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A Process Approach to Corporate Coherence

by

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June 1996

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Abstract

We address the notion of '*corporate coherence*', recently made prominent by Teece, Rumelt, Dosi and Winter (1994). We argue that the literature is confused on the meaning of the notion (and similar notions) in a number of dimensions. Drawing on insights from market-process theories, we put forward a *dynamic* understanding of corporate coherence as involving the corporate capacity to strike a favorable balance between the production and the exploitation of new knowledge. This argument is elaborated drawing on Austrian, evolutionary and post-Marshallian economics.

Keywords

Corporate coherence, knowledge, competences

JEL classification

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I. Introduction

This paper develops an approach to *corporate coherence* that is inspired by market-process approaches, such as Austrian (Hayek, 1948; Lachmann, 1956, 1986; Kirzner, 1973), post-Marshallian (Loasby, 1976; Langlois and Robertson, 1995), and evolutionary economics (Nelson & Winter, 1982; Dosi & Marengo, 1993). We link up with a minor but growing literature that tries to establish links between strategy thinking and market process approaches (Jacobson, 1992; Teece, Rumelt, Dosi & Winter, 1994; Langlois & Robertson, 1995; Nonaka & Takeuchi, 1995). In contrast, most economically inspired approaches to strategy have taken their cues from industrial organization economics (notably Porter, 1980), organizational economics, and/or standard price theory.

While we rely on more heterodox economics, we do this for the same reason that animates the contemporary trend towards infusing strategy thinking with more of the economic way of thinking: it allows us to approach and handle interesting problems in a novel and fruitful way. Specifically, we shall be concerned with analyzing the notion of corporate coherence, a concept that was coined by Teece, Rumelt, Dosi and Winter (1994). However, the notion involves ideas that reaches back to work that has been founding of the strategy discipline, namely that of Edith Penrose (1959), Alfred Chandler (1962) and H.Igor Ansoff (1965). The relevant ideas are represented by such notions as 'synergy', 'related diversification', 'corporate parenting', and 'core competence'.

As a general matter, the notion of corporate coherence is used by Teece et al. (1994) to refer to a property of the multiproduct, divisionalized firm¹, specifically, to the ability of such a firm to generate and explore 'synergies' of various types. This ability is often measured in the diversification literature by the proxy concept of 'relatedness' in terms of products and/or underlying resources and capabilities, the underlying rationale being that such relatedness indicated the presence of sub-additive cost functions, or, 'economies of scope'. However, in our opinion, the interpretation of synergy as economies of scope is much too narrow. And it is not necessarily the case that relatedness is a good proxy measure of synergy.

Surely, strategy theorists have more in mind with 'synergy' than what can be captured by economies of scope (see Campbell & Sommers, 1992). As normally used, economies of scope merely refers to economies from sharing given -- often tangible -- assets. This is a quite static interpretation of synergy. But as we argue, it is possible to interpret corporate coherence in a much more dynamic way, one that is also closer to contemporary thinking on the multi-product, divisionalized firm (such as Prahalad & Bettis, 1986; Prahalad & Hamel, 1990; Bartlett & Ghoshal, 1993; Hedlund, 1994).

We argue that coherence should be seen in a dynamic context as a system-wide capacity to

¹ However, there is no logical reason why the notion shouldn't be applicable to single product or functionally organized firms.

generate *and* exploit complementarities between localized (e.g., divisional) stocks of knowledge and learning processes, processes that are kept together by organizing principles. Thus, we explicitly adopt a dynamic knowledge-based perspective that is best represented by modern process theories, such as Austrian, post-Marshallian and evolutionary economics.

However, the main argument is perhaps most directly associated with the work of Friedrich Hayek (1948, 1973). The idea that diversity may foster collective learning is an important element of Hayek's social thought. However, Hayek has also stressed commonality, namely in the form of shared abstract rules of conduct (Hayek, 1973). In fact, in Hayek's view, evolutionary success is a matter of adopting a favorable trade-off between generating and exploiting diversity. We suggest to use this argument not -- as Hayek does -- with reference to societies in large, but to a much smaller 'society', namely the firm.

To reiterate, in the context of the firm, we think of coherence -- corporate coherence -- in a dynamic way as the corporate capacity to exploit and explore complementarities between a diversity of stocks of dispersed knowledge and localized learning processes. This brings other Austrian favorites into the picture, namely the entrepreneur (Kirzner, 1973) and the concept of complementarity (Lachmann, 1956). For an essential component of our understanding of corporate coherence is the ability to *discover* new -- potentially profitable -- combinations of various types of assets where the relevant combination is based on some complementarity².

Recent strategy research has also emphasized the links between such corporate entrepreneurship, firms' knowledge-bases and their strategies. This literature incorporates what is usually referred to as 'the capabilities perspective'³. The essential premise of this literature is one that can also be found in market-process approaches: firms are *essentially* different -- not necessarily because they come equipped with different initial endowments, but because they are exposed to different circumstances and because they learn differently. Thus, firms' knowledge endowments differ -- an essential premise for market-process approaches. In fact, Robert Jacobsson (1992) went so far as to title the recent capabilities literature 'the Austrian theory of strategy'. Whatever the precise doctrinal justification of this may be, it is quite clear that there are a number of affinities. This makes it sensible for us to also link up with the capabilities view in the following.

Our specific design in the following is to begin with a brief review of work on corporate coherence. We argue that the literature is far from unanimous on the issue and that there is a static and objectivistic bias to the literature that does not square easily with basic tenets of market-process theory. In order to put forward a more consistent understanding of corporate coherence,

² The relevant complementarity need not be technical. In an economic sense, there is complementarity between two assets -- for example, two stocks of knowledge -- when the returns from accumulation of one of the assets is a positive function of the level of the other asset and *vice versa*. Often, however, technical and economic complementary coincide (Richardson, 1972).

³ We use this term to refer to 'the resource-based perspective' (Wernerfelt, 1984; Barney, 1991), 'the dynamic capabilities view' (Langlois, 1992; Teece & Pisano, 1994), and recent work on 'core competences' (Prahalad & Hamel, 1990; Foss, 1993).

we rely on core ideas from market-process approaches, particularly on ideas drawn from Hayek and Lachmann (Austrian economics), Richardson and Loasby (post-Marshallian economics), and Richard Nelson, Sidney Winter and James March (evolutionary economics). We finally argue that an understanding of corporate coherence informed by market-process theory not only allows us to understand the basic features of the topical Japanese firm, but much of the logic behind the organization of such giant multinationals as ABB, ITT and Philips (Prahalad & Doz, 1987).

II. Corporate Coherence: A Brief Survey of Previous Contributions

II.i. Edith Penrose on Diversification and Coherence

Within the resource- and competence-based literature of recent years, Edith T. Penrose's seminal contribution, *The Theory of the Growth of the Firm* (1959) has become a standard reference, because of its role as a precursor of modern thinking on resources and competences of firms. Penrose (1959: 24) defines the firm as 'a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision'.

The coherence issue enters the agenda already in her opening discussions of the decisive features of the firm:

'One important aspect of the definition of the firm for our purposes, then, involves its role as an autonomous administrative planning unit, the activities of which are interrelated and are coordinated by policies which are framed in the light of their effect on the enterprise as a whole' (p.15).

Now we should remember that Penrose was explicitly only concerned with *successful* diversified firms. Thus, such firms are by definition 'coherent' in the broad sense that they efficiently coordinate interrelated assets and activities and assess the implications of those decisions for the firm as a whole; that is, they balance the need to specialize with the need for integration across functions and business units.

However, Penrose's primary theoretical contribution concerns the growth process of the firm. As she argues, there are fundamentally three significant obstacles precluding the firm from settling down in an "equilibrium position" with no further internal incentive to expand:

'Those arising from the familiar difficulties posed by the indivisibility of resources; those arising from the fact that the same resources can be used differently under different circumstances, and in particular, in a "specialized" manner; and those arising because in the ordinary process of operation and expansion new productive services are continually being created' (1959: 68).

Thus, growth (including diversification) may result from an attempt to more fully exploit idle resources (the opportunity cost of doing so being zero), existing resources, and those continuously created 'in the ordinary process of operation and expansion'. To dress Penrose's reasoning in more modern garb, the growth of the firm is largely a result of learning by doing (in operation and in management) and of explorative learning (e.g., in R&D). This growth is articulated in increasing and 'coherent' diversification. What is 'coherent' diversification, according to Penrose, is to a large extent a matter of the knowledge and perceptions of the management team, since the firm's productive opportunity set is itself a cognitive category (Penrose, 1959: 5). Note in passing that this is a subjectivist perspective that fully harmonizes with the subjectivism of, for example, Austrian economics.

As Penrose also points out, innovation is based on existing resources -- even when it leads to products that are radically new both to the firm and to the consumer (e.g., Penrose, 1959: 84). This introduces a seeming paradox: Even if growth is strongly path-dependent with respect to the firm's resources and competences, the manifestation in terms of new *product-markets* may be seen to be almost wholly "unrelated" to existing product-markets. Nevertheless, such a firm may exhibit coherence, because the coherence in question is a matter of underlying capabilities and the cognition of the management team rather than a matter of products.

In economics, specialization in the sense of the production of a single product has normally been seen as incurring a premium in terms of increasing productivity, while multi-product production has been associated with decreasing productivity⁴. This should constitute an argument for "coherent growth" through specialization and disintegration (e.g., Stigler, 1951). However, firm growth, beyond a certain size level, nearly always involves diversification and some of the most successful and efficient firms are highly diversified. From the competence perspective, the reason must be that the relevant dimension of specialization is not in terms of products, but rather in terms of competence.

II.ii. Coherence as Related Diversification

Within the last two decades a burgeoning empirical literature has studied the relationship between corporate diversification and performance⁵. Yet, no unanimous pattern of results has emerged. Richard Rumelt's 1974 study is one of the early important contributions, and the overall result of his study -- that related diversifiers perform better than un-related diversifiers on the average -- has become nearly conventional wisdom in much of the strategy literature. Coherent diversification is related diversification. However, subsequent studies have shown inconsistent results, some confirming Rumelt's results, others showing that firms involved in unrelated diversification are at

⁴ Or, so it was until the advent of the concept of economies of scope.

⁵ Ramanujam and Varadarajan (1989) provide an overview of the literature.

least as profitable as firms involved in related diversification (see, e.g., Grant, Jammine and Thomas, 1988).

From a market-process perspective, a fundamental problem in most of the empirical (if not necessarily theoretical) work on diversification and relatedness is that traditional measures of relatedness only look at the industry or market level -- *not* at the level of capabilities or other assets. This is a problem because, as we shall later argue in more detail, concepts such as relatedness, coherence, etc. are essentially cognitive concepts, and what may be related diversification or coherent organization to one firm may not be so to another firm.

Others have also pointed out the dangers of using objective -- context-independent -- measures of concepts such as relatedness. As Markides and Williamson (1994) point out, the standard measures of relatedness may sometimes suggest industry or market similarities that do not really provide any potential to exploit these similarities for competitive advantage ('exaggerated relatedness'). And as recent research by Pari Patel and Keith Pavitt (1994) suggests, much of what is measured as unrelated -- and therefore interpreted as inefficient -- diversification may actually reflect dynamic synergies from having a diversity of capabilities and other assets under the corporate umbrella.

Perhaps most seriously, the underlying mechanisms are essentially unidentified in most of the work on the performance effects of various types of diversification. For example, why is it fundamentally that related diversification should be associated with higher performance levels than unrelated diversification? In our opinion, no really convincing micro-oriented rationale has been given for this.

II.iii. Coherence As Interconnectedness Between Assets

A rather different understanding of coherence to be discussed here refers to relations of interconnectedness, particularly co-specialization, of the constituent resources and capabilities of the firm. A coherent firm is one that is characterized by a high degree of co-specialization of the constituent resources and capabilities. In the terms used by the Austrian economist, Ludwig Lachmann (1956), the coherent firm in this perspective is a capital structure characterized by particularly tight relations of complementarity between the constituent capital assets.

From an interconnectedness perspective David Teece (1986) analyzes the role of complementary assets for the commercialization of technological innovation, one of us (Christensen, 1995, 1996) analyzes profiles of assets for technological innovation, Dierickx and Cool (1989) discuss interconnectedness in order to understand sustainability of competitive advantage and Langlois and Robertson (1995) construct a dynamic theory of the boundaries of the firm that strongly relies on ideas of interconnectedness.

In these contributions, both the tradeability of the assets, and the degree of interconnec-

tedness between the involved assets⁶ are considered decisive parameters in determining make or buy decisions and creating a competitive advantage. Whereas there is a tendency in the resource-based approach to treat resources as singular distinct items (Peteraf, 1993), this approach highlights resource and capability *configurations* and the ways in which resources and competences are nested within the firm or in inter-firm relations.

So far, however, this approach has primarily focused at configurations of resources and competences at *a given point of time*, and has not considered interconnectedness in a dynamic perspective -- for example, how learning within a given activity may assist learning within other activities over time (e.g., marketing and R&D) . Moreover, the nature of links between resources and the synergistic effects of such links are not fundamentally accounted for, except perhaps by pointing to the presence of economies of scope (Teece, 1982). Assuredly, economies of scope are important, but they are only a small part of the meaning of corporate coherence.

For example, the concept of economies of scope does not capture the presence of dynamic (Edgeworth) complementarities (Milgrom & Roberts, 1995) between activities and assets, that is, the situations in which doing more of one activity (such as building an asset) increases the return from doing more of another activity (such as building another asset) (Dierickx & Cool, 1989). In contrast, the exploitation of such complementarities is an important part of the dynamic understanding of corporate coherence that we shall later present.

II.iv. Teece et al. (1994) on Coherence

A landmark contribution in the discussion of corporate coherence is Teece, Rumelt, Dosi and Winter (1994). Their approach is particularly pertinent to the present discussion, since they base their discussion on a market-process approach, namely evolutionary economics. They take as starting points three characteristic features of the modern corporation that are in need of an explanation: 1) Its multi-product scope, 2) its non-random product portfolio, and 3) the relative stability in the composition of its product portfolio. Their concept of corporate coherence exclusively relates to multi-product corporations:

'...a firm exhibits coherence when its lines of business are related, in the sense that there are certain technological and market characteristics common to each'
(p.4).

Now, this is not a very informative definition; however, in the latter part of their paper, Teece et al. come somewhat closer to a capabilities conception of corporate coherence. The firm is here defined as an integrated cluster of capabilities and supporting complementary assets, and coherence is a quality of the relations between the constituent competences and assets,

⁶ Such as the types of innovative assets involved in producing technological innovation, or between a product innovation and the complementary assets required to appropriate the rent from the innovation.

corresponding to the notion of coherence as asset interconnectedness introduced in the previous section.

In our opinion the primary importance of the Teece et al. paper does not lie in the way in which they operationalize the notion of corporate coherence. Rather, its importance lies in the fact that they have put the concept of coherence on the agenda of corporate strategy research, and moreover have taken the first steps in proposing some building blocks in a theory of corporate coherence.

Specifically, they argue that an understanding of corporate coherence requires the incorporation of essential elements of market-process theory -- such as, organizational *learning* dynamics within the firm, *path-dependency* characteristics, *complementary assets*, the depth and scope of *technological opportunities* in the neighborhood of the firm's present technological competences and R&D investments, the dynamic/static features of *firm capabilities* (both organizational and technological), and structural characteristics of *the selection environment*.

Organizational learning dynamics may be slow or rapid depending on the internally embedded routines and the technological opportunities available to the firm. Path-dependency may be high or low, or tight or broad, depending on the nature of existing competences and supporting complementary assets, and on the nature and richness of the technological opportunities that the firm faces. The selection environment may be tight or weak, depending on the strength of competitive forces, public policy and the nature of technological development (e.g., the frequency of technological discontinuity). Three fundamental propositions can be distilled from these insights:

- In the long run, more coherent corporations tend to outperform less coherent corporations.
- The degree of corporate coherence is a function of the interaction between: (a) learning dynamics in the firm, (b) path dependencies (as shaped by existing competences and complementary assets and technological opportunities), and (c) the selection environment.
- The tighter the selection environment, the more likely it is that the boundaries of the corporation is drawn 'close in' to the core capabilities (Teece et al., 1994: 22) and that less coherent corporations will be outperformed.

We are in broad agreement with these general propositions and the underlying theoretical reasoning. However, there are (at least) two issues which further research on corporate coherence should address in order to gain a more consistent theoretical framework: first, the building blocks drawn from market-process theories and their interdependencies should be better specified. Secondly, the building blocks do not provide any insights on the internal organization issues that

relate to corporate coherence⁷.

II.v. Summing Up

Although the above contributions all have some bricks to add to the coherence building, none of them have erected the entire edifice. The insight that we associate with Penrose (1959) -- that corporate coherence is a cognitive category that involves a *dynamic* dimension through learning, path-dependence, and the accumulation of heterogenous knowledge assets -- is not captured by associating coherence with the rather static concept of economies of scope, nor by associating it with relatedness (in terms of product markets) in diversification. Thus, our basic position is that we should in this sense go back to Penrose, and update her reasoning in terms of market-process theories. In the following section, we supply some insights from market-process theories that assist the understanding of corporate coherence.

III. Insights From Market-Process Theories

In this section, we briefly discuss some market-process ideas that are helpful in the context of the resource-based and capabilities literature generally, and in the context of the issue of corporate coherence more specifically.

III.i. Austrian Economics: Utilizing Dispersed Knowledge

It has often been observed that there is no Austrian theory of the firm (Loasby, 1989; Minkler, 1993; Foss, 1994)⁸. This is in spite of the many references in the Austrian literature to the entrepreneur (Kirzner, 1973). However, Kirzner and other Austrians may argue that they are primarily interested in the entrepreneur, because it allows them to construct a dynamic theory of the *market* process, and this theory is not a theory of the individual actors on the market per se. As a general matter, and to use Hayek's (1973) terms, the study of spontaneous orders -- such as the market-process -- has taken precedence over the study of designed order, such as organizations (although we shall later argue that this distinction is in fact far from clear-cut).

Nevertheless, one may maintain that the neglect of the firm is a paradoxical feature, since what may arguably be "the most obvious deficiency in Austrian economics" (Loasby 1989: 166)

⁷ In another paper (Christensen & Foss, 1996), we apply organizational economics to the corporate coherence issue.

⁸ But elsewhere one of us have observed that it is really something of a doctrinal puzzle that the Austrians never came forward with a theory of the firm (Foss 1994). This is so because they had so many of the necessary elements of modern theories of the firm, such as a basic understanding of the principal-agent relation, dispersed knowledge (Hayek 1945), "routines" (broadly conceived) (Hayek 1973), knowledge costs (Hayek 1945), asset specificity and complementarity (Lachmann, 1956), etc.

lies in the market process itself. Austrians have next to nothing to say about pricing, buyer-seller relations, vertical integration and other aspects of economic organization; in other words, one of the most important constituent mechanisms of the market process, namely firm behavior, is simply not theorized in Austrian economics.

In spite of the neglect of firms in Austrian economics, we submit that much inspiration may be gained from this body of thought when addressing economic organization. We are not the first to do this. For example, Langlois (1992b) argues that the Austrian -- or, more precisely, Hayekian (Hayek, 1973) -- understanding of social institutions as spontaneously emerged and generalized rules of behavior may be able to further the capabilities view of the firm. Like Langlois, we shall primarily concentrate on Hayek's ideas, but also mention some of Lachmann's ideas where they are relevant.

Austrian economists, it is usually said, are subjectivists. Briefly, this means that people are not only exposed to different facts, but also interpret these 'facts' in different ways, process information differently, and therefore also typically hold diverging expectations with respect to many future contingencies⁹. Arguably, such subjectivism simply follows from a consistent methodological individualism, since this implies thinking in a sophisticated way about the knowledge, plans and thoughts behind people's actions. However, it has a number of profound insights, not the least for the theory of the firm.

Fundamentally, Hayek argued that the fact of the division of knowledge radically changed the character of the economic problem confronting society:

The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate "given" resources -- if "given" is taken to mean given to a single mind which deliberately solves the problem set by these "data". It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality' (Hayek, 1945: 78).

The problem is not only a matter of the sheer complexity of the problem -- the enormous amount of bits of knowledge that need to be taken into consideration. It is just as much a matter of much of the relevant knowledge being tacit, and therefore impossible to communicate directly to a center. Hayek's response to the problem follows promptly:

⁹ Sophisticated recent statements of the basic subjectivist position is O'Driscoll and Rizzo (1985) and Lachmann (1986).

'If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in the particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them. We cannot expect that this problem will be solved by first communicating all this knowledge to a central board which, after integrating all knowledge, issues its orders' (Hayek, 1945: 83-84).

We note in passing that although Hayek directed his analysis to the societal level, his knowledge dispersal problem and the problem of how best to secure adaptations to changes in 'the particular circumstances of time and place' is surely also relevant to large-scale organizations. Firms, such as Asea-Brown-Boveri, with more than 200.000 employees certainly face a knowledge dispersal problem of almost the same caliber of the general societal knowledge dispersal problem (The Economist, 1995). To presume that ABB top-management can simply centralize all relevant knowledge is -- as Ghoshal et al. (1995) point out -- simply absurd.

We return to this, and here proceed with noting that there is still a problem left in Hayek's reasoning -- for how exactly is the integration of the dispersed bits of knowledge accomplished? Hayek's answer, of course, is to point to the 'telecommunications system' of market prices: the function of prices is to integrate dispersed knowledge and thereby promote a tendency to dovetailing plans. Moreover, much of Hayek's later work (e.g., Hayek, 1973) concentrated on how other institutions than the price system -- such as the rules of just conduct contained in traditional morals and the common law system -- furthered the societal tendency to coordination of plans (Kirzner, 1992b).

However, in economics the institutional context of Hayek's (1945) reasoning has often been forgotten: his message has been interpreted as being be that the market economy operates efficiently with a minimum of information, since (equilibrium) prices supply *all* the correct incentives. Local producers and consumers do not have to bother with, for example, strategic interaction. But Hayek notes that the 'limited individual fields of vision' of market participants '...sufficiently overlap so that through many intermediaries the relevant information is communicated to all' (1945: 86). And under perfect competition, 'individual fields of vision' do not overlap; and there are no 'intermediaries'. Arguably, what Hayek indicated, but did not elaborate, in such passages was the existence of *entrepreneurs* who drove the market process towards equilibrium.

Whatever that may be, it has been left primarily to Israel Kirzner (1973, , 1992) to provide a detailed view of this adjustment process. Central to his argument is the distinction between 'Robbinsian maximizing'-- the mechanistic activities of the neoclassical agent -- and 'alertness', the active entrepreneurial quality which allows agents to perceive and act on hitherto undiscovered possibilities for trade. The entrepreneurial exercise of alertness closes pockets of ignorance in the

market and thereby moves the economic system towards a coordinated state.

However, as many of Kirzner's critics have argued, there is no theoretical guarantee for such a tendency. The actions of the entrepreneur may just as well act to destabilize the system in a more or less Schumpeterian manner (Lachmann 1986: chapter 7)¹⁰. We shall use the overall themes of this debate to categorize two knowledge problems in a way that will prove useful in the present context.

The first is called *Knowledge Problem 1*, and refers to the Hayekian problem of integrating dispersed knowledge. In the context of the market, this problem is handled by alert entrepreneurs, by the price system and by other institutions. Within firms, it is handled by corporate intrapreneurs, by management information systems, routines, and by shared cognitive constructs, such as corporate culture.

But there is also a *Knowledge Problem 2*, which is not fundamentally a coordination problem. Rather it is concerned with how new knowledge is created, with the emergence of novelty (Witt, 1992). In the context of firms, this is the problem of understanding how competitive advantage may be made sustainable by the accumulation of new knowledge and continuous innovation (Dierickx & Cool, 1989). It concerns variety creation by firms. According to Kirzner (1973), Knowledge Problem 2 does not fundamentally lie within the domain of Austrian economics. But it is treated in evolutionary and post-Marshallian economics. Since we need to say something about Knowledge Problem 2 for our approach to corporate coherence, we now turn to a (very brief) discussion of evolutionary and post-Marshallian economics.

III.ii. Evolutionary and Post-Marshallian Economics

A main attraction of evolutionary economics is that it allows to simultaneously address Knowledge Problem 1 and 2; it allows, in short, for both addressing the mechanisms that produce order and stability, and the mechanisms that produce disruptions and variety. We shall here be concerned with the role of firms in evolutionary economics.

It is key that firms in evolutionary models -- such as the classic Nelson and Winter treatment -- come equipped with *different* decision-rules, whereas neoclassical firms are only hard-wired with maximization as decision-rule. Nelson and Winter (1982) construct this less stylized view of the firm by developing an 'organizational genetics', where firms' hierarchically arranged routines are the relevant genotypes. Organizational structure, degree of diversification, revealed firm performance, etc. thus correspond to the phenotype, that is, the outward manifestation of the firm-specific knowledge coded in routines.

Nelson and Winter (1982) devote two chapters (4 and 5) to developing the notion of routines as parts of a wider theory of organizational knowledge. This analysis is firmly grounded in behavioralist organization theory, but adds an elaborate analysis of the tacitness of

¹⁰ The debate is surveyed in Vaughn (1994).

organizational knowledge. Routines are stores of empirical knowledge and are, as such, conjectural in nature. They code organizational knowledge, and are history-bound, socially produced (and reproduced), and rigid. Their presence introduces path-dependence and inflexibility on the cost side, while introducing specialization advantages and coherence on the benefit side.

There has traditionally been a rather sharp diversion between ontogenetically oriented approaches to the firm in which the firm is factored in its own right, and phylogenetically oriented studies in which firms are factored because they embody mechanisms of heredity, variety and variety-creation but where the analytical attention is towards the industry-level. Of course, the difference in terms of the anonymity with which firms are described is to a large extent a matter of the difference in terms of level of analysis. Sometimes, however, one also see the distinction phrased a matter of a deep and clear-cut difference between the study of the adoption on the part of economic system or the study of individual adaptation.

However, the evolutionary argument that firms are inert does not amount to the proposition that firms are completely unable to change. Rather, it is a much more subtle argument that some parts -- perhaps the crucial ones -- are much less likely to change rapidly in response to outside changes than other parts. It is widely recognized that the resources that matter the most for firm success -- such as technological competencies, culture, reputation, etc. -- are best viewed as *stock variables* that can only be gradually changed by appropriately chosen input flows (Dierickx & Cool, 1989)¹¹.

This is not necessarily to say that the fundamental evolutionary mechanisms are inapplicable to the organizational level. On the contrary, Herbert Simon (1962) long ago explicitly tied organization-level learning dynamics to evolutionary theory by arguing that processes of search and discovery can be conceptualized in terms of variety and selection. This suggestion has been taken up by important recent work on organizational learning, such as March (1991) and Marengo (1992).

Taking his cues from behavioralist organization theory, Marengo is particularly interested in the coordination of (variety-generating) individual learning processes inside the firm, how a stock of organizational knowledge emerges from the interaction of these learning processes, and how this knowledge allows the process of variety generation to be exploited. In his simulation model, agents do not have any prior knowledge of the environment they are facing and they do not possess a shared partition of the states of the world (that is, there is no common knowledge). However, such a shared partition is necessary for coordination to take place. And, in fact, as demonstrated by Marengo's simulations, coordination emerges gradually and spontaneously, as agents interact under given organizational structures and under the impact of given environments. Thus, by demonstrating how a common knowledge basis that creates such a degree of commonality that variety generation from localized learning processes may be exploited (made into

¹¹ Thus, there is nothing wrong in principle with positing the simultaneity of ontogenesis and phylogenesis on the social domain; they "simply" constitute a hierarchy of processes (cf. Simon, 1962).

organizational learning), Marengo has elegantly combined what was called Knowledge Problems 1 and 2 above.

Moreover, drawing on March's (1991) work, Marengo elaborates the idea that there is a trade-off between *exploitation* (of new knowledge) and *exploration* -- a trade-off that really confronts any system, be it firms, networks, markets or whole societies.

As James March (1991: 71) says, firms

'...that engage in exploration to exclusion of exploitation are likely to find that they suffer the costs of experimentation without gaining many of its benefits. They exhibit too many undeveloped new ideas and too little distinctive competence. Conversely, firms that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria.'

The generality of this idea is indicated by it being clearly related to Hayek's later theory of cultural evolution (Hayek, 1973), with its combination of the order-producing properties of the market and the experimentation with cultural practice that characterizes an open society¹².

In a way, the exploitation/exploitation trade-off may also be distilled from the Marshallian tradition. For example, Marshall's idea of the industrial district is essentially that of a coherence creating institution that is organized around a process of incremental technological change; but this idea is really cast within a much broader theory of integration (exploitation) and differentiation (exploration), derived from a Smithian division of labor perspective (Loasby, 1991).

Drawing on Marshall and the post-Marshallian work of Penrose (1959), Brian Loasby (1983) clearly identified the trade-off between diversity/flexibility and commonality/coherence in the context of the firm, and argued that finding the optimal trade-off is a crucial design problem:

'Indeed, the redrawing of organizational boundaries is usually intended to invalidate old constructs which were thought to be leading to decisions that are now judged to be undesirable when assessed from some higher viewpoint...Partial insulation may allow the development of simpler constructs within each field of interest making management more effective within those limits. The art of organizational design requires the creation of such insulating barriers where they will facilitate good and low-cost local decision-making, while maintaining a sufficient commonality of framework to ensure (if assurance is indeed possible) that the outcomes of local decisions are not disastrous -- for example, that products designed to replace the existing range are not totally outside the manufacturing competence of the existing equipment and workforce.'

¹² And see Langlois (1986) for some pertinent thoughts inspired by Lachmann's work.

In the following section, we apply these ideas to the coherence issue. Specifically, we shall focus on the simultaneous needs for integrating dispersed knowledge in organization and for maintaining flexibility, and the exploitation/exploration trade-off this introduces. We shall argue that corporate coherence means a corporate capacity to strike a favorable trade-off.

IV. Corporate Coherence: Implications From A Process Perspective

Much of Austrian economics, and in fact also standard economics and organizational economics, has been working with an overly restrictive separation between spontaneous and made orders, or between, 'markets and hierarchies'. However, as we have indicated, the distinction is far from watertight. Firms, at least large firms, face a knowledge dispersal problem that may be on a par with the societal knowledge dispersal problem, and all sorts of emergent processes take place inside firms. This is not to say, of course, that the distinction is completely superfluous, for whereas a firm is end-directed (profit-seeking), a society -- at least of the liberal staple -- isn't. Moreover, from an analytical perspective, the fact that the distinction is somewhat blurred is a virtue rather than a vice, since it allows us to use insights developed in the context of analyzing the market-process to firm organization. Specifically, we use market-process insights to address the notion of corporate coherence.

IV.i. Coordination and Learning

Arguably, the dominant view of the firm in contemporary economics is to see it as a contractual institution that exists on account of its ability to dampen or eliminate problems of misaligned incentives (e.g., Holmström & Milgrom, 1994), whether these are associated with team-production or high levels of asset-specificity. The firm allows input-owners to escape cooperation dilemmas of the sort represented by the paradigmatic prisoners' dilemma. In this setting, variety of behaviors and (non-traded) interdependencies are vices rather than virtues, because they open the door to all sorts of agency problems.

In an older and perhaps sounder perspective on the firm -- one that incidentally includes Coase's original contribution (Coase, 1937) -- the role of firms is seen in a different and more dynamic perspective: firms' primary *raison d'être* is that they coordinate some productive tasks -- particularly those having a strong intertemporal dimension and involving close complementarities -- better than market or inter-firm relations are capable of (Lachmann, 1956; Malmgren, 1961; Richardson, 1972; Loasby, 1991; Langlois & Robertson, 1995). Rather than transforming non-cooperative behavior in potential prisoners dilemma games to cooperative behavior, the role of firms in this tradition is to provide an institutional setting that solves coordination type games (cf. Foss, 1993; Langlois & Robertson, 1995).

Thus, it is the more basic coordination problem of making activities, individual efforts, learning processes, strategies, etc. mesh that is highlighted, rather than the logically secondary problem of, for example, controlling and influencing the level of efforts once everything is in place, as it were. Clearly, such a coordination view of the firm links up with what was called Knowledge Problem 1 in the above. In this context, firms solve knowledge dispersal/coordination problems by various means, such as command, management information systems, routines, and shared cognitive constructs. For example, corporate headquarters may through command see to it that knowledge emerging from R&D is not entirely uncoupled from knowledge acquired in marketing and sales operations. Corporate entrepreneurs may thus act in a basically Kirznerian way by demonstrating alertness to opportunities for integrating hitherto dispersed knowledge. Indeed, one may argue that in large firms the knowledge dispersal problem is on a par with the knowledge dispersal problem confronting real economies, and that there will for this reason be a need for a function similar to that undertaken by the Kirznerian entrepreneur in a market setting.

As we have emphasized, there is also a Knowledge Problem 2 which is concerned with the creation of new knowledge, the creation of new variety. Whereas much organization theory has really been concerned with knowledge problems of type A -- integrating knowledge in the face of differentiation and reacting to outside disturbances -- recent strategy research has increasingly stressed knowledge problems of type B, problems relating to the acquisition and production of new knowledge.

For example, Prahalad and Hamel (1990: 80) in their landmark contribution on 'The Core Competence of the Corporation' take a very Schumpeterian (rather than Kirznerian) view of management, thinking of its 'critical task' as '...creating products that customers need but have not yet even imagined'. Thus, with Penrose, they see the firm's productive opportunity as essentially a subjective category, as something existing in the heads of the management team. 'Unimagined products' emerge from the firm's core competence, which is only inadequately described by calling it a scale economy in product development (cf. Milgrom & Roberts, 1992: 107). Core competence is identified as '...the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technology' (Prahalad & Hamel, 1990: 84). Thus, new knowledge arises from Schumpeterian 'new combinations', that is, from the discovery of complementarities between relevant stocks of knowledge and localized learning processes (for example, in the broad categories of microelectronics and information technology).

IV.ii. Corporate Coherence: Generating and Exploiting Economies of Diversity

We take corporate coherence to mean the corporate capacity to balance knowledge problems 1 and 2, that is, to integrate existing knowledge, generate new knowledge, and successfully exploit this new knowledge. Another way of phrasing this is that corporate coherence means the corporate capacity to generate and exploit what may be called 'economies of diversity'. With

'economies of diversity', we associate the evolutionary argument that more variations increase the probability of finding an 'optimum' type of variation (at least within a given range), and the Schumpeterian argument that more diversity in terms of resources, competences, technologies, etc. increases the probability of making new combinations. Clearly, such economies are constrained by the context of the firm, such as the dominant logic of its management team; for example, no firm can handle a number of new variations or combinations that approaches infinity.

Generating corporate coherence necessarily implies some measure of centralized control through managerial hierarchies. Obtaining economies of diversity may be a matter of engaging in what Markides and Williamson (1994) call 'asset creation', which is the potential to utilize a capability developed through the experience of building strategic assets in existing businesses, to create a new asset in a new business, or 'asset fission', that is, the potential for the process of related diversification to expand a corporation's existing pool of capabilities because, as it builds capabilities in a new business, it will learn new skills that in turn will allow to improve the existing capabilities in existing businesses. Or, it may 'simply' be a matter of mixing in new ways technologies that are already under the control of the business, as Patel and Pavitt (1994) suggest.

Problems such as the above are normally seen as favoring intensive knowledge flows and centralized control (Milgrom & Roberts, 1992). However, to some extent this runs into the Hayekian insights that complexity puts a constraint on the possibilities of top-down direction¹³, and that collective (organizational) learning is fostered by diversity of behaviors. Arguably, one approach to the problem lies in building up a powerful learning *code*: when agents differ in terms of their representations of the environment, there must exist a body of shared knowledge that can further the cohesion of the various learning processes. Establishing such a code helps solve both knowledge problems, and may therefore play an essential role in the process of achieving an efficient trade-off to knowledge problems A and B.

IV.iii. Coherent Firms

Much recent research has documented rather deep differences in management styles -- and ultimately in the management of knowledge -- in Western and Japanese corporations (Aoki, 1990; Hedlund, 1994; Nonaka & Takeuchi, 1995). The topical Japanese firm and its equally topical management style are characterized by a greater tolerance for tacit knowledge -- as distinct from formal instruction, deductive reasoning and command -- than Western firms. This style clearly allows for local initiatives, experimenting and, typically, incremental innovation, much in accord with Hayek's emphasis that important '...decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them' (Hayek, 1945: 83). In other words, the tolerance for variety in behaviors

¹³ For an argument that Hayekian knowledge dispersal problems help us to understand the boundaries of the firm, see Kirzner (1992c: 162).

allows for a significant amount of explorative efforts to go on.

As Nonaka and Takeuchi (1995) argue, however, there cannot be any truly collective learning process -- and no significant exploitation -- if the knowledge acquired through local experimenting isn't somehow disseminated. Quality circles, as well as long working hours and collegial after-hours drinking, are means to encourage and make effective the transfer of tacit knowledge. Strong corporate cultures and an explicit policy of not allowing at least younger employees to stick to one place in the organization for longer periods of time are also means to increase the organizational exploitation of localized explorative efforts -- in short, to increase intra-firm knowledge-diffusion. Thus, the topical Japanese firm balances explorative and exploitative efforts -- achieves corporate coherence -- through a number of distinct organizational mechanisms.

Arguably, the picture of the 'Western firm' that has been featured in some of the work on Japanese vs. Western management styles has bordered on the caricature; particularly, as more and more Western firms have explicitly adopted management styles and organizational principles that are -- if not identical to those of their Japanese competitors -- then surely is directed towards achieving the same balance between exploration and exploitation. Particularly pertinent examples are Asea-Brown-Boveri and Philips (Bartlett & Ghoshal, 1989; Ghoshal et al., 1995; *The Economist*, 1995).

In the colorful words of Percy Barnevik, the CEO of ABB, the chief design principle is to simultaneously be 'local and global, big and small, radically decentralized with central reporting and control. Once we resolve these contradictions, we will have real organizational advantage' (quoted in Ghoshal et al., 1995: 750). Following this philosophy, Barnevik has broken ABB up into more than 1300 highly autonomous (e.g., they are legally separate) companies with 200 employees as the average number. These small companies, in turn, are sub-divided into more than 5000 (strictly monitored) profit-centers. Corporate headquarters are quite small (appr. 100 persons), and most of the R&D budget is allocated to technology development in the frontline companies' centers of excellence. This strong decentralization is undertaken in order to exploit localized knowledge and learning processes; however, a matrix form of organization ensures that there are strong mechanisms of knowledge transfer between individual companies. All of this is underpinned by the very conscious efforts of Barnevik and other top-leaders to build up a strong and shared sense of corporate mission and identity.

Philips, the Dutch consumer-electronics giant, has long followed a policy of allowing large autonomy on the part of their worldwide national operations (Bartlett & Ghoshal, 1989). This is not only a matter of creating room for local experimentation; rather, it is a matter of encouraging and rewarding local managers for using local resources to develop creative and innovative solutions to local problems -- a policy that is deeply embedded in the company's culture. Company culture also makes it mandatory for aspiring managers to become expatriate. But unlike most multinational companies, expatriate managers do not just return to corporate headquarters after 5 to 6 years abroad; rather, they are transferred to another destination. The idea behind these

organizational design principles is to stimulate local experimentation and learning through giving much autonomy to local managers, and to have the results of such experimentation made accessible to other parts of the organization through personnel transfers.

V. Concluding Comments

This paper has suggested a novel approach to corporate coherence, one that is inspired by market-process approaches, such as Austrian, evolutionary and post-Marshallian economics. We began by noting that corporate coherence referred to various types of synergies that 'glued together' a firm, typically a multi-product, divisionalized corporation. The concept of economies of scope captures some of the relevant synergies, but not all, because of its static connotations.

After a brief review and critique of selected previous work on corporate coherence (and related concepts), we distilled a number of insights from market-process approaches. The main point we sought to develop was that coherence should be seen in explicitly knowledge-based terms, and more explicitly as referring to the properties of collective learning processes. In this understanding, coherence is a general property of human systems, including firms, and refer to the balance between the exploitation of existing knowledge and the production of new knowledge, to the relation between what has called Knowledge Problem 1 and Knowledge Problem 2. We ended by arguing that successful real world firms are -- to a large extent -- successful, because they balance this trade-off in a superior way.

On the overall level, the theoretical novelty of the present paper lies in 1) carrying the analysis of corporate coherence somewhat further, and in 2) suggesting that basic categories developed to analyze market allocation and firm interaction may in fact be brought inside firms, as it were. Thus, we argued that at least large firms confront knowledge dispersal problems on a par with those that real economies confront, and we argued that in such firms there is a need for entrepreneurship in the Kirznerian sense. Moreover, we also argued that the concept of complementarity that plays such an important role in Austrian capital theory may be put to use in the analysis of firms. In such a perspective, firms may be seen as structures of complementary knowledge assets, and the particular constellations of complementarities may be determinative of sustained competitive advantage.

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Danish **R**esearch **U**nit for **I**ndustrial **D**ynamics

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- *The firm as a learning organisation*
- *Competence building and inter-firm dynamics*
- *The learning economy and the competitiveness of systems of innovation*

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The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

Theme B: Competence building and inter-firm dynamics

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

Theme C: The learning economy and the competitiveness of systems of innovation.

The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

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