

**CAPITAL STRUCTURES AND ORGANIZATIONAL STRUCTURE:  
AN AUSTRIAN MARKET-PROCESS THEORY OF THE FIRM**

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Abstract

Edith Penrose and G. B. Richardson can be seen as pioneering an approach to understanding the business organization that is richer than the accepted production function approach found in mainstream economics. In this paper, the Penrose-Richardson approach is related to both the well-known Coasian-transaction-cost literature and to the less well-known modern Austrian discussions of the capital structure. Building on the work primarily of Richard Langlois I find that a central defining characteristic that emerges in this synthesis is the phenomenon of change. Change is seen as key to understanding both the rationale for the business firm and the type and extent of institutional adaptations that occur over time.

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[I]n capitalist reality as distinguished from its textbook picture, [the]...kind of competition which counts [is] the competition from the new commodity, the new technology, the new source of supply, the *new type of organization*. (Schumpeter, 1947 pp. 84-5, italics added, quoted in Penrose, 1995 p. 114n)

### *1. Introduction*

The Austrian School of economics is perhaps best known for its theory of capital. It is ironic therefore that the modern (and as yet modest but growing) resurgence of interest in Austrian economics should feature so little of capital theory. It is to the school's original founder Carl Menger rather than to its most illustrious capital theorist Eugene von Böhm-Bawerk that the modern (or "post-modern") "market process" movement most consciously looks for inspiration.

This revival has produced much of interest; for example, in the fields of comparative systems analysis, free banking theory, history of economic thought, law and economics, and entrepreneurship (for a recent description and analysis see Vaughn, 1994). As yet, in addition to the notable absence of extended discussions on capital theory, there have been relatively few contributions to the theory of business organization - the theory of the firm (see however Foss, 1997). Surprisingly, these two oversights (the theories of capital and the firm) are related. Some aspects of the contributions made by Böhm-Bawerk in capital theory, which served to publicize the School in the eyes of the economics profession at large, have been a source of ambivalent but profound dissatisfaction to the market-process Austrians. They have felt largely unable to identify with the particular approach to capital theory that Böhm-Bawerk's legacy has inspired in mainstream Neoclassical economics, perhaps most simplistically portrayed in the production

function approach to the theory of the firm. Yet they have paid little attention to the development of an alternative approach. (A notable exception is Klein, 1996). Among the later Austrians, Frederich Hayek (1941) and Ludwig Lachmann (1978 [1956]), 1986) tried to reconstruct Böhm-Bawerk's approach to render it more "process oriented" (see Lewin, 1997a). I shall be concerned here primarily with Lachmann's contribution and relate it to a discussion of the economics of organization in the following way. Böhm-Bawerk argued that economies develop by the progressive adoption of wisely chosen roundabout methods of production. Lachmann reinterpreted this to mean the evolution of abilities enabling the use of more and more complex production structures. How is it that Böhm-Bawerk's "wise choices" get made and that such abilities to use more complex methods evolve?

Thus, in this paper I investigate the relationship between capital and business organizations. The classical approach to capital that developed out of the economics of Ricardo did not feature "capitalist" institutions in any way. And though Carl Menger was among the first, and most profound, of economists to analyze the diverse nature and function of institutions, he did not tie up his insights into the compositive nature of capital with the decision making functions of business institutions. Hayek and Lachmann working in the Mengerian tradition, elaborated on Menger's insights, but did not develop a theory of organizational structure to complement the theory of the capital structure.

A large literature on the structure of business organizations has recently developed. It has been variously characterized as The New Institutional Economics (Langlois, 1986a), Transaction

Cost Economics, Evolutionary Economics and Post Marshallian Economics.<sup>1</sup> In many ways it is most accurately thought of as an alternative to (critique of, extension of) the Neoclassical theory of the firm. It is beyond my purpose to undertake here a review or evaluation of this literature. I examine its implications, however, for an understanding of how a “capitalist” economy works.

That there are indeed such implications is perhaps the explanation for the scarcity in modern economics of contributions that can be classified as being in the field of capital theory. The highly abstract debates, that have been typical of that field, take on an increasingly sterile appearance in the light of these mounting contributions on the periphery of mainstream economics relating to an understanding of the organizations that actually accumulate and use capital. This literature has not, to my knowledge, except for some passing references (for example Foss, 1995 p. 32, Loasby, 1991 pp. 28, 29, 41, 70, 85) attempted a connection to the theory of capital more broadly. I begin by examining two pioneering contributions.

## *2. Capabilities and Capital*

This new literature on business organizations is sometimes also referred to as the “capabilities” literature. This is in reference to the conception of a firm as a repository of certain kinds of evolving abilities that are the key to understanding the “why” and “how” of the firm (Demsetz, 1991). It is in order to organize the necessary capabilities in a reliable manner that the

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<sup>1</sup> The invocation of Marshall’s name is related not to his “neoclassical” theory of costs and supply, but rather to his insistence that biology and evolution are more enlightening in the business environment than are mechanics and physics, and to his many discussions of the role of institutional factors (like trade practices and agreements) in the “ordinary business of life.” See also Foss 1994, 1995, 1996a, 1996b.

firm is seen to derive its purpose. So in a fundamental way, this literature grows out of the problem originally posed by Ronald Coase (1937) in his classic article probing the essential rationale of the firm (Williamson and Winter, 1990). Using the market to purchase the necessary inputs (capabilities) is costly involving transactions costs (the need to locate, identify, and bargain for inputs and construct and enforce contracts) which have to be balanced against the costs of internal ownership and direction of resources (the costs of training, monitoring and policing). The nature of these various costs have been the substance of much of the discussion of this literature. It is not surprising, as we shall emphasize below, that they involve considerations relating to the nature and acquisition of different types of knowledge.

A parallel source of origin of this “capabilities” literature, and the one from which it derived its name, is the pioneering work of G.B. Richardson (1990 [1960], [1972])<sup>2</sup> and Edith Penrose (1995, [1959]). This approach is more concerned with the way in which firms function and grow than in explaining their existence, although the latter emerges by implication. So this second source has adopted a more dynamic, evolutionary approach and one that is more obviously related to the question of capital accumulation.

#### Capabilities and Equilibrium - G. B. Richardson

In common with Ludwig Lachmann’s approach to capital, Richardson’s examination of investment in business institutions is an avowedly disequilibrium approach. In strikingly similar fashion to Lachmann (but apparently independently<sup>3</sup>), Richardson mounts a devastating critique

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<sup>2</sup> The term “capabilities” in this context was invented by Richardson.

<sup>3</sup> It seems that the common denominator is Hayek 1937a.

(perhaps the finest to be found) of the relevance of the model of perfectly competitive equilibrium (1990, Part 1). There are, as we will see, other informative commonalities.

Richardson advocates,

the setting aside of the concept of perfect competition, both as an explanatory device and as an ideal, my aim being to demonstrate that, even as a hypothetical system, it has one quite fundamental flaw, the exposure of which will point the way in which constructive revision can most properly be made (1990 p. 1).

This “fundamental flaw” is the inability of entrepreneurs (investors in capital) to get the necessary information, in or out of equilibrium. If they were in equilibrium how would they know it, how would they know their actions were optimal? If they were out of equilibrium how would they get the information necessary for them to take the actions that would produce a tendency toward equilibrium? (See Lewin, 1997b).

Given the manifest inconsistencies and implausibilities of the equilibrium model, Richardson sets himself the task of explaining how it is then that investment activities actually proceed in a highly orderly fashion in which the activities of suppliers, manufacturers and consumers are in great measure highly coordinated, even in the face of changes in the economic environment. He begins by distinguishing between two kinds of relevant investment information, *market information*, information about the activities of other market participants - customers, competitors or suppliers - which obviously influences the profitability of investment, and *technical information*, information relating to the physical transformation possibilities. It is the availability of market information that Richardson sees as most problematic.

It is evident an entrepreneur could rationally undertake an investment decision only if he had some minimum information about what [other] entrepreneurs would or would not do,

if he were assured that competitive investment would not exceed and complementary investments would not fall short of, certain critical levels (1990 p. 32).

Since, “a general profit potential, which is known to all, and equally exploitable by all, is, for this reason, available to no one in particular” (Ibid. p. 14), Richardson is concerned to determine how entrepreneurs obtain the minimum necessary information. Investors in capital projects need information about complementarities and about substitutes. We consider these in turn.

Complementarities occur at two levels. On one level they refer to necessary complementary activities required to complete the project. This includes the supply of materials by suppliers, the provision of services by contractors, and similar activities. And, obviously, these complementary activities must be available at the right time in the right sequence. We see here a manifestation of the time structure of production (Lewin, 1996). At another level there are complementarities in consumption that will determine the profitability of any investment project taken in isolation.<sup>4</sup> The sale of radios will depend on the availability of electricity. (One may recall here Lachmann’s (1978) discussion of indivisibilities and the scale and scope of investments, a theme echoed by many theorists in this literature). Computers must be sold in order for the production of printers and of software to be profitable (and vice versa). We see here a manifestation of a structure of consumption activities, which has its own logic in time and space.

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<sup>4</sup> Activities are complementary “in the sense that their combined profitability when undertaken simultaneously, exceeds the sum of the profits to be obtained from each of them if undertaken by itself.” (Richardson 1990 p. 72)

Richardson is grappling with the evolution of the capital structure “from the bottom up” as it were. Like Lachmann he perceives this structure as held together by complementarities at various levels, notably, levels internal and external to the firm.<sup>5</sup> But he is much more explicit regarding the micro economics of the evolution of this capital structure. The capital structure exists within and is dependent on a broader decision making structure that addresses the problem of how the minimum information necessary for the making of decisions is made available to the decision makers. Richardson identifies a number of “helpful imperfections” that constitute this decision making structure. Among competitors we find numerous types of trade agreements (defining aspects of “the rules of the game”), joint ventures (IBM and Apple, Chrysler and Toyota) and tacit understandings that ensure that perceived opportunities are not squandered. Much evidence exists (Chandler, 1977, 1990, 1992) to suggest that cartel formation, anti trust

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<sup>5</sup> “An entrepreneur will have to recognize that the profitability of his own investment will depend on the terms on which he can obtain inputs, and therefore indirectly on the volume of the investment which has been, or will be, undertaken elsewhere. Thus *the same kind of complementarity which exists between the application of different resources within the firm, exists also between the application of resources by different firms.* In the former case coordination, designed to ensure the best combination of complementary factors, is brought about directly by the entrepreneur in control; in the latter, it has to be achieved by different means ...” (Richardson 1990 p. 73, italics added). And in considering the interdependence as well of the cost structures of different firms, he notes, “The whole economy one may presume, is united by bonds of this kind, the strength of which will vary widely according to circumstances” (*Ibid.* p. 74).

concerns to the contrary notwithstanding, were crucial stages in the emergence of modern capitalism.<sup>6</sup>

A different kind of “imperfection” exists that helps to ensure that responses by competitors to perceived profit opportunities do not negate them (the opportunities). These fall into the category of factors limiting the ability of individual firms to expand in response to perceived opportunities. Unlike the Neoclassical firm,<sup>7</sup> firms in a dynamic world are idiosyncratic, they possess unique (inimitable) and limited capabilities that they have developed over the course of their histories (not always in a conscious manner).<sup>8</sup> Richardson refers here to

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<sup>6</sup> These evolved devices are made necessary by the dynamic nature of the world in which investment decisions are taken. In a world in which no significant change were taking place they would be (or would become) unnecessary. And indeed, in such a world, cartel and price fixing/market sharing agreements might indeed be a concern for eager policy makers. But a world of persistent technological change invites and requires persistent organizational change and, in any case, is not conducive to such “anti competitive” agreements enduring over time.

<sup>7</sup> It is interesting to note that in the Neoclassical literature the production function does “double duty,” serving as a tool of analysis for both the economy as a whole and for the individual firm. Given the assumption of constant returns to scale (CRS) in readily identifiable inputs, this is not surprising, since there is nothing to limit the size of firm. In an important sense the economy is simply the “firm writ large.”

<sup>8</sup> It is difficult to avoid the use of anthropomorphic language that suggests the firm possesses some sort of collective consciousness. I affirm strongly however that it is ultimately the individuals in the firm, at any point in time, in their various capacities that are the decision

“economies of experience” that serve as natural and helpful barriers to entry (Ibid. p. 60). Thus not every would-be investor is in a position to take advantage of a perceived opportunity at any point of time or within the relevant period (indeed *the very perception of the opportunity* may depend on particular capabilities). Emphasis is laid here on the importance of investments in specific and specialized assets, that is assets whose value is somewhat unique to the firm within which they are combined with other specific assets in a complementary relationship (cf. Lachmann, 1978). “The more specific the resources required for the manufacture of the product, and the smaller their elasticity of supply, the greater will be the likelihood that scarcities and bottlenecks will deter further expansion. Expansion in the capacity of some industry may be temporarily held up, that is to say, by delay in undertaking complementary investment elsewhere” (Ibid. p. 61).

The information requirements implied by complementarities are similarly mitigated by information networks and specific capabilities. Every investment project can be conceived of as a conscious, if necessarily and deliberately vague (because of the need for adaptability) plan.

Every business can be regarded as having to formulate, with greater or lesser precision, an investment program consisting of a set of planned activities related through some process of production or transformation. It will be based on an assessment of the various technical and market conditions upon which the prices at which the firm will buy its

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makers and the perceivers of information and in whom the capabilities “of the firm” must ultimately reside. I hope to make clear in what way the organization (the firm) may manifest these capabilities in different individuals at any point of time yet provide for their carrying forward through time and across individuals.

inputs and sell its outputs will depend. As this assessment is likely to be in the form, not of certain knowledge, but of expectations of varying degrees of reliability, an entrepreneur will wish his program to be as flexible or adaptable as possible, in order that it can be modified to take account of changing and unexpected circumstances (Richardson, 1990 p. 79).

That plan will usually include contracts of various terms and conditions, which will tend to reduce the degree of uncertainty attaching to the production plan, but only at the sacrifice of adaptability. In addition, the freedom of choice of the entrepreneur is further likely to be restricted by the fact that certain work is already in progress and certain specific inputs have already been purchased. One may assume that the entrepreneur will attempt to balance adaptability and uncertainty in a dynamic way as time unfolds. This uncertainty is of a “radical” or “structural” nature (Langlois and Robertson, 1995); that is, it is not probabilistic uncertainty, but uncertainty about the very structure within which decisions will have to be made in the future. It includes “uncertainty about the particular factor combinations which, at some future date, it will prove most advantageous to adopt” (Richardson, 1990 p. 83). Richardson is thus emphasizing the “element of trial and error” present in every real world production process. Thus we can say “there is no unique single way in which complementary investments come to be coordinated” (Ibid. p. 84). And there is certainly no unique way that is known ahead of time to all producers as suggested by a simple production function formulation. In terms of the market (or the economy) as a whole then, the firm cannot be said to be in equilibrium. There is no overall plan consistency. “[D]ifferent people may form different expectations or beliefs on the basis of identical information” (Ibid. p. 188).

Richardson does not dwell on the necessary failures that must occur as a result of these inconsistencies, the trial and error process at the level of the market, and is more concerned to show how successful production decisions can be made. His analysis is rich and (although it was relatively neglected for some time) has laid the basis of a number of important contributions to our understanding of the workings of organizations and investment processes.

### Penrose and the Growth of the Firm

Perhaps an equally important, and in very many ways complementary, pioneering work, is that of Edith Penrose (1995 [1959]). Penrose's work is concerned with the dynamics of firms. What external and internal factors are responsible for the way in which firms develop over time, the activities they undertake (or contract with others to undertake), the techniques they adopt, the products they choose to produce<sup>9</sup> and so on? The firm is viewed as a specialized "pool of resources" (cf. capabilities)<sup>10</sup> whose nature (productive potential) changes over time in response to events internal and external to the firm. Penrose has a compelling bona fide theory of endogenous change.

With the passage of time, the knowledge possessed by the employees in any firm changes. This knowledge, which includes productive and organizational skills related to the firm's particular experience, is a productive-resource specific, in some degree, to the firm. Thus, with time and experience, the firm accumulates productive capabilities that provide it with an important source of "excess capacity." For example, in the earlier stages of the production and introduction of a new product, employees are in the process of trial and error learning about the

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<sup>9</sup> We note again the caveat about using language that suggests that the firm per se "chooses."

<sup>10</sup> Penrose refers to these as "competencies."

product. As they accumulate expertise, much of which is of an informal, non communicable nature, they will find that they need less effort to achieve the results. The accumulated skills will present the firm with a form of increasing returns and indivisibilities that cry out to be used and provide an irresistible internal impetus to expansion. Much of what was novel becomes “routine,” leaving capacity for the development of new endeavors. This expansion occurs naturally in the production of new products and services that use similar skills (a point emphasized also by Richardson (1972)). Skills, however, are continually changing. Since experience generates new knowledge, “the productive opportunity of a firm will change even in the absence of any change in external circumstances or in fundamental knowledge” (Penrose, 1995 p. 56; see also Loasby, 1991 p. 62).

Expansion may occur through merger and acquisition, which is a way to acquire specialized human capital, or through internal expansion. But, however it occurs, in a competitive, technologically progressive industry, a firm specializing in the production of given products, can hope to maintain its position with respect to those products “only if it is able to develop an expertise in technology and marketing sufficient to enable it to keep up with and participate in the introduction of innovations affecting its products” Penrose, 1995 p. 132).

Expansion is also often necessary in a growing market because a firm’s share in the market is sometimes itself an important competitive consideration. In some industries, for example in the production of certain types of durable consumer goods, consumer acceptance of the product is influenced by whether the producer can reasonably claim to be one of the “leading” producers. It is under these conditions that growth is often said and with good reason, to be a necessary condition of survival (Penrose, 1995 p. 133).

This insight may be described as a “grow or die” hypothesis.

In common with Richardson (and Lachmann), Penrose notes the importance of complementarities in consumption in sometimes influencing the nature of firm expansion, especially when similar skills are called for in production, marketing or distribution. The same firms that make washers tend to make dryers. In the final analysis, however, it is the ability of the firm to maintain the productive value of its basic abilities, its human and physical resources, that determines its ability to survive. Capital investment takes place within a perceived decision making structure, only part of which consists of the technical intertemporal imperatives of production. In a very real sense prospective demand has to be “manufactured” through internal organization, market agreements, distribution arrangements and marketing efforts and these will have to be continually adapted.

In the long run the profitability, survival, and growth of a firm does not depend so much on the efficiency with which it is able to organize the production of even a widely diversified range of products as it does on the ability of the firm to establish one or more wide and relatively impregnable “bases” from which it can adapt and extend its operation in an uncertain, changing, and competitive world (Penrose, 1995 p. 137).

Each businesses is thus a kind of “research program” (Loasby, 1991) in which products, processes, methods of production and organization are continually being tried out.

### *3. Organizations in a Dynamic World*

#### Joint production is the key

Penrose and Richardson laid the basis for much of the work that followed in exploring the nature of business organizations in a dynamic world, a world of incessant, unpredictable technological change. These organizations can be seen as evolved responses to the need to make decisions in such a world. It may be doubted that organizations such as the firm would have any

enduring rationale or would survive in a world of stable equilibrium. Seen from the perspective of the evolving capital structure of the economy as a whole, the matrix of valuable, related productive capabilities, firms are incubators and filters through which these capabilities become available to the economy as a whole. The nature of the firm is thus relevant to the nature of the capital process. What is the rationale of the firm and what determines its boundaries and how they change over time?

A crucial feature of the firm, from our perspective, indeed in many ways its defining characteristic, is the fact of *joint production*. (Hicks (1973) emphasizes “jointness” as the key defining characteristic of (the problem of) capital). The fact that resources have to be combined in diverse, and sometimes mysterious (not fully perceived) ways, in order to be productive, can be seen to be the central principle around which firms function. Firms are in the business of making, monitoring and altering productive capital combinations (cf. Lachmann, 1978). We must include in the “capital” of these capital combinations, the human capabilities (skills, perceptions, judgments, etc.) to which I referred above.

The problem that the firm faces is quite simply the imputation problem. (The imputation problem contains within it other (sub)problems, like forecasting the level of sales. This will emerge from our discussions below). When a number of resources cooperate jointly in the production of a common output, unless we are dealing with a fairly divisible, repeatable process, in which the levels of output and input can be varied along a broad continuum so as to isolate in an “objective” way the contribution at the margin of each input (physical and human), there is bound to be a substantial degree of indeterminateness about the relative input contributions.

We may contrast this with the Neoclassical competitive model in which the productive processes are, in effect, standardized. The production function approach is one in which, by

assumption, input and output can be easily connected, thus facilitating the identification of marginal product. Competition thus ensures that earnings of the factor owners will tend to equal the values of the marginal products, and this of course also militates in favor of the most efficient use of resources. Efficiency and fairness are bound together. It is also a world in which the capital values of the individual capital items that constitute the capital stock, can be easily and conveniently calculated as the present value of the stream of value marginal products thus identified. And in this world the perception of capital in terms of aggregate economic values makes sense.

*But in such a world there is no reason for the firm.* All resources could be separately owned in a state of complete decentralization and could be brought together when necessary in order to fulfill profitable joint ventures. Since the marginal products are known to all, the matter can be handled by contracting with each of the factor owners. Labor could be seen to hire capital just as validly as the other way round. It is natural, therefore, that, in seeking to explain the existence of the firm in a manner basically consistent with the perfectly competitive model, recourse should be had to the costs of contracting and exchanging - transactions costs.

Yet, as we shall see, when examining this approach in greater detail, the existence of the firm must lead to an abandonment of the essentials of the competitive model and to the embrace of the firm as a response to productive processes which have an irreducible degree of indeterminateness (and arbitrariness). The seminal article in which Coase (1937) sought an explanation for the existence of the firm, and which has been the seed of a voluminous and diverse literature on the firm its nature and development, was at its base an appeal to problems presented by the incompleteness, *in some sense*, of information. Transactions costs are introduced as “frictions” in the otherwise smooth functioning of the economic system. As has

been noted many times, however, “all transactions costs are at base information costs” (Langlois and Robertson, 1995 p. 30, referencing Carl Dahlman, 1979).

### The existence of the firm and its boundaries<sup>11</sup>

Following Alchian and Woodward (1988) and Langlois and Robertson (1995) we note that the transactions costs literature can be divided into at least two (apparently) distinct approaches. One emphasizes the costs of administration, direction, negotiation and monitoring of the joint productive activities, while the other emphasizes more specifically the problems of assuring quality or performance of contractual obligations. Langlois and Robertson call the former the measurement cost view and the latter the asset specificity view.

The central notion of the measurement cost approach is connected to the indeterminateness of joint production. The difficulties in (inability to) isolate individual input

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<sup>11</sup> The dimension along which the boundaries of the firm are drawn may be an issue. The usual one is ownership. This is a legal distinction (Masten 1991). But it is not the only one. Another is control. For example, the owner of the firm does not own the labor he employs. In what sense are the employees working “within” the firm? The usual answer is that there exist long term contracts that effectively give the owner of the firm ownership over the outputs of the labor he employs and control over their inputs. However they don’t always go together. Along the control dimension, control over resources may exist even in the absence of ownership, as in the case of joint ventures between two separate legal entities. Alternatively, divisions within firms may behave with a great deal of autonomy, effectively like separate firms. We shall retain the familiar dimension of ownership realizing that the dividing line between the market and the firm is in many ways quite fuzzy.

contributions lead to a variety of important *organizing* problems, which the business *organization* is designed to solve. This approach focuses on the indivisibilities inherent in team production which may lead to shirking or fraud which is costly to monitor and detect (Alchian and Demsetz, 1972). An apparent implication of this is the suggestion that the residual claimant be the one to monitor and control since he has the most incentive to do so. This begs the question of who the residual claimant should be. Yoram Barzel (1982) has suggested it be the owner of the input whose contribution to the joint output is most difficult to measure. This is the input factor whose owner is most tempted by the potential fruits of moral hazard and, therefore, most in need of self policing. He then becomes the principal, leaving the inputs more easily measured to be owned by the agents. But this in turn rests on the presumption that we know, ahead of time, which contributions are easiest to measure and monitor. In some situations this may be obviously true, but surely not generally, suggesting that a certain degree of arbitrariness (non economic considerations) may be inevitable in determining the structure and boundaries of ownership.

The asset specificity approach, as its name implies, focuses on the information problems associated with the fact that joint production relies to a large extent on assets that are specific to their current employment. This is an (unconscious) application of Lachmann's (1978) concept of multiple specificity. An asset is specific when its opportunity cost is substantially below the value of its current contribution to production. In other words, the price that the asset could fetch in the market for employment in its next best use is substantially below (the discounted sum of) its current marginal value product(s).<sup>12</sup> It is producing a "rent" (surplus). The greater the

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<sup>12</sup> Of course, as I pointed out earlier, an important aspect of using the firm to organize production is that marginal products are not easy to determine. Still, where an asset is specific in nature it is

specificity the greater the “rent.” This means that it (its owner) is both powerful and vulnerable, depending on which contingency one considers. On the one hand, the owner of a specific asset can engage in profitable opportunistic behavior, the more essential the asset is to the joint product, by threatening to “hold up” the production process unless the terms of the joint product agreement (contract) are not altered in its favor. On the other hand, the other factor owners could behave opportunistically by threatening to cut out the specific factor, thus subjecting its owner to a capital loss directly proportional to the degree of specificity, unless the “rent” appropriation is not altered in their favor. The outcome will thus depend on the (perceived) balance between these two risks and on the costs of enforcing (at law or otherwise) any prior existing explicit contracts. There is a large literature on these questions which includes discussions of specific historical examples, like General Motors and the Fisher Body Company (for overviews see Williamson and Winter, 1990, Langlois and Robertson, 1995).

Both of these approaches suggest that the firm is an organization whose purpose is to cope with the inevitable information problems of joint production. If information were completely available, albeit at a (known) cost, then all production could be handled in a series of spot and long term contracts. “When contingencies can be adequately specified, or when the decisions of the cooperating parties don’t affect one another, contracts are possible and integration [into firms] is unnecessary” (Langlois and Robertson, 1995 p. 28). As it is, contracts are necessarily and deliberately incomplete. There is no way to completely account for all of the

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clear to all those involved in the production process that the value of its marginal contribution is substantially above its opportunity cost, even if a degree of arbitrariness attaches to the measurement of these values.

possible contingencies. In the literature this is sometimes described by saying that agents are “boundedly rational” and/or that information is “impacted” (contains unfathomable implications). These are variations around the Hayek/Popper/Polanyi theme concerning the special characteristics of knowledge (and the information from which it derives) (see Lewin, 1997b). In this context the “knowledge problem” is very specifically related to the indeterminacies of team production, involving as it does complementarity, specificity, indivisibility and change. Production not only involves complementary specific assets that are indivisible, but these relationships change over time. The importance of change is not always sufficiently emphasized and we shall return to it momentarily.

As suggested, one way to cope with the necessary incompleteness of the joint production contract is through the distinction between residual rights and specific (contractual) rights. All factor owners besides the residual claimant are paid a preagreed rate of earnings. The surplus over and above this is counted as profits. Profits then serve as the barometer by which firm’s performance is judged. The firm is owned by the residual claimant(s) who contracts with other factor owners. The residual claimant must make a judgment as to which factors to own and which to buy (or rent).

Thus where one draws the line between “the firm” and “the market,” depends on a variety of considerations that derive from the nature of joint production. The same indeterminacies and uncertainties of joint production that provide for opportunistic behavior also account for and provide clues to coping with the difficulties of framing, monitoring and enforcing explicit contracts. As Langlois and Robertson (1995) suggest, however, these considerations are likely to be continually changing over time and thus the boundaries of the firm are unlikely to be static.

## Production and Change

Production is a *joint venture* and production *takes time*. These two characteristics account for many (perhaps all) of the interesting and problematic aspects of the production process.

When we say that production is a joint venture this includes not only the fact that production processes may involve combining inputs in close proximity or under centralized control, but the more general fact, that whether under centralized control or not, production is a process of value creation (when successful) that depends on a variety of complementary inputs. Production is characterized by an implicit (and evolving) input and output structure that transcends the boundaries of the firm. The institutional (organizational) structure overlays and is intimately related to the production structure in such a way that it is impossible to accurately characterize the production structure without bringing in business organizations. *Organization matters for production*. It is part of the “capital” of any economy. Synergies of joint production (in this general sense) underlie the emergence of excess capacity (economies of experience) that Penrose describes and provide the basis for the “helpful imperfections” identified by Richardson, that constrain the actions of competitors and influence the norms of trade. Synergies of joint production are also at the root of the transactions costs of negotiating and monitoring arms-length contracts for joint outputs and of avoiding the moral hazards of hold ups.

Joint production would not be a problem were it not for the fact that production occurs over time. Time and knowledge belong together. This is Lachmann’s axiom. “As soon as we permit time to elapse, we must permit knowledge to change ...” (Lachmann, 1976 pp. 127-28, italics removed). It is inconceivable that time should elapse without learning. This is as true about the production process as about anything else. We can see how time and change enter into the production process in at least four different ways.

1. As we have discussed, ongoing processes of joint production contain an element of irreducible indeterminateness in deciding the *relative* contributions of the inputs. It is not possible to know at any point of time what the relative contributions of the various inputs are with any definite “objectivity.”
2. Rewarding the factor inputs in terms of the *value* of their marginal products assumes knowledge of the value of the final output per period of time. Yet, since input necessarily precedes output, the value of the latter is a matter of speculation, even assuming there are no uncertainties attaching to the technical aspects of the process.
3. Technical and organizational aspects are, however, bound to be uncertain to a greater or lesser degree concerning the quantity or quality of any output. Over time, as learning proceeds, things get done differently, and in ways no one could have expected.
4. Even assuming that 1, 2 and 3 above were not problems, there remains the problem of connecting units of specific input with specific units of output over time.

These observations echo some aspects of Böhm-Bawerkian capital theory. If the production process were fairly divisible and if it were unchanging over time, then with enough time one could (or the market would) vary the input configurations over a sufficiently wide range to be able to solve the imputation problem. Competition would then tend to ensure that each factor was paid the value of its marginal product. When the world is one of constant innovation, and the innovations often come in “lumps” (embodied in indivisible units or non-rival inputs), this is not possible. We shall encounter these issues in our consideration of how firms engage in productive activities below.

## Organizations and Change

In a number of contributions, Richard Langlois (for example, 1992, 1995, Langlois and Robertson, 1995) has extended the capabilities approach to business organizations to provide a dynamic theory of the boundaries of the firm. He considers the firm to be a device for acquiring and economizing on useful knowledge (see also Demsetz, 1991). Firms are able to do this because they are institutions. Institutions, broadly understood, are systems of rule following behaviors. Rules (or, in the context of the firm, routines) provide a way of acquiring information about the future actions of others, within particular domains. (We confidently expect everyone in the USA to drive on the right side of the road). These rules can be understood sometimes as an aspect of human behavior, in the form of tacit knowledge (people follow them unconsciously), or, alternatively, as constraints external to the individual (like private property). In both cases they are conducive to an “orderly pattern of behavior” (Langlois, 1992 p. 166).

A firm is an organization embodying a system of (sometimes unarticulated) rules and routines (Vanberg, 1992; also relevant is Nelson and Winter, 1982). Vanberg considers a firm as a “constitutional system” within which behaviors are conditioned by the written or unwritten rules of the constitution. This constitutional aspect is made necessary by the nature of joint (team) production - the dependencies of teamwork necessitate contractual constraints of certain kinds and duration. Thus the firm’s constitution, like Britain’s political constitution, is implicit and composed of the understood rules of conduct that facilitate concerted and cooperative action. “The procedural rules that underlie organized or corporate action can justly be viewed as a *constitution* because they *constitute* organizations as corporate actors” (Vanberg, 1992 p. 136). Perhaps one way to think of the effect of the constitution of a firm (or any organization) is to suppose that the behavioral response (choice) to certain categories of events is independent of the

responding (choosing) individual in that organization. This requires that the individuals of an organization have internalized the rules, routines, procedures, etc. that constitute its constitution, its “culture.” Langlois connects this with the capabilities of the firm by “applying the ideas of rule following to questions of organizational form ... the rule - the routines - that agents follow within an organization embody (often tacit) knowledge that is useful for action. This knowledge constitutes the *capabilities* of the firm” (Langlois, 1995 p. 251).

Though the founding of a firm may have been the result of a well articulated plan (and purpose), there is a sense in which firms are organic rather than pragmatic organizations (Menger, 1985). Following Vanberg (1989), Langlois (1992, 1995) has added a dimension to Menger’s well known distinction between organic and pragmatic institutions. The distinguishing feature in Menger was the question of origin. He distinguishes between pragmatic institutions (like firms, clubs, legislation) that were created for specific purposes and organic institutions (like common law, language, money) that are the unintended results of behavior. Hayek, working along this Mengerian theme, distinguishes between orders and organizations according to whether they serve a specific purpose or not. “The rules of an order are abstract and independent of purpose, whereas the rules of an organization are concrete and directed toward a common purpose or purposes” (Langlois, 1992 p.168; Hayek, 1973 p. 38).

Thus instead of a single dimensional line we have a two dimensional matrix of institutional types.

**Table 1: Types of Institutions.**

	<u>Orders</u>	<u>Organizations</u>
<u>Spontaneous</u>	organic orders (law, language, money)	organic organizations (firms?, bureaucracies)
<u>Planned</u>	pragmatic orders (designed constitutions or contracts)	pragmatic organizations (firms?, clubs)

Langlois writes (1995 p. 249)

Both parts of the term *spontaneous order* are of interest. What makes a system of rules spontaneous rather than planned is, in effect, a question of origin... Unlike an organic system of rules, a pragmatic structure is one set in motion by conscious intention, and thus, in a sense ...is a creature of planning. At the same time, a system of rules in Hayek's theory can be either an *order* or an *organization*. In an order, the rules that guide behavior are abstract and independent of purpose; in an organization, those rules guide behavior toward more or less concrete ends.<sup>13</sup>

It is clear that the firm should be in the right column. But it is not clear that it fits obviously into either the top or bottom row exclusively and, in an important sense, is a hybrid.

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<sup>13</sup> From a "God's eye" perspective or from a Public Choice perspective the organic/pragmatic dimension might collapse. "[O]ne might easily portray the entire Public Choice theory of politics as undermining a conception of government as a pragmatic institution" (Langlois 1992 p. 169).

Though it may be a creature of the conscious design of its owner/founder it almost never develops in a predictable way, especially if it is to be adaptable enough to survive in a dynamic world. As Langlois conjectures, the more dynamic the environment the more abstract the nature of the organization's constitution needs to be for it to survive, the more it needs to be like an order. Hence the firm is more akin to an organic organization.

To see more specifically how firms evolve, one needs to focus on the capabilities and routines that constitute it. In Langlois's theory the determinants of organizational structure are the nature of the capabilities both within and outside the firm on the one hand, and the nature of change and uncertainty that it faces on the other. The story of economic progress and development is the story of the introduction of innovations of various types at various levels, new products, new characteristics of existing products, new methods of production, or some combination of these. In terms of their effects we may distinguish between two types of innovation. *Systemic* innovations and *autonomous* (I prefer "stand alone" or decomposable) innovations (Teece, 1986; Langlois, 1995). Systemic innovations have system wide implications, they require (if they are to be successful) changes in several related stages of production. This implies that some existing assets would be rendered obsolete and capabilities not previously valued, or perhaps not yet available, would become useful.

This "regrouping" of capital combinations (Lachmann, 1978) that constitutes the changing ("mutating") capital structure carries with it implications for the organizational structure. Existing capabilities may be under separate ownership. "Under this scenario, the business firm arises because it can more cheaply redirect, coordinate, and where necessary create the capabilities necessary to make the innovation work. Because control of the necessary capabilities in the firm would be relatively more concentrated than in a market-based

organizational structure, such a firm could overcome not only the recalcitrance of asset holders, whose capital would be the victim of creative destruction, but also the “dynamic” transaction costs of informing and persuading new input holders with necessary capabilities” (Langlois and Robertson, 1995 p. 2). Dynamic transactions costs are the “costs of not having the capabilities you need when you need them” (Ibid 2n).

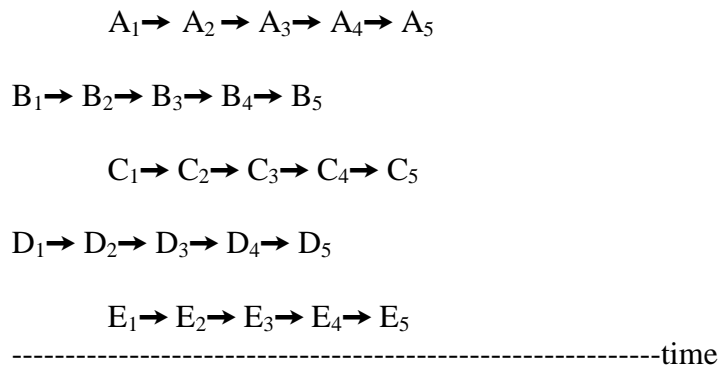
According to Langlois this scenario is an accurate description in general terms of the historical development of many of the enterprises that feature in the “second Industrial Revolution” in North America and Germany in the late nineteenth and early twentieth centuries as chronicled in the work of Alfred Chandler (Langlois, 1991, Chandler, 1977, 1990, 1992). Systemic innovations like the lowering of transportation and communication costs created profit opportunities for those who could create mass markets and take advantage of production economies of scale and scope (steel, farm machinery, meat, soap, and many others). In an important sense, we see in retrospect that a series of innovations were connected in a complementary way, but these profitable improvements implied the destruction of existing decentralized systems of production and distribution in favor of integration into large scale production. Integration is seen in many cases to be necessary to overcome the “opposition of vested interests” (Langlois, 1995 p. 252), of people doing things the old way.

Organizational structure is here seen to be the result of entrepreneurial innovation. In order to exploit perceived opportunities entrepreneurs had to change the existing organizational structures in addition to production structures, or, more accurately, in order to effect the latter they had to accomplish the former. An excellent generic example of how altering the organization of production can be a value creating innovation is provided by Axel Leijonhufvud (1986, see also Langlois and Robertson, 1995, chapter 3). Leijonhufvud shows that it is not just

(or even necessarily) a matter of using large scale machinery that accounted for the profitability of factory production. To make the point he schematically contrasts craft production with factory production. In craft production, craftsman sequentially complete all the operations necessary to make the product. In factory production, by contrast, each worker specializes in one operation. We recall Adam Smith’s pin factory where “the important business of making a pin is ... divided into about eighteen distinct operations which, in some manufactories, are all performed by distinct hands” (Smith, 1982 pp. 4-5, quoted by Leijonhufvud, 1986 p. 208).

For example, imagine five distinct operations being performed by five different craftsmen. Each one works at his own pace and differs in skill (both absolutely and relatively) across the different operations. This is depicted in Figure 1.

**Figure 1: Craft Production**



Now suppose that we simply rearrange the work as depicted in Figure 2. Work previously done in parallel now proceeds in series. Worker A specializes in performing operation one, worker B in performing operation 2, and so on. We have introduced joint or team production. Each individual now has to work at the pace of the team, making supervision easier. It is important to note, however, that the engineering parameters of the production process have not been changed. The tools are the same in kind (though each workman no longer needs a complete

set<sup>14</sup>) and the workers are the same people. Yet we may expect an increase in product. Production is not simply a matter of identifying and combining the inputs (in an unspecified way), unless we broaden what we mean by “input” so as to empty it of all analytical power. As Leijonhufvud pertinently notes this “sequencing of operations is not captured by the usual production function representation of productive activities; nor is the degree to which individual agents specialize...Smith’s division of labor - the core of his theory of production - slips through modern production theory as a ghostly technological-change coefficient or as an equally ill-understood economies-of-scale property of the function” (Leijonhufvud, 1986 p. 209).

**Figure 2: Factory Production.**

$A_1 \rightarrow B_2 \rightarrow C_3 \rightarrow D_4 \rightarrow E_5$

$A_1 \rightarrow B_2 \rightarrow C_3 \rightarrow D_4 \rightarrow E_5$

$A_1 \rightarrow B_2 \rightarrow C_3 \rightarrow D_4 \rightarrow E_5$

$A_1 \rightarrow B_2 \rightarrow C_3 \rightarrow D_4 \rightarrow E_5$

$A_1 \rightarrow B_2 \rightarrow C_3 \rightarrow D_4 \rightarrow E_5$

-----time  
 The economies achieved by moving from crafts to factory production arise from an increased division of labor, a move from individual to *team* production. Leijonhufvud enumerates three aspects of this. First, team production results in *product standardization*,

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<sup>14</sup> In this sense the innovation is *capital saving* rather than requiring capital of larger scale. Also, it is possible that the new process may need less “goods in process,” inventory. In crafts production workers may leave goods unfinished as they move from one operation to another, working on a few goods at a time. In team production this does not happen (Leijonhufvud 1986 p. 210).

workers produce the *same* product. Second, greater coordination is achieved in time sequencing, supervision under a shared set of rules, routines and tacit understandings (that improve over time). Third, the labor of individual workers become complementary inputs rather than competitive activities. The absence of any worker will disable the production process.

Recalling the context of Adam Smith's original observations, it has often been noted that *human capital* is intimately involved. Smith explains how specialization improves dexterity, saves time and leads to worker-inspired innovations. To this we should add that specialization may result in the saving of certain kinds of human capital. Workers need no longer possess the skills necessary to make a pin from beginning to end (Leijonhufvud, 1986 p. 211). The division of labor is also, in an important sense, a division of (human) capital. In this context it is easy to see how the assumption of a homogeneity of human capital is every bit as misleading as the assumption of homogeneity of physical capital. As the society and the economy progresses, people obviously learn "more" and the knowledge "of the society" is in a very real sense greater. But it is also true that, in another sense, individuals do not have to know as much in so far as they are more specialized.

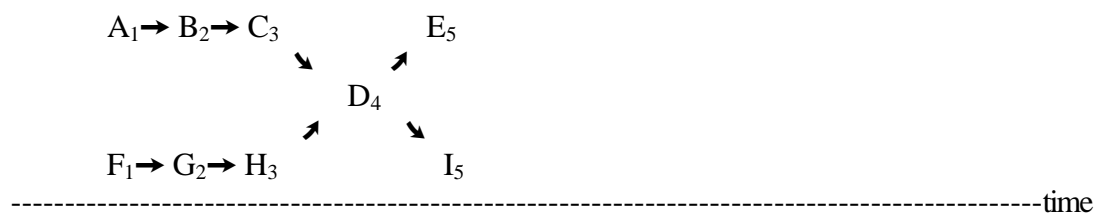
An interesting aspect of this example is the fact that the increase in output occurs without any change in the types of inputs (and with fewer capital goods and goods in process) or any change in technology. Though changes in technology may follow upon, or precede, organizational changes, as this example shows, organizational changes themselves can sometimes bring improvements in productivity. This underlines the problems associated with physical notions of the capital stock. In this example, considering capital as being composed of the types and quantities of the inputs fails completely to capture the source of any increase in

value that arises. This suggests that *organizational structure is a crucial aspect of the capital structure in general.*

Obviously this example is suggestive of particular types of organizational innovation, one employing a vertical division of labor. It gives one reason why integration of workers may prove profitable. But other forms of profitable organizational change may not be so clear in their implications for organizational type.

Leijonhufvud notes that economies are to be gained from judicious horizontal divisions as well. This can result from the indivisibilities that come with prior innovations. So for example, imagine that one of the stages of production - stage 4 - is running at half capacity (a railway car, a telegraph system). Imagine running two parallel production processes as shown in Figure 3. There is twice the output of just one process, but the double output comes at the expense of less than twice the inputs, a clear economy of scale of the Lachmann (1996) variety. These economies of scale come from organizational change rather than from technology, though the indivisibility that makes it possible may be the result of a technological innovation.

**Figure 3: Parallel Processes and Indivisibilities.**



In this example the two “industries” or firms or processes share operation 4. They may not even be the same processes. They may have a common need for operation 4 (like transportation, communication or electricity) and be quite different in other respects. This is a different type of division of labor. Stage 4 has become a specialized activity on its own. It is

clear that these economies of scale depend in a crucial way on the “extent of the market” or on the “throughput” (Lachmann, 1996 pp. 147-48), that is on the size of the demand for the services of the various stages that are supplied in indivisible multiples. It is also clear that more complex patterns will most likely arise with indivisibilities and cross-process connections at more than one stage. The degree of returns to scale depends on the amount of excess capacity at each stage. (A similar observation is made by Penrose considering resource combinations within the firm that have to be made up to the “lowest common multiple” Penrose, 1995, pp.72-73 ). If the number of stages is held constant, these economies become less and less significant as output is increased and, in this case, approach constant returns to scale in the limit (Leijonhufvud, 1986 p. 214). However an aspect of economic progress is an increasing number of interrelated activities or stages of production (Lachmann, 1978 chapter V). Pursuing this line of reasoning, there is then an unending source of scale economies in the market process.

As Leijonhufvud explains (interpreting Smith and Marx) the process of the division of labor is connected to the process of technological change. “As one subdivides the process of production vertically into a greater and greater number of simpler tasks, some of these tasks become so simple that a *machine* could do them...[We are led to] the *discovery* of ...opportunities for mechanization” (Leijonhufvud, 1986 p. 215). If we think of each of the organizational schemes of production such as those discussed above as being one of many possible schemes, then we can easily see the part they could play in an evolutionary process toward greater complexity (a larger and larger number of interdependent productive activities and stages). In effect (paradoxically), greater complexity in production leads to the achievement of greater simplicity and convenience in consumption. (The more complex the central processing unit of the computer the more user friendly it can be made).

So, returning to Langlois's dynamic theory of the firm, changes in organizational structure lead (directly and indirectly) in a plausible way to changes in production costs. In the move from craft production to a factory this implies a form of vertical integration as did the kind of changes required in the Second Industrial Revolution. Integration is favored in situations where changes are systemic and require large scale entrepreneurial reorganization of existing capabilities and where new required capabilities are not easily available from the market. But more generally, for example in the case of indivisible shared resources, it is not so clear that change leads to integration and may lead in the opposite direction to disintegration or "spin offs." In many cases the innovations may be local or decomposable. Perhaps the most important examples occur in *modular systems*, like personal computers, stereo sound systems, telephone systems and the like. "For present purposes, the key feature of a modular system is that the connections of 'interfaces' among components of an otherwise systemic product are fixed and publicly known. Such standardization creates what we might call *external economies of scope* (Langlois, 1992 p. 253)." This is a phenomenon of complementarities in consumption (household production) that both Richardson and Penrose noted. It allows component manufacturers to specialize their capabilities independently but confident of a sufficient market (cf. Richardson, 1990).

As economies develop the capabilities needed for innovation are more likely to be found in the market and Chandler-type integration may be unnecessary. Even if at first the firm may find it necessary to develop its own marketing and distribution networks and specialized production capabilities, over time, with the growth of knowledge, outside specialists may develop. So integration may be a phase that becomes superseded by disintegration (as for example happened in the case of Ford Motor Company). In addition, some of the obsolete

existing capabilities may already exist inside the firm and require excision as in the case of “downsizing” caused by technological restructuring. On the other hand, this situation may account for an element of inertia in some corporations, making it more difficult for them to adapt. As in the computer industry and the illustrative case of IBM, “economic change has in many circumstances come from small innovative firms relying on the capabilities available in the market rather than existing firms with ill-adapted internal capabilities” (Langlois, 1995 p. 253)<sup>15</sup>

According to Langlois, the boundaries of the firm are thus not only a matter of transactions costs and moral hazard, but must be seen within a changing environment as a form of strategic adaptation. In the absence of change, knowledge of prices, products, abilities, reputations, and anything else that is important to the (unchanging) production process, becomes general and the need for the firm as an organizing device progressively disappears. (Opportunistic behavior, for example, is less profitable when the same game is repeated many times (Langlois, 1992)). But in a dynamic world the capital structure evolves within an evolving institutional and organizational structure.

#### *4. Conclusion*

In this paper we have seen that the Neoclassical firm as a “black box production function” bears very little resemblance to that dynamic, enigmatic, ever changing business organization that we know from our everyday experience as the firm. Instead we have learnt from a number of theorists to view it in a different light, as a remarkable organizational device

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<sup>15</sup> The “make or buy” decision may also be influenced by the regulatory structure in the face of competition and change as, for example, in the case of the decision to “outsource” to non-union specialist manufacturers.

for the achievement of productive activity. The firm, in this view, is “a device for the coordination and use of particular kinds of knowledge, including the coordination of knowledge generation, by the imposition of an interpretive framework” (Loasby, 1991 p. 59). It is an important example of the coexistence of equilibrium and change (Lewin 1997b). As a system of (sometimes tacit) rules, routines, procedures and cues, it evolves over time, but it does so sufficiently slowly, if it is to succeed, to provide a stable, understandable environment within which decision makers can act, can conjecture about product types, methods of production, types of inputs, the meanings of market signals and the like. Each firm, based on its experience (the experience of its members) “acquires a unique character as an interpretive system, construing events and acting on the basis of its interpretations” (Loasby, 1991 p. 60). The decision outcomes are thus the results of idiosyncratic interpretation combined with commonly observed information, like market prices, in a generally understood decision making process.

We need to note, for the sake of completeness, that the same evolved capabilities that have served some firms in good stead in favoring them to adapt to particular circumstances, may, in other circumstances, prove to be its undoing. Firms used to a particular “way of doing things” may exhibit a degree and type of inertia or narrowness of approach that may render them unsuitable for particular environments. In such situations we get radical organizational change. And this may occur at the market level, where those organizations who happen to have the right configuration and approach will be favored, and at the firm level where those firms who are able to adapt survive. An example might be the emergence of the M form structure of corporation

(Williamson1986), or the move toward non hierarchical organizations (Minkler, 1993).<sup>16</sup> Often the crucial factor in these shifts is the changing nature of the knowledge utilized by business organizations.

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<sup>16</sup> Minkler provides an interesting analysis of organizations with “knowledgeable workers” that is to say workers who posses not only a degree of “know how” but moreover the capacity to make decisions in hitherto unencountered situations, “initiative.” Such organizations would, under most situations, tend to be participatory rather than hierarchical. So as the nature of productive knowledge changes so must the nature of the organization. See also Drucker 1993 and Nonaka and Takeuchi 1995.

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