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**Competitive Interfirm Dynamics within
an Industrial Market System**

by

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Abstract

This paper develops a conceptual framework within which the fundamental resource dynamics of an economy may be investigated. The framework has heterogeneous firms at its center, and the dynamics governing their competitive, evolutionary and entrepreneurial interactions are made the object of analysis. This approach is motivated by the desire to penetrate to the resource dynamics of a capitalist economy, and to bring out the significance that interfirm resource networks play in the way that economies adapt and respond to novel situations. The management of these relational assets - resources, routines and interfirm relations - is seen as a critical issue in the success of individual firms and of whole economies. The paper embarks on this project through the synthesis of four current business perspectives, in the belief that rapid changes in the global economy call for renewed efforts towards theoretical integration. The four perspectives are the dynamic capabilities perspective on the firm (incorporating the resource-based view) as developed in the strategic management literature; the markets-as-networks view, as developed in the industrial marketing and purchasing literature; the evolutionary economic view, as developed by Nelson and Winter; and the entrepreneurial discovery view, as developed by Schumpeter and the Austrian school. It is contended that a synthesis of these perspectives will reinforce each, and lead to novel insights.

Keywords: networks, firms, economic development

JEL: L21, D23, M13

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Introduction

This paper develops a conceptual framework within which the fundamental resource dynamics of an economy may be investigated. The framework has heterogeneous firms at its center, and the dynamics governing their competitive, evolutionary and entrepreneurial interactions are made the object of analysis. This approach is motivated by the desire to penetrate to the core industrial dynamics of a capitalist economy, and to bring out the significance that interfirm resource networks play in the way that economies adapt and respond to novel situations.

The paper develops a conceptual framework within which industrial dynamics and competitive interfirm interactions can be analyzed in terms of adaptive responses to changes in the complex system of which the firms form part – rather than in terms of anomalies and exceptions, such as the “market failures” and “externalities” favored in mainstream microeconomics. In order to do so, the framework draws on insights from four current business perspectives, namely the dynamic capabilities perspective on the firm (incorporating the resource-based view) as developed in the literature on strategic management; the markets-as-networks view of interfirm coordination within industrial markets; the evolutionary economic view that seeks to account for changes in firms’ competitive performance in terms of variation in their underlying organizational routines, and the entrepreneurial discovery perspective of Schumpeter and of the wider Austrian school. The paper brings these perspectives into alignment within an integrated conceptual framework.

The motivation for this exercise is the increasing complexity of global economic processes, involving multiple interfirm linkages and evolving institutional frameworks, calling for renewed efforts towards theoretical integration.¹ Firms operate in a world economy rich in interfirm connections, rich in resources. The most nimble firms today are quick to take advantage of these resources, accessing them through a variety of international interfirm contractual relations. The theoretical models utilized in management and economics ought to reflect this wealth of

¹ The *World Investment Report 2000* (UNCTAD 2000) describes the world economy in terms of multiple cross-linkages between a growing number of multinational enterprises (reaching 63,000 in 1999, controlling 690,000 national subsidiaries), between which there is a “plethora of interfirm connections.” Flows of resources, such as technologies and capital, between these firms with international activities, has been growing at an accelerated rate. World Foreign Direct Investment reached close \$865 billion in 1999, accounting for 14% of world gross capital formation – up from only 2% in 1980.

opportunity that firms can discover. The aim of this paper then is to build conceptual bridges between these various theoretical perspectives. The goal is lay the foundations for a synthesis that may bring the economic and management sciences closer together, and in closer accord with current business developments and opportunities.

The past two decades have seen substantial progress achieved in developing a dynamic view of the workings of the economy centered on the role of firms and their heterogeneity. The “dynamic capabilities” view of the firm, encompassing the related “competence-based” or “resource-based” views of the sources of the firm’s competitive advantages, has developed an acute sense of the sources and dynamics of competitive advantage.² According to this perspective, the observed variations in firms’ profitability and performance results not from the different industrial settings in which essentially uniform firms compete (the conventional assumption) but from the heterogeneity of the firms themselves, based on the distinctiveness of their “resource endowments” and the capabilities they build out of these. The framework has been extended to encompass the routines that firms build in order to make use of their resources: the two then contribute through mutual effect to the development of the firm’s dynamic capabilities. This framework has been very successful in accounting for firms’ abilities to diversify and to sustain the sources of their competitive advantage.

A quite different line of inquiry has been developed toward understanding the heterogeneity of firms and their strategic postures, and that is to focus on interfirm relations themselves, and the networks that are thereby created. In this “markets-as-networks” framework, the focus is on networks of exchange relationships between firms as a major coordinating mechanism within market economies, and as a major source of collaborative advantage for the firms involved. This approach has been associated initially with the work of Scandinavian theorists, but is now widely adopted as an intuitively satisfying perspective on business relations in industrial markets. The firm is seen as acquiring an identity, not just through its internal resources or capabilities, but through its external connections and interrelations, i.e. in the notion that “no business is an island.”³

² See Teece, Pisano and Shuen (1997) for the key description of the “dynamic capabilities perspective” (DCP), to be discussed in detail below. References to the RBV are given below.

³ The phrase comes from Håkansson and Snehota (1989).

Neither of these business frameworks has yet to make much impression in the wider economic literature, such as in the evolutionary economics current which seems to be rapidly moving to become the mainstream. This despite the fact that the “founding text” of evolutionary economics, namely Nelson and Winter (1982) explicitly formulated an approach to evolutionary dynamics grounded in firms and in the organizational routines they develop. Nelson and Winter insisted that firms do not make instantaneous responses to market signals, as in the neoclassical economic fantasy, but in fact make “satisficing” responses mediated through their “sticky” routines. It is variation in these routines, and the resultant changes in selection pressures felt by firms (positive or negative) that accounts for competitive dynamics from an evolutionary perspective. This was a big step away from traditional economic theorizing about the firm (in terms of production functions, instantaneous transmission of information, perfect information concerning technological possibilities etc) and towards serious engagement with the internal dynamics of firms’ capabilities development.

Finally the literature on entrepreneurship has exploded, driven by the exceptional dynamism of the “new economy” and the startup firms it generates.⁴ There have also been parallel developments such as the rising importance of corporate spinoffs (as counter-trend to mergers and acquisitions) whereby firms seek greater focus and entrepreneurial initiative through divesting parts of their operations as viable businesses.

It is long overdue that these perspectives should be brought into closer and mutually reinforcing alignment. The dynamic capabilities perspective goes a considerable way in doing so, but it stops short of developing a model which engages directly with evolutionary theorizing and with network dynamics. Calls have been made to develop a synthesis of the RBV of the firm with evolutionary economics.⁵ Economists have sought to extend the capabilities view to encompass “distributed capabilities.”⁶ Likewise there have been efforts to take the insights of industrial

⁴ See for example Kirzner (1985; 1997a: b) on the entrepreneurial process as one of discovery of new opportunities, which is a source for the approach adopted here.

⁵ See the essays in Montgomery (1995) as representative. Winter (1995) in particular discusses connections between the two streams, in terms of “four Rs of profitability: rents, resources, routines and replication.”

⁶ See for example Coombs and Metcalfe (1999).

markets theory into the wider sphere of economics.⁷ Yet the disciplines and frameworks remain stubbornly apart.

This paper takes as its starting point a somewhat radical proposal for bringing these intellectual traditions into closer alignment, or at least to a point where they conceptually meet and mutually reinforce each other. The proposal is couched in the form of a simplified representation of economic reality, which may for our purposes be called an *Industrial Market System* (IMS). It is this abstraction which provides the neutral conceptual ground where analysis may be conducted that draws simultaneously on the different traditions.⁸ In a nutshell, the IMS models an economy in terms of six categories: *actors* (or firms), their *activities*, the *resources* they assemble in order to be able to conduct their activities, the *routines* they build so as to actually perform their activities, the *relations* they establish with other firms, to create networks of influence and coordinate their activities, and finally the *fitness functions* employed by actors to provide them with a set of criteria for deciding what kinds of activities to engage in, what kinds of resources to acquire, what kinds of relations to establish, and so on. It is through the choices made in terms of the fitness function that firms acquire their distinctiveness, or heterogeneity, which then underpins their divergent strategies and leads to a range of competitive dynamics. The categories specified are those with which the industrial markets and the competitiveness literatures deal. The radical nature of the proposal lies in the claim that these categories are also sufficient for discussing the essential features of evolutionary and entrepreneurial dynamics within an economy.

The model of the economy captured by the IMS describes economic dynamics in terms quite different from those used in conventional neoclassical analysis. It is not concerned with features of firms' activities, such as costs, prices, profits, and existence or otherwise of market-clearing sets of prices, as is pursued in general equilibrium theory in a comparative statics setting. Rather its concern and focus is on the path-dependent trajectories followed by sets of firms as they make adaptive adjustments to external circumstances in terms of their constitutive resources, routines and relations. The focus then is on the adaptive behavior of the firms themselves, individually and in interacting groups (networks) as the complexity of the system

⁷ See for example Snehota (1990) and Forsgren et al (1995).

⁸ See Hakansson and Snehota 1995; Tesfatsion 1997; Wilkinson, Wiley and Lin 2000 for discussion of the ingredients of an IMS and the motivation of the concept.

evolves. The resources which are available to firms, and the routines the firms build to fashion capabilities, and the networks they create through their relational interactions, become the prime focus of interest, not just in a static sense but as pathways of development. The dynamics through which firms come to acquire and make use of resources, and the processes through which new resources are produced within an economy – in short the *resource dynamics* of the economy -- thus come to acquire a significance which is almost totally suppressed in conventional microeconomics.

In this exploratory paper, the dynamic behavior of firms in the IMS is investigated conceptually, with a view to reproducing the main findings developed in the RBV of strategy, and in the network view, and placing these within an evolutionary and entrepreneurial framework. In this way, the IMS framework will be utilized to generate industrial dynamic behaviors that are plausible. But an attempt will also be made to demonstrate some of the novel insights that emerge from such an investigation. One such insight concerns the view of resources as seen not by incumbents (the usual perspective in the RBV) but by challengers. While it makes sense for firms that possess resources that are valuable and rare to seek to sustain competitive advantages based on them by making them as non-imitable as possible, this situation in fact only applies to a minority of firms. The majority are seeking to make a living as best they can, and frequently this means replicating the resources of others with a view to imitating their competitive posture. Thus challenger firms sometimes choose to compete in activities for which resources are most easily acquired or imitated. This gives rise to quite different criteria for evaluating the competitive significance of resources for firms. From the perspective developed within the IMS, both pioneers (incumbents) and challengers play an important role in ensuring that industries remain dynamically adaptive. This broader evolutionary perspective is again in tune with developments in the global economy.

A final issue concerns the empirical grounding of the IMS in both experimental and data-based work. The IMS can be investigated experimentally and empirically in a number of interesting ways. For example, there can be micro-studies of the actual dynamics of resources, routines and relations in specific industries, in specific countries. There can be studies of the “speciation” of resources and routines and relations in different settings, such as in the processes of innovation or in market

expansion. There can be experimental simulations of specific formal realizations of the IMS framework, captured in graph-theoretic models, or in terms of the mutual interactions of intelligent agents, along the lines of artificial life simulations with their penetrating insights into emergent phenomena of complex adaptive systems. Perhaps the most interesting empirical application of the IMS is in the ambitious project to describe the complete set of kinds of resources, routines and interfirm relations available within a modern economy, seeing them as the “economic genome” specifying all possible varieties of industrial dynamics. Their exhaustive description would constitute in every sense of the word an “economic genome project.”

The industrial market system

Consider as an abstraction of the economy an “industrial market system” (IMS). The interfirm linkages and interconnections within an economy can be captured in such an abstraction and brought to the foreground of analysis.⁹ Such a notion abstracts away from other features of an economy such as production and consumption of commodities, price formation and the clearance of markets for goods and services, monetary phenomena, distribution of income etc. These are all of obvious importance but they have no direct bearing on the central issues of how firms generate distinctiveness through their interaction and how their interaction generates evolutionary and competitive dynamics. These become the central focus in the examination of the IMS.

Formally, we represent the IMS in terms of the set $\{A, X, \Theta, P, \Sigma, \Phi\}$

where A is the set of actors (firms) in the IMS (allowing for new firm formations and extinctions over time);

X is the set of activities carried by the actors;

Θ is the set of resources available to firms at any time;

P is the set of routines which firms have fashioned to make use of their resources;

⁹ The notion of an IMS can be described as “interrelated organizations involved in creating and delivering products and services to end-users” (Wilkinson, Wiley and Lin 2000: 2). Earlier treatments within the industrial marketing tradition have generally focused on three categories – actors, activities and resources – where relations are treated as a “resource.” Wilkinson, Wiley and Lin (2000) draw on A-life simulations, and add the fitness function. The treatment in this paper is therefore novel in capturing network effects through the category of “relations” and adding the category of “routine” as a way of linking with the evolutionary economics tradition initiated by Nelson and Winter (1982) and the dynamic capabilities literature (Teece, Pisano and Shuen 1997).

Σ is the set of relations through which firms coordinate their behavior with respect to each other (exchange, contract etc); and

Φ is the set of fitness functions employed by the actors.

The IMS may be formalized through a variety of methods, such as graph theoretic methods, and simulated in terms of intelligent agents, or Markov processes, or NK models of fitness landscapes, or through other means. The details of formalization nor computational details will not concern us in this initial paper.¹⁰ Let us start by elaborating on the six elemental categories, and the reasons that inform this choice.

Actors (firms). Firms are the basic driving entities in the IMS model, and the prime objects of interest. Firms are instruments of action; they exist to carry out activities in ways that are both effective and efficient. They control the resources needed for activities; they build the routines through which resources are utilized; they establish relations with each other. They make choices about all these things in terms of their goals, values or ‘fitness function.’

Activities. Firms are differentiated in terms of their activities, which complement each other. Very few firms perform all the activities necessary to bring some raw materials through a lengthy process of transformations to finished products in the hands of end users. These activities are accomplished by firms specialized in certain aspects of the process. This differentiation of activities constitutes the division of labor of the economy, which as Adam Smith first noted, is a function of the size of the market, ie the more extensive the market, the more specialized the differentiation between firms’ activities can be. The interactions, with their complementarities, underpin the collaborative and competitive features of the behavior of firms, and form the foundation for the organization of industry.¹¹

Resources. Resources are the productive assets of firms, the means through which activities are accomplished. The basic insight that separates the RBV of the firm, and evolutionary economics generally, from conventional economic and

¹⁰ As Metcalfe (1998: 8) put it: “Computational models are undoubtedly of great help in providing a more general treatment [of economic evolutionary dynamics] but I think that it is necessary at first to get the basics straight.” That is what I propose to do in this paper.

¹¹ See Richardson (1972) for a pioneering exploration of this notion in an economic context, complementing the discussion of the organization of industrial markets developed in various works by Forsgren, Håkansson, Johanson, Mattsson, Snehota et al in the Scandinavian tradition.

industrial organization analysis, is that resources are seen as lending distinctiveness to firms, ie generating heterogeneity. There is no “representative” firm in the IMS; the point is to model firms in all their heterogeneity, starting with their different resource endowments, and moving on to the dynamics of the processes through which these resource endowments may be changed (extended, contracted) through the development of routines and the inter-relations between firms. Actors’ resources set limits to what the company can do.¹² As such, resources include tangible entities such as production systems, technologies, machinery, as well as intangibles like brands, or property rights such as landing rights for an airline or bandwidth for a telecoms company.¹³ As pointed out by Wernerfelt (1984) products (activities) and resources are two sides of the same coin.¹⁴ Resources are utilized in the firm’s activities to convert inputs into outputs; the inputs themselves are not counted as resources. In this sense we are making a distinction between the services provided by resources, which enable the firm to accomplish its activities, and the stock of resources themselves. Think of resources in this sense as the catalysts that moderate a chemical reaction; they affect the rate, but they themselves are not consumed in the process. This is a vital distinction that has been somewhat obscured in treatments of the resource-based view of the firm and in some network models.¹⁵ In the conventional RBV, it is the firm itself which is seen to be in control of its own resources. This gives rise to an extensive strategic management literature concerned with how to preserve advantages based on resources which are held to be non-imitable etc. But in the IMS this is complemented by an approach which sees firms being able to access further resources

¹² Rumelt (1984) was one of the first to link strategic direction with resources; he argued that the firm’s strategic significance is “characterized by a bundle of linked and idiosyncratic resources and resource conversion activities” (1984: 561).

¹³ Teece, Pisano and Shuen (1997: 521) prefer the term “specific assets” by which they mean, the firm’s specialized plant and equipment, its “difficult-to-trade knowledge assets and assets complementary to them, such as its reputational and relational assets.” This is consistent with the treatment offered here, except that “relational assets” are treated as a separate category.

¹⁴ As Wernerfelt (1984: 171) put it:

"Most products require the services of several resources and most resources can be used in several products. By specifying the size of the firm's activity in different product markets, it is possible to infer the minimum necessary resource commitments. Conversely, by specifying a resource profile for a firm, it is possible to find the optimal product-market activities."

¹⁵ This goes back to the origins. Penrose (1959) for example included raw materials and work in progress in her list of resources. In the present account these are seen as inputs (or outputs) to firms’ activities, not the resources utilized in production activities. From a network perspective, Johanson and Mattsson (1987) spell out a formal model involving actors, activities and resources, but it is unclear whether they are making the distinction defined here. They say, for example, that “actors use

by virtue of their relations with other firms, ie through their membership of various networks. This access to a range of resources expands the strategic options available to firms. At the same time the resource dependence of firms on others with which they have links, constitutes a constraint on strategic initiative.¹⁶

Routines. Firms act on the real world through their routines, otherwise known as processes or standard operating procedures.¹⁷ It is routines that lie behind the effectiveness and efficiency of firms as instruments of action. Thus firms sell outputs to other firms and end-users, and do so through sales and marketing routines, invoicing processes, stock adjustment processes and so on. Firms purchase inputs, and they do so through purchasing routines, goods inward checking and storing processes; and various kinds of search processes and comparison processes. Firms purchase resources, such as capital equipment, through routines such as capital asset budgeting procedures and investment evaluation routines. Firms have routines for employing staff; for conducting their activities (production, product and service development, customer support); for conducting audits and accounting for their costs and revenues. Cyert and March (1963) introduced the concept of standard operating procedures and made them the basis for a behavioral theory of the firm, seeing them as “sticky” attributes which are difficult to change. Nelson and Winter (1982) added an important evolutionary and purposive dimension to the concept, calling them routines. Their value lies precisely in their being able to function repetitively, giving stability to the firm’s operations. But again this conservative character means that firms can be “stuck” in behavioral patterns that become maladaptive as circumstances change. It is variation in routines that can generate selective dynamics amongst firms and thus an evolutionary process.

Relations. No business is an island (Håkansson and Snehota 1989). The reality is that firms exist and develop an identity based on the relations they build with other firms, either directly as suppliers or customers, or indirectly as collaborators or as competitors. To treat firms as atomistic entities making all their decisions for themselves, as is done in mainstream economic analysis and in much management analysis, does serious violence to this reality. Thus a central feature of the IMS is that

certain resources to change other resources in various ways” thus leaving open the interpretation that resources might refer to production inputs as well as to technology and equipment.

¹⁶ An initial exploration along these lines is provided by Dyer and Singh (1998).

it treats firms as interconnected in large or small, tight or diffuse networks – as is the reality for all firms in actual economies. The dynamics of firms’ relations – the creation of linkages, their modification or rupture, and the patterns formed – become a central focus of interest in the network view. The management of relations also becomes a factor in firms’ success of equal significance with the management of internal operations. Relations, like resources and routines, can only be changed slowly. Thus firms can be caught in networks that represent a threat to survival if the network as a whole is losing competitiveness. In the IMS it is the reality of interfirm relations that is brought into focus, without making the mistake of claiming that network structures are always advantageous.

Fitness functions. Firms are intelligent agents, and assess their current choice of resources, routines and relations against the alternatives available, and against the performance of their activities relative to that of their competitors. Thus the actors/firms in the IMS are equipped with a goal-setting function that we may identify as providing the firm’s values, or its theory of its own efficacy, or what Drucker has called its “theory of the business.” This function allows the firm to make choices, or to discriminate between courses of action. It is the function through which the firm determines its activities and their intensity, and how it makes choices as to the resources, routines and relations needed to support these activities.

IMS model. These basic elements of the IMS constitute a self-contained whole whose behavior over time will emerge, based on the core features of the actors, namely their resources, routines and the relations between them, and their theories of how they may best adapt to their environment in terms of these resources, routines and relations. It is thus the “stickiness” of routines, resources and relations that lends stability to industrial market systems; while the variability in these elements promotes adaptation and response to changing circumstances not just by the firm on its own, but by the networks as a whole. The IMS thus offers the simplest possible representation of the interfirm dynamics of a real economy, in terms of these six basic elements and their interactions.

What is of interest in such a representation of economic reality is the capacity of the firms to respond and adapt to change, both individually and in collaboration

¹⁷ On processes as organizational routines, see Garvin (1998); on standard operating procedures, see Cyert and March (1963/1992). The vast literature of the 1990s on “business process reengineering” attests to the importance of business processes, or routines.

with other firms in networks. In this sense the firms are intelligent agents capable of generating “emergent behavior” that is not predictable in advance; what is of interest is the “worlds they mutually create.”¹⁸ It is the dynamics of the firms’ ability to vary their activities in terms of their underlying resources, and to engage in resource-sharing and resource-extending behavior through network dynamics that gives them enhanced competitive capacities. It leads to behavior that builds networks, alliances, development blocks and other “supra-firm” structures. These are the real engines of dynamic economic response to changing conditions – but they are suppressed in conventional microeconomic analysis which is focused almost exclusively on what goes on in product markets.¹⁹

Some economic features are not mentioned as fundamental, although in practice they are extremely important. The first to mention is the category of *market*. Rather than assume that markets exist, as is done in mainstream economic analysis, the model of the IMS takes the view that markets emerge as a result of the exchange relations between actors.²⁰ Thus it becomes an interesting issue to explore the economic processes through which markets emerge, and through which markets actually function.

A second category that does not appear as a root term is the notion of firm *capabilities*. Again this is done for the reason that capabilities are derivable from the way that firms choose and activate their resources, through their development of routines, and through their choice of linkages with other firms, ie relations.²¹ We may impute a sense of the firm’s capabilities to the breadth and depth of the routines which it is able to call upon as its operating circumstances change. Our interest lies in how

¹⁸ The phrase comes from Kauffman (1996) as representative of the Santa Fe approach.

¹⁹ In the words of Tesfatsion describing a more limited version of an IMS:

[T]he actions of each unit depend upon the states and actions of a limited number of other units, and the overall direction of the system is determined by competition and coordination among the units subject to structural constraints. The complexity of the system thus tends to arise more from the interactions among the units than from any complexity inherent in the individual units per se (Tsfatsion 1997: 534).

²⁰ In this the IMS is Austrian in inspiration, and it fits the “markets-as-networks” views developed in Scandinavia. On the Austrian school, with its notions of “market process as discovery” see for example Kirzner (1985; 1997a; b). This is further elaborated in the discussion of entrepreneurship below. On the Scandinavian “markets as networks” school, see for example Forsgren et al (1995); Johanson and Mattsson (1987, 1994); Håkansson and Snehota (1995).

²¹ Likewise in much of the RBV literature, an important distinction is maintained between resources (assets) and capabilities; see for example Amit and Schoemaker (1993) as well as the contributions to the “dynamic capabilities” view (Teece, Pisano and Shuen 1992; 1997).

actors (firms) build capabilities through the use of resources, routines and the relations that bind them to other firms.

Several other categories are not mentioned, and can be taken to emerge through the actions of actors, individually and in combination. For example various kinds of supra-firm structures can emerge, described as “development blocks” or “clusters” or “technological systems” or “technological trajectories” or consortia of various kinds, which shape the responses of economies to changing conditions. Within the IMS these can all be seen as various kinds of co-evolutionary phenomena that emerge from the complexity of the system, as actors seek to create systemic substructures for their mutual advantage. Institutions themselves emerge to shape economic behavior. In the context of the IMS, institutions can be treated as “generalized routines.”²²

Thus the idea of the IMS model is to bring out the implications of firms being placed in positions of mutual dependence – as is actually the situation in the real economy. The purpose in constructing such a model as an abstraction of a real capitalist economy, is to concentrate a discussion of competitive and evolutionary dynamics utilizing these six fundamental categories and those derived from them, such as networks, markets and firm capabilities, *and on nothing else*. This forces the focus on the resource dynamics that underpin firms’ advantage, and the nature of the interfirm resource exchanges that shape these dynamics – rather than the activities of firms producing goods and services, which distracts attention from fundamentals.

Think of this as giving a boardroom perspective on the firm’s operations. It would be very odd if the boardroom discussions of firms were focused exclusively on matters to do with production efficiencies, rather than – as is actually the case – on the fundamental relations between the firm and its competitors, its collaborators, its investors, its potential targets for acquisition to acquire further resources, and the potential acquirers who may be interested in adding its resources to their own. These matters have always in practice been the concern of boardrooms -- but not of conventional microeconomic analysis, with its production functions, cost functions

²² Of course the IMS does not exist in a vacuum. Rather it is embedded in a set of institutions, laws and conventions that enable it to work. These institutions are what differentiate capitalism as an “engine of progress” from capitalism as a system of organized criminality. But the details of these institutions, and their mode of operation, lie outside our immediate concern in elaborating the dynamics of the IMS.

and so on. It would be a positive step to bring the perspective of the boardroom into economics, which is what is encouraged in the framework of the IMS.

Resource dynamics within the IMS

The disposition of resources within firms is the outcome of entrepreneurial action, or it is bequeathed from earlier situations. It is the task of management to utilize such a resource stock and extract the most productive services from it in transforming inputs into outputs.²³ The range of goods and services to be produced with the services provided by such a resource stock cannot be known in advance; it is a matter of discovery, a process of learning, where the outcome depends on the management's knowledge, experience and capacity for imaginative experiment. Management seeks to capture synergies between resources (utilizing a resource bundle for more than one kind of activity, or to produce goods for more than one kind of market). The capture of such synergies is the resource-economy equivalent of co-specialization of assets and the capture of cost-based economies of scope in the goods and services economy.²⁴

The distinctiveness of the IMS as a framework for analysis compared with the conventional RBV is that it brings into focus the resource dynamics that actually drive the competitive performance of real firms in real economies.²⁵ It is striking that the business pages of the newspaper daily report these phenomena of resource dynamics. Firm A acquires a business division from Firm B because B is moving out of a certain business and A is diversifying, and needs the resources that B can provide. Or there is a public auction of telecoms licenses, giving firms access to spectrum that is thereby converted from a public resource to a private resource – or rather, a new set of

²³ It was Edith Penrose in *The Theory of the Growth of the Firm* (1959) who developed the first clear expression of a "resource-based view" of the firm. She considered firms to be "bundles of resources" and saw the specialization of these resources as fundamentally accounting for the variations between firms. As Penrose put it (1959/1995: 31): "The business firm ... is both an administrative organization and a collection of productive resources; its general purpose is to organize the use of its 'own' resources together with other resources acquired from outside the firm for the production and sale of goods and services at a profit" For a recent discussion of Penrose's contribution, see Pitelis and Wahl (1996).

²⁴ Teece (1992) has developed an account of the dynamics of firm diversification in terms of the co-specialization of the assets involved and the capacity of managements to appropriate the services of these assets.

²⁵ On the resource-based view, see the fundamental contributions by Wernerfelt (1984) or Barney (1991) or Amit and Schoemaker (1993); Conner and Prahalad (1996) and Collis and Montgomery (1995) provide a critical review. Foss (1998) develops a critique of the lack of a dynamic perspective – the issue addressed in this present paper.

economic resources is actually created. Firms C and D merge their operations, in order to create a greater resource base with global reach. Firms E and F enter a strategic alliance, sharing resources for the development of some new product while remaining competitors in every other way.

These processes are best described in terms of resource dynamics – the propagation, transfer, exchange of resources between firms, through various kinds of linkage and leverage contractual mechanisms. It is surely the restlessness of the resource dynamics processes within the economy that is a characteristic feature of successful capitalism.²⁶

Resource dynamics start with the *creation* of resources. Resources are created by firms, usually through the recombination of existing resources, and occasionally through the creation of something completely new. It is an entrepreneurial activity which creates new resource combinations, and out of these new combinations, managers need to fashion synergies through building routines which implement the new combinations as totalities. An interesting case of new resource creation involves the process of technological standardization. A technological standard is a resource which enables producers to build a market for a product. The process of standardization, which is actually one of the most important facets of economic dynamics (but ignored in conventional microeconomic analysis) is best understood as a process of resource creation and diffusion.

Firms that develop valuable resources, such as a proprietary technology standard, can exploit the profitable opportunities involved in disseminating this standard as widely as possible, either under their own control (technology transfer) or to third parties (licensing). This is aptly described as *resource propagation*. Firms are involved in a variety of contacts with each other, as customers, suppliers, collaborators as well as direct competitors. Firms find it expedient to enter into various kinds of collaborative arrangements, such as alliances and joint ventures, even with their competitors. The trick is to "manage" the spheres of collaboration and competition so that they do not interfere with each other. From the resource perspective these are cases of *resource sharing*.

²⁶ As Metcalfe (1998) puts it:

“.. markets are to be judged by their capacity to adapt to new opportunities and to facilitate the creation of new resources, and it is this openness to change which is the defining characteristic of market capitalism.” (1998: 7)

Firms can redeploy resources, effecting an exchange from one to another, as can occur in mergers and acquisitions. Here the acquiring firm can transfer tangible as well as intangible assets from the firm acquired; they might be broadcasting licenses, or airline routes, or process technologies. In each case the issue is: to what extent can capabilities be transferred along with the assets that make up the resources?²⁷ Firms can also obtain resources from other firms through active strategies of resource acquisition and absorption. Prahalad and Hamel (1990) called this *resource leverage* in the context of their treatment of the "core competence of the corporation." (1990). The gist is that firms with an active conception of strategy, as "stretching" the corporation to expand its resource base with a view to entering new markets or new businesses, seek out the resources required and take the steps needed to incorporate them. Latecomer firms from East Asia, for example, entered into Original Equipment Manufacturing (OEM) contracting arrangements with advanced firms in the USA and Europe, partly for the cash flow generated by producing goods for other firms to brand, but even more importantly for the flow of knowledge resources such contracts entailed. These firms were all acting on the assumption that resources were *available* and *accessible* -- provided suitable strategies were employed for securing access to them.

In these ways, through resource creation, propagation, exchange, sharing and leverage, there is a flux to the resource base of the IMS, as in a real economy. The competitive edge to this is the imitation of resources, putting pressure on the incumbents from challenger firms which seek to appropriate or replicate the incumbent's resources. Resources are subject to endless replication and imitation processes in any competitive economy. This is the origin of the richness of resources in the global economy.²⁸

Building firms' dynamic capabilities: Positions, pathways, processes

Teece, Pisano and Shuen (1997) created the benchmark for the study of firms' capabilities as sources of distinctiveness generating competitive advantages. They term their view a "dynamic capabilities perspective" (DCP) precisely to differentiate

²⁷ These issues are discussed in Capron and Mitchell (1998) where the term used is resource redeployment; such resource redeployment is a frequent object of the merger, rather than financial or competitive considerations.

²⁸ Note the different emphasis here from that of conventional microeconomics, where it is scarcity which is seen as the driving force of economic behavior.

it from the somewhat static approach taken in the conventional RBV. The DCP is concerned above all with how firms' capabilities are fashioned, and adapted to changing economic circumstances.²⁹ Our aim is to demonstrate how firms' dynamic capabilities may be built out of their resources, routines and relations. It is most straightforward to consider this from a dynamic perspective, considering how these elemental categories make varying contributions to the creation of firms' capabilities as they grow. This is a "capabilities life cycle" approach, which is very much in the spirit of "dynamic capabilities." We shall then show how the categories of the DCP, namely firms' positions, pathways and processes, may be made intelligible in terms of the categories of the IMS. The real strength of the IMS framework comes out when considering the specificity of resources, routines and relations in functional settings, such as the resources and routines needed for new product development.

Resource dynamics and the life cycle of firms' capabilities

The IMS allows us to construct an account of the building of capabilities with varying intensities of resources, relations and routines, depending on the stage of development of the firm.³⁰ We can see firms as depending initially on their resources and on little else. But as they acquire experience and develop products or services, so they build routines that enable them to make better use of their resources, or to acquire new resources and integrate them into the existing resource base. This is the period where the firm is expanding its capabilities, through diversification, and is acquiring an identity in terms of its distinctive routines and relations rather than just its resource base. At a further stage of development of the firm, its routines come to play a much more important element in its distinctiveness than its original resources. Firms can develop routines for resource acquisition that confer powerful competitive advantages. Cisco Systems for example, in Silicon Valley, has become famous for its practice of "outsourcing R&D" through the acquisition of small startup firms that bring fresh resources and routines into Cisco, oriented towards novel aspects of telecommunications systems operation. Or take the case of a consultancy like McKinseys or Anderson Consulting, both of which again have an extremely well developed set of distinctive routines for analyzing business problems that in a sense it

²⁹ The basic statement of the DCP is provided by Teece, Pisano and Shuen (1997) and the contributions to Dosi, Nelson and Winter (2000), while Teece (2000) provides an updated summary with applications to the case of firms from Newly Industrializing Economies.

doesn't matter who implements these routines. It is the fact that it is a McKinseys routine or an Anderson Consulting routine that the customer firm is paying for. Thus capabilities can rest differentially on resources, routines and relations: firms will differ in their strategic priorities in their sourcing of their distinctive capabilities.

Positions, processes and paths

Now let us translate this account into the language of the DCP. In this framework, the firm's *positions* are defined by its various "assets" such as technological assets, complementary assets, financial assets and locational assets. In the IMS, firms' positions are defined by their current stock of resources, relations and routines. The two approaches are getting at the same idea, which is that the firm's strategic options are constrained at any point by its current resource position, as well as by the routines and relations established.

In the DCP, a firm's *processes* are considered generally as encompassing not just routines, but also coordination and integration processes, organizational learning, reconfiguration of activities and organizational transformation.³¹ In the IMS, we see routines as a category that can accommodate these features of the firm's distinctive capabilities. A coherent classification of capabilities can be developed based on the kinds of routines that firms build on the basis of their resources and relations. The point is however that routines lend a firm strength, but they also trap it into learned patterns that may become suboptimal or downright inappropriate as circumstances change.³²

Now a firm's position and its processes are not given for all time, but constitute a base from which the firm may make adjustments as it seeks to adapt its operations to changing circumstances. Thus the *pathways* followed by the firm, the trajectory of its strategic options as defined by its capabilities, may again be captured in terms of the variation in its constituent resources, relations and routines. These can be traced as trajectories in a "resource space" or "routine space" where different strategic priorities and different starting points will lead to different trajectories.

³⁰ Christensen and Overdorf (2000) refer to this as "capability migration."

³¹ Likewise Sölvell and Birkinshaw (2000) discuss the dynamics of multinational firms in terms of their activities and their processes – except that they utilize the term "practices". There is clearly need for some standardization of terminology in this area.

³² A graphic example is provided by the repeated failure of semiconductor equipment supply companies to respond to even marginally different elements in the processes required in each product generation, as revealed in the study by Henderson and Clark (1990).

Functionally specific capabilities

Capabilities are best considered in specific functional settings, rather than in general terms. As soon as we turn our attention to specific capabilities such as those involved in innovation, eg new product development, or process variation, then the grounding of capabilities in resources, routines and relations can be rendered explicit and intuitively plausible. Consider the case of new product development, which is an important area where firms seek to develop distinctive capabilities. Such capabilities rest on functionally specific resources, routines and relations. The kinds of resources needed to support new product development include scientific research assets (such as testing laboratories); market research assets; and aesthetic design assets.³³ Routines need to be developed to set these resources in motion. In particular, routines are needed to coordinate the various phases of the product development process. Distinctiveness can be generated in terms of the degree of “parallel development” achieved in such routines, as opposed to simpler linear processes. Linkages between firms are increasingly seen to be critical to successful new product development, since most firms cannot hope to master the knowledge involved in every step of the process. This feature is captured in the notion of “distributed capabilities” in innovation; in the terms of the IMS, the same phenomenon can be described in terms of the management of interfirm relations as part of the process of building innovation capabilities.

For the purposes of this paper, we may define the firm’s capabilities as residing in its distinctive approaches to accomplish its activities, based on its resources, relations and routines, which it adapts and modifies as circumstances change. This approach to a definition has the advantage of linking the notion of the firm’s capabilities to its capacity to accomplish its activities, which is intuitively the way to link firm capabilities with the term as used in human psychology. It links skill to action. But at the same time, within the IMS, we link firms’ capabilities to their capacity to manage their network interactions, which are to be seen as an extremely important source of competitive advantage. The issue is the transfer or replication of capabilities, which is an issue to be taken up in the discussion of evolutionary dynamics.

Network dynamics and interfirm coordination

The ‘markets-as-networks’ perspective provides the benchmark for analysis of network dynamics within the IMS. This perspective enables us to make sense of a world that is “rich in interfirm connections” and possibilities for firms to develop and expand their strategic options in terms of linkage and leverage from other firms. The focus in this section is develop an account within the IMS of the ways that firms’ relations with each other shape their dynamic responses to new situations (in terms of their positions) and their capacity to vary these, while also providing an account of the way that responsive adaptation can occur at the level of the network as a whole, ie at a supra-firm level.³⁴

In the network view, it is the relations between firms themselves, ie their exchange relations, which becomes the object of interest. Firms coordinate their behavior with respect to each other by forging links and relations of various kinds. These are direct links, which form networks, and indirect links, mediated via third parties. Thus firms become involved in overlapping networks, which constitute the principal form of coordination in the IMS. As the number of members of a network grows, so the processes of interfirm coordination become more standardized, and come to approximate what we recognize as a market.

Firms share activities when they complement each other, to form what can be called a ‘value chain.’ Richardson (1972) captured this point, in his pathbreaking paper on ‘organization of industry’ when he discussed firms’ activities in terms of being either complementary or similar, putting firms into either collaborative or competitive relations with each other.

Intensity of interfirm relations

We can discuss the relations between firms in terms of their intensity. Using the categories of the IMS, we can identify three levels of intensity of relations, depending on whether they involve sharing of activities (the simplest level), the

³³ See Christensen (1995: 1996) for a discussion of what are called the “asset profiles” needed by firms to support new product development.

³⁴ On the markets-as-networks perspective, see contributions from scholars adhering to the IMP (Industrial Marketing and Purchasing) group, such as the contributions to Axelsson and Easton (1992) and Ford (1997). For a comprehensive introduction to the ideas that contribute to the understanding of business relationships, see Ford et al (1998), as well as Wilkinson and Young (forthcoming). See Forsgren et al (1995) for a summary of Scandinavian scholarship on markets as networks.

sharing of resources, or the sharing of routines (closest and most demanding of relations). Thus the sharing of activities is the most straightforward kind of interfirm connection, created for example between firms in a supply chain. At a higher level of intensity, firms may share resources. This is one of the critical sources of advantage of a network.³⁵ Provided it has access to firms with complementary resources, a firm can accept a business order from a customer that transcends its own abilities; it subcontracts parts of the order to firms within the network which have the requisite resources. This is sharing of resources, or securing access to ‘virtual’ resources, and it is a powerful source of competitive advantage, particularly for SMEs.

At the highest level of intensity, firms can build relations with each other that call for sharing of routines. This is the most complex and demanding of relations to manage, since each side is critically dependent on the capabilities of the other in co-managing the routine efficiently and effectively. But shared routines can give networks of firms powerful competitive advantages. They are also very demanding in terms of management attention and capacities.

Take the case of the network organization TCG, a clustered group of interacting IT firms in Sydney. This network of semi-independent firms has developed sophisticated trans-firm routines such as its ‘triangular’ process of product development.³⁶ TCG as a small firm would develop a competence in, say electronic metering. It would then seek to extend this competence into a new area, such as electronic metering of aviation fuel delivered to planes on airport tarmacs; in other words, it would look to diversify into this new business where it sees an opportunity. TCG would look for two kinds of partner firms to accomplish this diversification. First, it would look for a good customer firm who might underwrite the costs of developing an initial product – one of the oil companies, for example. Second, it would look to an existing supplier of aviation metering devices that is in the market, but lacks the critical electronic competence, and seek to forge a relationship. Thus the market is opened up to the new product, with TCG sharing the rewards with two partners.

So far then we have been concerned with interfirm dynamics from the perspective of resource exchange and propagation, and how this lends firms advantages through their interactions. Let us now turn explicitly to the time

³⁵ See discussion on this point in, for example, Foss (1998).

dimension, to examine these dynamics from an evolutionary and entrepreneurial perspective.

Evolutionary dynamics: Replication of resources, routines, relations

The ingredients of an evolutionary approach in economics are now reasonably well-defined.³⁷ It is clear that a consistent and coherent account must identify some category or categories as unit of variation and something else (or the same) as unit of selection, together with an account of the actual processes involved in generating variations and selecting entities according to some designated "fitness" criterion. Furthermore there has to be some kind of "inheritance" function, or entity which accounts for retention. Recall that Nelson and Winter (1982) introduced their pioneering analysis of evolutionary economic processes by making the argument that selective pressures operate on firms in terms of variations in their underlying capabilities and routines (and by extension, resources).³⁸ This was a completely novel way of viewing interfirm dynamics. It dispensed with neoclassical fantasies such as that firms adjust instantaneously to changes in commercial conditions, eg changes in prices, by adjusting their production functions. Instead Nelson and Winter argued that firms respond to changes in conditions through the medium of their routines, which can be varied only slowly and with difficulty. They modeled evolutionary dynamics in terms of random variations in firms' routines, tracing out the selective pressures subsequently felt over hundreds of repeated iterations.

In the two decades since NW appeared, there has been an explosion of interest in evolutionary processes, not just in economics but across the board, in every facet of human and cultural behavior as treated in the social and behavioral sciences. Darwinian processes of variation followed by selection and retention are now recognized in a vast array of domains, from individual development, to the acquisition of behavioral routines, and from the evolution of languages, through evolution of

³⁶ See Miles, Snow, Mathews et al (1997) for a summary description.

³⁷ For excellent introductions, see Witt (1992), Dosi and Nelson (1994) or Metcalfe (1998); Langlois and Everett (1994) provide an illuminating discussion informed by a reading of the current evolutionary debates in the biological sciences.

³⁸ See discussions by Nelson and Winter (1982) and the individual contributions of each author, such as Nelson (1989; 1991) and Winter (1987; 1995).

conceptual thinking, to evolution of technologies, organizations, institutions and laws.³⁹

This then provides the setting for discussing evolutionary processes within the economy, and specifically within the IMS. At the outset, we should not be surprised to find several such processes operating simultaneously, and over very different time spans. Furthermore, we should not equate “change” with “evolution”. The essence of the evolutionary perspective is not captured simply by a sense of change. Things change in the economic sphere, as in many other areas of human activity. But the changes might be entirely in terms of stimulus and response. They might entail learning. Or they might be simply random. What distinguishes evolutionary processes from all these is its character of blind variation (ie variation with unforeseen consequences) followed by selection combined with retention (or inheritance).⁴⁰

The replicator-interactor perspective

The ruling idea behind the replicator-interactor perspective, is that evolution proceeds through variations in the replicators, which give distinctive advantages (or disadvantages) to the actors embodying these replicators.⁴¹ In the biological world the replicator is genetic material, and the interactors are organisms. In the cultural and behavioral world, the replicators are memes, and the interactors are people whose brains carry the memes. In the business world, the replicators are firms’ resources, routines and relations, and the interactors are the firms themselves. The firms are then selected, through market competition, and hence reproduce the replicators which conferred on them the advantage. The special feature of the evolutionary model is that it takes a replicator perspective rather than the usual firm perspective, seeing the dynamics of the system through the operation of these two levels or interlinked processes. Three issues then present themselves for immediate analysis. How are variations effected in the replication of resources, routines and relations? How do firms’ competitive prospects depend on these variations? How are the successful variations transmitted?

³⁹ On Darwinian processes in general, see recent reviews such as those by Cziko (1995) or Plotkin (1993).

⁴⁰ See Metcalfe (1998) for a comprehensive discussion of the issues. By “blind” variation is meant a process where actors are not in a position to anticipate or predict the consequences of their actions, since these depend on the actions of so many others in the complex system. Blind variation certainly does not imply purposeless behavior.

⁴¹ See Knudsen (2000) for an exposition of this perspective.

First, let us consider the *replication* of resources, routines and relations.⁴² *Resources* are replicated when the firm which developed them, or more usually a rival firm, seeks to recreate the resources using both tacit and explicit elements. Competition through imitation is the most powerful driver of economic dynamics. Franchising arrangements, which have exploded in popularity in the past half-century, are cases of what we shall call resource replication. *Routines* are replicated when a firm recreates routines to which it has had access, and applies them to its own activities. Firms are constantly striving to learn about other firms' routines, with a view to replicating them within their own operations. Imitators of a fast food set of routines, for example, might replicate the routines of fast food preparation and customer service, but do so with a twist of their own.⁴³ *Relations* are replicated when a firm moves to a new area of operations and recreates the bonds with other companies that it has built originally. The simplest example is the case of Japanese automotive producers moving abroad. They draw advantages from the fact that they can draw on a system of relations replication.

Variations in these processes of replication may be propagated through the economy, resulting in differential selection pressures being experienced by firms embodying the variations in resources, routines and relations. Here we shift the focus, as in evolutionary theorizing, to see resources, routines and relations as *replicators*, ie as propagating independently of the wishes of the firms that generate them in the first place. The key issue is to demonstrate how variety within the economic system, which is the key to adaptive responsiveness to changing external conditions, may be generated by variation in underlying replicators, here taken to be resources, routines and firms' relations. The variation is Darwinian in the sense of its sheer variety and in the sense that even though the variations are purposively introduced by firms, their

⁴² In the DCP literature, Teece, Pisano and Shuen (1997) make a distinction between replicability and imitability. Replicability is held to involve the firm in transferring or redeploying its competences from one economic setting to another. Imitation is defined as replication performed by a competitor. It is argued that replication is difficult enough, even when a firm is supposed to know and understand its routines, but that for an outsider, it is even harder. I don't find this distinction to be helpful. From an evolutionary perspective, the point at issue is replication as a process of diffusion, whether it be conducted by the firm itself or by an imitator. The interest indeed lies in the fact that replication can be taken out of the hands of a firm which initiates some new process, precisely through the speed and capabilities of an imitator. This is the open-ended character of the evolutionary process.

⁴³ The issues of the replication of routines, and of capabilities more generally, can only be touched on here. See Zander and Kogut (1995) for a discussion that is informed by empirical findings, and Winter and Szulanski (1999) and Zollo and Winter (2000) for recent approaches.

implications within the wider economy cannot be predicted in advance.⁴⁴ Resource variety is also generated by new combinations and, sometimes, by genuinely new resources, as in the case of a new technological standard emerging and driving the spawning of a new industry. This brings us to the consideration of entrepreneurship and its role in generating economic variety.

Entrepreneurial dynamics: Recombination of resources, routines, relations

We turn now to entrepreneurial dynamics, to make sense of a world that is actually rich in opportunities for firms. Within the IMS, and certainly within real economies, novelty is generated principally through recombination of resources, routines and relations.⁴⁵ It was Schumpeter who had the clearest possible conception that it is entrepreneurship which creates new lines of development within an economy, in ways that cannot be anticipated through analysis of the regular production and exchange of goods and services – what he called the "circular flow" economy. Entrepreneurial initiative creates new activities, whose profitability then attracts imitators, and so the new activities become incorporated in a new version of the "circular flow" where the resource distribution in the economy as a whole is shifted. Thus we have a succinct definition that in the IMS, entrepreneurship is to be taken as the recombination of resources, routines or relations, in such a way as to initiate a new line of business, or set of activities.⁴⁶

Schumpeter insisted that the creation of new enterprises takes place in a disruptive fashion, outside the normal economic course of events, or what he calls the "circular flow" of economic events wherein demand induces supply which meets

⁴⁴ In his Graz lectures on *Evolutionary Economics and Creative Destruction*, Metcalfe (1998) expresses the view that economic evolution is not Darwinian because there is insufficient variety. I cannot agree with him on this point. Adopting a perspective on the economy as a whole, the capitalist economic system appears not just to be an amazing "engine of progress" but an equally amazing "engine of variety."

⁴⁵ For a non-equilibrium perspective on entrepreneurial dynamics, see for example Dahmén, Hannah and Kirzner (1985). The aim in this section, as elsewhere, is to translate the terms used in such descriptions into those of the IMS, thereby effecting a link with evolutionary processes, with the resource-based view, and with network dynamics.

⁴⁶ Compare with Snehota (1989: 33):

"Initiating and carrying out exchange transactions, the possibility of which has been unnoticed previously by the market participants can be qualified as the entrepreneurial action or function ... the entrepreneurial function consists in linking of potential exchange parties, in a mutually advantageous exchange." Snehota stresses that these exchanges could involve resources as much as products exchanged in product markets, and that the definition makes entrepreneurship independent of notions of technological innovation.

demand, and so on. The "circular flow" can be equated with the static conception of the mainstream "goods and services" economy, where the emphasis is on the equilibrating process through which supply matches demand. The circular flow cannot generate variety; it cannot adapt to new situations.⁴⁷ But equipped with a new element called the "entrepreneurial function" -- in all its messiness and disruptiveness -- the circular flow can be transformed into a dynamically adjusting economy. I wish to take over these terms to the case of the IMS where it is the dynamics of the production and exchange of the resources, routines and relations needed for production of goods and services that is the object of entrepreneurial interest.

From the perspective developed here, there is virtually nothing to be changed in Schumpeter's account. Recombination occurs outside the sphere of firms' activities, and involves instead the fitting together of resources, routines and firms' relations in new combinations. (In Schumpeter's terms, new enterprise formation occurs outside the "circular flow" of normal economic events.) It is existing resources, routines and relations which are recombined, ie the process does not involve creation of something completely new. (In Schumpeter's terms, new enterprises are created through recombination.) The new combinations are assembled not by managers but by entrepreneurs or other corporate promoters (e.g. a merchant bank); it is the entrepreneur/promoter who establishes the firm's initial business strategy on the basis of the particular combination of resources assembled. (In Schumpeter's terms, it is the entrepreneur who initiates a new sequence of economic operations -- as the "new employment of existing production goods" (1934/1996: 136)).

Subsequent to Schumpeter, other contributors to the "Austrian school" notably Hayek, von Mises and latterly Kirzner (1985; 1997a; -b) have elaborated on the entrepreneurial process as one of "discovery." This means essentially that it departs from the perfect information assumptions of neoclassical economics, and actually traces the processes through which myopic individuals may be able to perceive opportunities of pure profit through matching unmatched demands, for example by assembling new combinations of resources, routines and relations.

While Schumpeter focused his attention on the "disequilibrium" aspects of innovation (as creative gales of destruction) the wider "Austrian school" has looked at

⁴⁷ As Metcalfe says in his Graz Schumpeter lectures on "Evolutionary economics and creative destruction": "Schumpeter's vision was perceptive and correct: stationary capitalism or even capitalism with the growth of all activities at a uniform rate is a contradiction in terms" (1998: 3).

market process and the role of entrepreneurship in terms of driving the economy towards equilibrium. Kirzner in particular emphasizes how this develops a realistic account of the “market process” in real economies – a topic which is actually assumed out of existence in equilibrium approaches. Entrepreneurial discovery of previously unknown profit opportunities, creates new value, rather than exploiting existing value. All these features carry over to the account of entrepreneurial discovery in the IMS.

The recombination of relations draws attention to the inseparable link that ties network dynamics in an economy to entrepreneurship. The two are in a sense two sides of the same coin. If markets are conceived as networks, and economic adaptation and responsiveness is conceived as changes in these networks, then entrepreneurship is the source of such changes. Thus our conceptual framework provides a satisfying closure in that each major feature of economic dynamics is seen be linked to the others.

Economic adaptation and industrial dynamics within the IMS: Clusters, blocks and interfirm specialization

Finally we turn to the level of the economy as a whole, where supra-firm patterns of coordination lead to superior or inferior adaptive responses to changing business circumstances, and hence to superior or inferior economic performance. The economic significance of networks is that they generate the capacity to adapt to changing circumstances as a total entity, ie as a network, rather than as individual firms on their own. In this section, our concern is to demonstrate how various kinds of “market structures” emerge through the operation of resource dynamics and the mutual adaptive responses made by firms.

It is important to stress that resource configurations within the economy usually span firms – in “development blocks” or “technological systems” or “national systems of innovation” - and call for supra-firm modes of organization that facilitate the sharing of resources.⁴⁸ These are the market structures that emerge in any real economy, and shape its performance. Yet we find that they are ignored in most

⁴⁸ On development blocks, see Dahmén (1989); on technological systems, see Carlsson and Stankiewicz (1991). Foss (1996) refers to all these forms of industrial organization as operating at the meso level -- between the firm and the national industry. On national systems of innovation, see Lundvall (1988; 1992); this concept spans firms as well as supporting institutions such as public R&D laboratories. From the resource perspective, these concepts all embody the notion of resources held in common and shared within a specified group of firms and institutions.

microeconomics treatments.⁴⁹ Our task is to demonstrate how some of these supra-firm adaptive responses can be captured within the conceptual framework of the IMS.

Enhanced performance at the economic level, as at the organizational level, can be captured through specialization and the emergence of intermediate input suppliers, which in turn is associated with decomposing a process into a finer division of labor. Consider the case of a group of firms, each specializing in a particular range of products and overlapping with each other in terms of their resources and routines. As the market expands, some firms can specialize in intermediate subassemblies, to create more complex value-adding pathways within the industry. Standardization of subassembly modules enables potential economies of scale to be captured, and an organizational reconfiguration of resources to be effected. It is the possibility of intermediate specialist activities emerging, as the scale of the market expands, that drives specialization of resources.

Sometimes the required further specialization is not achieved, and the economic performance of a group of firms is thereby degraded. This has occurred over and over again as industrial districts wax and wane. The district of Okayama, in western Japan, for example, provides a striking case. It became a flourishing center of production of varied kinds of farm engines in the 1950s and 1960s, as Japan's farmers moved en masse to mechanize their operations. Over 30 manufacturing firms arose in the Okayama district to service this need, producing small, light engines of variable but low horse-power to a variety of end-specifications, for distribution by specialized distributors throughout Japan. But nothing remains of this district today. It was wiped out by the rise of mass producing firms in Tokyo and other metropolitan centers, who were much more vertically integrated and connected to lengthy subcontracting chains than were the small Okayama producers who encapsulated all the technical capabilities needed to produce an engine in one small firm.⁵⁰ From the resource perspective, these Okayama producers were not able to make the breakthrough from self-sufficiency in resources to a new configuration where some resources are shared between firms. There was apparently no mechanism in this case to shift the cluster of firms to a new configuration. Successful clusters of firms, such as in a Silicon Valley, are able to make these configuration shifts; others stay “locked in” to a particular

⁴⁹ An exception is Katz and Rosen (1998) which provides a rigorous treatment of the conditions under which firms are likely to cooperate.

⁵⁰ See Tokumaru (1998) for a description and analysis of this episode.

configuration and decline. The issue is how such shifts are accomplished, and whether they call for specific institutional interventions, or are accomplished by the actors themselves.

Thus within the IMS, it is intuitively plausible to see structures like development blocks and industrial clusters develop, but there is no assumption made that these are necessarily desirable or a “good thing.” Firms can draw advantages from suprafirm clusters if the clusters are well adapted to economic circumstances. But if the cluster is poorly adapted, or generates destructive interfirm competitive dynamics (such as a downward price spiral), then it can be a source of disadvantage for the firms that are caught within it. Thus it becomes clear how a firm’s strategic options depend not just on its own choices, but also on its market position and “network position” within wider industrial structures. The pursuit of these kinds of questions should properly be seen as the domain of industrial dynamics.⁵¹

The key organizational insight is that economic performance is not optimized by simply looking to optimize the performance of each productive resource, on its own.⁵² Nor is economic competitiveness likely to be enhanced simply by looking at firms on their own, but in relation to networks – frequently spanning several countries. Thus a viable and plausible national economic learning strategy can be couched in terms of promoting linkages between domestic and foreign firms, rather than in terms of the more traditional approach of promoting domestic value chain formation.⁵³ The organizational dimension is essential in order to deal with the issue of coordination. The organizational dimension operates at several different levels -- bundling resources in firms to capture synergies, and then connecting firms with each other to capture further synergies, and groups of firms with other groups of firms to capture further synergies again. Thus the ingredients of the IMS bring the focus to the fundamental factors involved in economic performance.

⁵¹ See Carlsson (1989) for a pioneering exploration along these lines.

⁵² Likewise it is a commonplace in cybernetics and systems theory that optimization of system performance cannot be guaranteed by partwise optimization of the system elements independently – except in the extreme case of completely decomposable systems. In most cases, it is inter-element dynamics that must be taken into account in achieving overall system optimization.

⁵³ See Wilkinson, Mattsson and Easton (2000) for an exposition of such a network-based approach.

Sources of competitive advantage: Resource selection criteria

As an illustration of the kinds of insights generated within the context of the IMS, let us look at the issue of the characteristics of resources and their strategic selection. The RBV of the firm emphasizes the sustainability of competitive advantages due to resource endowments (extended by the routines and relations developed by firms) which have certain *characteristics*. The RBV is focused almost exclusively on the extent to which firms can capture resources which are *difficult to imitate* and not easily transferred or substituted.⁵⁴ These characteristics are said to lend the capacity to earn rents by the firm. It is through uncertain imitability of resources that incumbents are able to establish sustainable competitive advantages. The more that incumbents are able to create (resource-based) isolating mechanisms, the more sustainable their advantages. Lippman and Rumelt (1982) and Rumelt (1984) introduced these ideas in the explicit context of a resource-based view of strategic competitive dynamics. They demonstrated how an analysis at the level of resources would shed light on the sources of sustainability, i.e. through uncertain imitability.⁵⁵

For our purposes, where we are concerned as much with a challenger perspective as with incumbents, the Lippman and Rumelt theorem, and its elaboration through such notions as time compression diseconomies, tells only half the story. The complementary proposition concerns how challengers successfully confront incumbents, even when they have built a resource base on causal ambiguity and strewn the competitive landscape with as many "isolating mechanisms" as they can devise. It is through the fundamental imitability and transferability of resources that challengers are able to invade industry segments occupied by incumbents. Challengers acquire the requisite resources through internal development and through external leverage, where they are guided in their choice of which industry segment to attack by the availability of resources which are most easily imitated and transferred. We may coin the expression "reliable imitability" for such an approach, to bring out the complementarity with the uncertain imitability of Lippman and Rumelt.

It is worth pausing to examine the implications of this remark. The conventional RBV of the firm makes the claim that, from an incumbent's perspective,

⁵⁴ See Barney (1991) or Dierickx and Cool (1989) for representative discussions.

⁵⁵ Rumelt introduced the idea of an "isolating mechanism" as the (resource-based) firm-level analogue of mobility barriers at the industry level.

it is desirable to build competitive positions from resources which are least imitable, transferable, and substitutable. But exactly the same reasoning *from the perspective of a challenger* would lead the firm to target resources for acquisition, adoption and adaptation that are as *most imitable, most transferable* and *most substitutable*. Such resources are maximally susceptible to leverage, and can be utilized to build a competitive position in a new market or new industry. In other words, they underpin diversification.

Thus challengers can target their attacks on sectors where knowledge of product or process becomes more explicit, through licensing, or third party vendors of equipment, or consultants. There is ample evidence to justify these assertions. All these patterns where challengers are able to take advantage of the attributes of the resource accumulation process, are evident in the way that latecomer firms from East Asia fashioned an entry into the world semiconductor industry.⁵⁶

If resources were non-transferable and non-imitable, then incumbents' competitive advantages would be sustainable forever. But firms are able to diversify and challenge incumbents' positions. They are able to do so because they adjust their resources to their strategic needs. This insight flows directly from the integrated perspective developed within the IMS.

Empirical estimation of the IMS: An “Economic Genome Project”

The IMS can be investigated experimentally and empirically in a number of interesting ways. First, there can be micro-studies of the actual dynamics of resources, relations and routines, within specific industries or countries or time periods. These will utilize “stylized facts” of the evolution of specific kinds of industries, generating specific kinds of firms exhibiting certain kinds of behavior, utilizing just the categories of the IMS. Such empirical work will get at the “thick description” of economic dynamics, generating for example accounts of the complex interconnections between firms that can be used as a platform for developing further abstract analyses. Such work might get at the varieties – or “species” of firms, and institutions, which adapt to certain kinds of economic shock better than others. In the same way, rich empirical description of biological phenomena in the 18th and 19th centuries preceded

⁵⁶ These points are made for what appears to be the first time, in Mathews (1997b; 1998). The semiconductor experience is related in detail in Mathews and Cho (2000) and in the case of Korea,

the development of more abstract accounts of biological processes, including evolution itself, genetics and development. Such empirically estimated versions of the IMS might also be useful to generate predictions of the likely effects of certain kinds of exogenous shock to an economy, such as the introduction of a new kind of product technology or process technology, or a major shift in pricing of an important good utilized in many firms' activities.

A second kind of investigation would involve experimental simulation of some realization of the IMS – following the lead of artificial life simulations and the powerful insights into complex adaptive behavior they have generated. Thus the IMS might be realized as a graph theoretical system, with different weights attached to nodes to represent different resource commitments by firms to their interfirm relations; the dynamics of such a system could then be investigated through computer simulation. Alternatively the actors (firms) could be realized utilizing intelligent agents, with a view to simulating some of the complexity generated by their mutual interactions, and their strategies conceived and executed in the light of each others' strategies and goals. A further alternative could be the use of fitness functions on a given kind of “fitness landscape” representing a complex economic setting, where again the object of the computational exercises would be to investigate emergent forms of behavior as firms jointly seek to realize their fitness functions with limited knowledge of the landscape on which they are operating. In these ways, and in many more yet to be devised, the IMS offers a promising framework for empirical investigation.

Finally, and perhaps most interestingly of all, we might think of the exhaustive description of the elements of the IMS applied at the level of the economy as a whole. In this case, what is of interest is not just the set of resources, routines and relations found within a single firm or group of firms, but the set of all resources, and all routines, and all relations, found in any real economy. The analogy between such a set and the particular realizations, and the biological counterpart of particular genetic codes and a total genome, is arresting. So let us call the totality of resources, routines and relations in an economy, its “economic genome.” An equivalent then of the celebrated human genome project, would be a comparable project of fundamental economic investigation that we could dub the “economic genome project.” Such a

Kim (1997) or Mathews and Cho (1999). Kim and Nelson (2000) provide a comprehensive overview

project would be concerned to investigate and classify all the economic resources available to firms. It would seek to identify the actual routines or “business processes” that firms utilize. It would investigate and identify the actual kinds of relationships binding firms to each other, and estimate their strength in terms of their committed resources and routines and shared relations. These are indeed the fundamental features of an economy, as fundamental as the genetic code of a biological organism.

Such issues are not investigated in mainstream economics because the assumptions of the neoclassical synthesis marginalize them. To achieve the demonstration of the existence and uniqueness of general equilibrium, certain assumptions are made such as that firms know all possible technological possibilities, and have instantaneous transmission of information, and respond costlessly to new price signals. While it is acknowledged in most microeconomics texts that these are highly unrealistic, the price paid is that the actual market processes of real economies are not investigated, and the actual resource dynamics that underpin the production and exchange of goods and services are ignored. The IMS strongly and unequivocally corrects this bias.

An “economic genome project” would cost millions of dollars to mount, and would require strong institutional support. It would indeed be comparable in its scale and effect to the “human genome project” which is currently reporting its results. The “readout” of the economic genome project would likewise be a listing in full detail of the fundamental resources, routines and interfirm relations that drive real economies.⁵⁷ The data would doubtless be expensive, and would have less immediate practical significance than the data generated by the human genome project. But western economies already spend millions, even billions, on investigation of much more abstruse phenomena, such as the scattering of protons and neutrons under the impact of a high-energy beam. Huge scientific institutions such as CERN in Europe and the Lawrence Livermore Laboratories in the U.S.A. support such investigations at public expense. Interesting as such phenomena may be, they surely cannot equal the importance of understanding the fundamental “scattering properties” of a real economy subjected to a high-energy shock such as a quadrupling of oil prices, or the

of the dynamic capabilities perspective applied to Newly Industrializing Countries.

⁵⁷ One could make the case that something equivalent to the proposed economic genome project was mounted in the modern era by Diderot and the *encyclopédistes* in pre-Revolutionary France. This giant project sought to document every single technological process known to mid-18th century Europe, utilizing uniform terminology and graphics – something never before or since accomplished.

diffusion effects of a totally new kind of technology. The IMS provides both the conceptual framework, and the incentive, to mount such an ambitious empirical project.

Concluding remarks: A dynamic resource network view of economic behavior

The perspective offered in this article is that of the economy seen as a dynamic industrial market system. This model of the economy emphasizes features that are suppressed or ignored in conventional microeconomics. Firms are modeled as agents with purpose and attributes such as their resources, routines and the relations established between themselves – rather than simply as generic production functions. The features of the economy are brought out through the emergent behavior of these agents interacting with each other, driven by the dynamics of their constituent resources, routines and relations. Markets emerge in such a setting, through interfirm coordination, as do firms' dynamic capabilities, resting on strategically prioritized combinations of resources, routines and relations. As firms jostle for competitive advantage, they are led to form mutually-reinforcing blocs and “suprafirm structures” such as consortia, development blocks and value chains. These form the foundation for the analysis of emergent industrial dynamics, which focus on the most interesting features of economic adaptation. The IMS framework thus enables us to focus on economy-wide performance issues such as dynamic adaptation and responsiveness to exogenous shocks – not just through a set of arbitrary behavioral equations (as in standard econometric models) but through the fundamental features of the economy's “genetic code” – its resources, routines and relations.

But conventional microeconomics is part of the IMS view of the economy as well. Firms engage in activities, which can largely be accounted for in terms of production and exchange of goods and services. They make decisions as to what kinds of activities to engage in, and to what extent, in terms of microeconomic categories such as marginal and average costs, or upward or downward sloping demand curves. None of this has to be sacrificed. It is simply put in the correct perspective. It is a small but important part of the industrial dynamics of any real economy.

The model of the IMS has been built from a synthesis of four strands of thinking: the resource-based view (RBV) of the development of competitive advantages by firms; the markets-as-networks view of industrial markets; the

evolutionary economic approach associated with Nelson and Winter, and the entrepreneurial approach associated with Schumpeter and the wider Austrian school. The synthesis allows us to discuss issues of competitive strategy in a wider and more interesting context. The network perspective adds realism to the resource perspective, in that firms' competitive strategies are in practice finely tuned to their relations with customers, suppliers and other firms with whom they interact and on which they develop dependence. Conversely, the resource perspective adds strategic depth to the network view, and brings networks as competitive and strategically important entities into focus, rather than seeing them primarily in terms of collaborative processes, which has been the tendency amongst marketing theorists. It is proposed that the perspective offered here be called the "resource network perspective" in that it combines elements of both the resource-based view and the network view, and makes them both essential perspectives for grasping the realities of competitive industrial dynamics in real economies.

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Danish Research Unit for Industrial Dynamics

The Research Programme

The DRUID-research programme is organised in 3 different research themes:

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

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

Theme A: The firm as a learning organisation

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.

The main empirical and policy issues are related to changes in the local dimensions of innovation and learning. What remains of the relative autonomy of national systems of innovation? Is there a tendency towards convergence or divergence in the specialisation in trade, production, innovation and in the knowledge base itself when we compare regions and nations?

The Ph.D.-programme

There are at present more than 10 Ph.D.-students working in close connection to the DRUID research programme. DRUID organises regularly specific Ph.D.-activities such as workshops, seminars and courses, often in a co-operation with other Danish or international institutes. Also important is the role of DRUID as an environment which stimulates the Ph.D.-students to become creative and effective. This involves several elements:

- access to the international network in the form of visiting fellows and visits at the sister institutions
- participation in research projects
- access to supervision of theses
- access to databases

Each year DRUID welcomes a limited number of foreign Ph.D.-students who want to work on subjects and projects close to the core of the DRUID-research programme.

External projects

DRUID-members are involved in projects with external support. One major project which covers several of the elements of the research programme is DISKO; a comparative analysis of the Danish Innovation System; and there are several projects involving international co-operation within EU's 4th Framework Programme. DRUID is open to host other projects as far as they fall within its research profile. Special attention is given to the communication of research results from such projects to a wide set of social actors and policy makers.

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