firms that are likely to be involved in co-operative activity. If co-operation tends to emerge after firms have become large and diversified, then we would expect this to be reflected in the characteristics of the firms involved in co-operative activity.

This tends to support arguments that scale and diversity of firms is likely to encourage switches from internalisation strategies to co-operative behaviour (Buckley and Casson, 1988, Hennart, 1988, Kay, Robe, and Zagnoli, 1987 and Kay, 1992). It also tends to be consistent with the empirical evidence, with Boyle (1968) Berg and Friedman (1978) and Berg and Hoekman (1988) all finding a relationship between size of firm and propensity to undertake co-operative activity such as joint ventures. Berg and Hoekman's (1988) study also found evidence that supports the argument here that co-operative activity is likely to be stimulated by corporate diversification<sup>18</sup>. Our analysis here provides a theoretical context in which to place these empirical findings.

*(3): Merger waves preceding and triggering the emergence of co-operation.*

A further point that is related directly to the preceding issue is that merger and co-operative activity are more than potential substitutes, merger activity may help actively stimulate co-operative activity by creating larger and more diversified firms. This suggests that merger may potentially have a dual role, acting both as a substitute for present co-operation and a trigger for future co-operation. In turn, this encourages a reconsideration of the role of merger waves, particularly those of the Sixties and Eighties that helped fashion the large diversified firm of the post-war era (Scherer and Ross (1992, pp.153-59). If we were to limit our perspective to mergers and co-operative arrangements as substitute modes for business opportunities, then previous merger would have little or no relevance to present decisions as to whether or not to opt for co-operation. It is only when we start to look at these modes from the perspective of the *firm*, as in Figures 3-6 inclusive, that previous merger activity may begin to acquire serious implications for current co-operative opportunities. In our analysis it is not accidental or coincidental that the emergence of co-operative activity in the post-war period was generally preceded by major merger activity of a diversifying nature. These are the conditions we would expect to set the stage for subsequent co-operation as outlined in the transition from Stage 3 to Stage 4 in Figure 5 and Figures 6 above.

## **7: CONCLUSION**

There is a simple conclusion that can be made here. By looking at the firm as an integrated system concerned with businesses and linkages between these businesses (internal and external), we can deal with a variety of related topics of relevance to the theory of the firm. These include topics relating to the direction of the firm, its boundaries, and the mode of co-ordination of economic activity, particularly the choice between merger and co-operative modes of economic organisation.

This basic approach developed here could be extended to examine other phenomenon related to the setting of firm boundaries and inter-firm relationships. Other possible extensions of the basic approach could include the evolution of alliances, networks, and the role of small firms in co-operative activity. These are aspects which are explored in Kay (2005). Parallel extensions of the basic approach could look at other issues, such as conglomerate organization, multinational enterprise and the economics of internal organization

The framework here offers a simple integrative approach that may help examination of a variety of phenomenon that traditionally have been analysed as separate and distinctive issues in many cases. By looking at external and internal linkages between and within firms in the context of the relevant firm and/or group of firms, it offers a systemic perspective on the evolution of firms and industries.

We would also note in passing that agent-based modelling approaches could well be useful in helping further exploration of areas of economic behaviour discussed here. Such modelling is typically based on simple rules and choices and can finish up generating quite complex patterns of behaviour, much like the approach discussed here.

It has hoped that this paper has suggested a way of analysing firm behaviour that promises to open a number of interesting avenues for future exploration.

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<sup>1</sup> See Child and Faulkner, p.66.

<sup>2</sup> See Child and Faulkner, p.66.

<sup>3</sup> See Child and Faulkner, p.67.

<sup>4</sup> See Child and Faulkner, p.69-73.

<sup>5</sup> See Child and Faulkner, p.73-80.

<sup>6</sup> See Scherer and Ross (1990, pp.159– 67) for one such survey of possible motives for merger.

<sup>7</sup> Child and Faulkner (pp. 67-68) do suggest that in the case of the particular motive of entry into new international markets, a contingency analysis may identify the most appropriate mode by reference to the company's strategic objectives on the one hand, and local conditions on the other. But even if that were the case (and we shall suggest later that there may be more systemic factors at work in determining choice of mode) the problem is, as Child and Faulkner point out (p. 68), that a company's strategic objectives may not be fully consistent, and local conditions may not be fully understood.

<sup>8</sup> For a survey of the empirical literature in this field, see Shelanski and Klein (1995)

<sup>9</sup> There are also some problems with transaction cost economics approach to vertical relations. See Kay (1997, pp. 33-57) for some of these problems and a discussion of how the resource based aspects of the approach developed here can be adapted to deal with questions of vertical integration.

<sup>10</sup> For good surveys of this literature, see Foss (1997a), Mahoney and Pandian (1992) and Peteraf (1993). Examples of resource-based perspectives include Barney (1986), Kay (1982), Richardson (1972), Rumelt (1986), Teece (1980) and Wernerfelt (1984). Nelson and Winter's (1982) evolutionary theory of the firm also contains much that may be seen as consistent with resource-based perspectives.

<sup>11</sup> See Foss (ed.) 1997(b) for a number of readings that pursue this line.

<sup>12</sup> See Hart (1996) for a review of the elements of principal-agent theory and its relationship to other theories of the firm.



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<sup>13</sup> There are different ways links might be coordinated, e.g. group or corporate marketing or R&D units may be created, joint teams or projects may be organised, output (e.g. patents) may be cross-traded between divisions. See Kay (1997, pp. 247-60) for further discussion of these issues.

<sup>14</sup> For example, see the theoretical and empirical analysis in a good standard IO text such as Scherer and Ross (1990), with its focus on product-market problems.

<sup>15</sup> U-form firms are organised by functions

<sup>16</sup> M-form firms are organised by divisions, usually on a product-market basis.

<sup>17</sup> “Roughly speaking, transaction cost economics predicts that there will be a shift out of markets...as the condition of asset specificity builds up. Hybrid modes of organization (joint ventures, franchising, regulation, various forms of long term contracting) are interpreted as governance structures for which an incentive intensity/adaptability compromise has been reached” (Williamson, 1990, p. 68)

<sup>18</sup> See Kay (1997, 177-207) for further discussion of these studies and their implications