Ignorant Actors in the Resource Rich World of the Knowledge Based Economy – On Rational Management in an Experimentally Organized Economy (EOE)

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- on rational management in an experimentally organized economy (EOE)

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Abstract

The internal dynamics of the Experimentally Organized Economy (EOE) force actors to constantly innovate to survive competition from all other actors in the same situation, or from new actors entering the market. Since ignorance of circumstances that may be critical for survival characterize the situation of each actor, business mistakes abound. With tacit knowledge distributed over hierarchies and markets analytical methods of management not only feed management with the wrong information but also mislead management, and especially so when something unusual occurs.

The change from a seemingly orderly and plannable market environment to an unpredictable, faster and differently organized New economy over the last few decades has made this dynamic an acute management problem. Advance in economic and management theory to help policy makers and management cope is lagging economic development . The managers of the new, distributed (over the market) production organizations have little to learn from the experience of their predecessors in monolithic hierarchies. Hence, the rate of business mistakes has escalated, jeopardizing the life even of the big companies with ample resources to finance a come back. The business manager in the new economy is being subjected to a genuine Darwinian learning experience in the market.

Access to competence blocs of organized tacit knowledge distributed over markets, however, minimizes the economic consequences for the firm and for the economy at large of business mistakes, notably the risk of losing the "winners". Since creating and identifying winners and carrying them on to industrial scale production is the single most important growth promoting factor, a broad based competence to choose the appropriate management method for the occasion is also the important growth promoting factor. For the policy maker this means helping to organize *vertically complete and horizontally varied competence blocs* of actors with tacit competencies.

1. The problem

A decision maker is always guided by some " theory" that helps him/her organize facts and thinking. Theory, however well tested empirically is always structured by prior assumptions based on more or less well considered guesses. A theory of the firm or of firm management has to relate to some theory of the environment of the firm to be managed. The choice of environmental theory will make an imprint on the theory of the firm. In economics the tendency has been to make the theory of the firm compatible with the mainstream economic model . As a consequence the roles of the firm and the entrepreneur in economic development have had difficulties being recognized in policy making. That may be so. It is, however, far more serious to allow a theory of management to be derived directly from the mainstream theory of the firm, since management theory may influence management decision making. Then the empirical assumptions upon which the theory is based begin to matter.

The by far most critical assumption in economic modeling concerns the size and/or complexity of the state space assumed for the model. This assumption about the space in which economic actors play, the *business* or *investment opportunities space*, is rarely spelled out in academic literature, but implicit in all economic models. In the mainstream general equilibrium model of economics it can be indirectly derived to be small and be made fully transparent at no or negligible transaction (information and communications) costs. This implies scarcity of resources and that economizing on these resources will be the prime focus of economic analysis. A narrow definition of economics emerges the relevance of which I question in this essay. Obviously, the characteristics of the state space assumed will determine the nature of the theory of the firm and of management; Will central planning over a known opportunities space or strategic choices ("strategizing") from a virtually unlimited opportunities space be the optimal mode of decision making ?

The alternative Austrian view, or assumption that I will, therefore, pursue here is that of a world rich in resources (I have borrowed the term from Mathews 2002) or business opportunities, the exploitation of which is only being limited by the (*receiver*) *competence* of the actors in the economy to capture them. This new opportunity based view will be introduced under the heading of the theory of the *Experimentally Organized Economy* (EOE) and of *competence blocs*. While the mainstream economizing model is a "reduced" version of Adam Smith (1776), narrowed down onto an analytical format by Leon Walras (1874), Kenneth Arrow and Gerard Debreu (1954) –the WAD model – the theory of the EOE derives directly, and without loss of generality, from Adam Smith, by way of Austrian economics, notably that of Carl Menger (1871) and Joseph Schumpeter of 1911 (Also see Eliasson 1992a). The distinguishing feature of the two approaches is to be found in their respective assumptions about the state space of their models, or in economic terms, of the set of business opportunities offered. With huge opportunities and the right economic incentives innovators will abound and entrepreneurs will recognize winners and help carry them on to industrial scale production, generating economic growth in the process. This internal dynamics of the experimentally organized economy (EOE) force actors on tip- toe innovating as best as they can to survive competition from all other actors in the same situation, or from new actors entering the market to capture the opportunities. Since ignorance of circumstances that may be critical for survival characterize the decision situation of each actor, business mistakes also abound. With tacit knowledge distributed over hierarchies and dynamic markets determining the outcome analytical methods of management not only feed management with the wrong information but also mislead management, and especially so when something unusual occurs. I will, therefore, also ask the question whether both views, the WAD model and the theory of the EOE, can be simultaneously useful as an intellectual foundation for management theory.

The development of new methods of globally distributed production over markets of specialized subcontractors (Eliasson 1996a, 2003a) and the change from a seemingly orderly and plannable market environment to an unpredictable and faster New economy over the last few decades have made this dynamic an acute management problem. The economic development has not been preceded by a parallel advance in economic and management theory to help policy makers and management cope. It is still structured on the notion of a well defined firm using analytic forecasting and internal control methods. The managers of the new, distributed (over the market) production organizations in fact have little to learn from the experience of their predecessors in monolithic hierarchies and the rate of business mistakes has escalated, jeopardizing the life even of the very big companies with ample resources to finance a come back. The business manager in the New Economy is being subjected to a genuine Darwinian learning experience in the market.

Access to competence blocs of organized tacit knowledge distributed over markets, however, reduces the economic consequences for the firm and for the economy at large of business mistakes, notably the risk of losing the "winners". Since creating and identifying winners and carrying them on to industrial scale production is the single most important growth promoting factor, a *broad based competence of choosing the appropriate management method or the right priors for the occasion is also the important growth promoting factor*. The most important criterion for good management or decision theory is a choice of priors that allows the decision maker to organize his/her thoughts such that single valued conclusions become possible[1].

I here carry on from an idea (in Eliasson (1992, 1998b)) that even though the economic environment is highly non-linear and often unpredictable the decision maker will have to use a linear model or cognition system to make single valued decisions possible. This means that no decision model will be universally applicable . The art of business decision making will be the art of choosing the right decision model for the occasion (Eliasson 1996a, p.101). This also defines the nature of ignorance of economic actors.

Economics and business administration theory have long lived an uncomfortable coexistence, business administration being once an academic break- out of economics. While economics is analytically structured to address macro or policy problems and tends to ignore the role of micro dynamics, business administration theory looks inwards at the problem of controlling a given firm hierarchy, and prefers to take the environment as given. Business administration theory, however, being an inductive science still leans on economics for theoretical support, but economists with a strong deductive approach look down on their "theoretically less endowed dependents". I don´t follow these academic traditions and prefer to pick up from the contribution Schumpeter (1954) credited Marshall with, namely the introduction of business economics into economics. Hence, my problem is about the role of ignorance both in business economics (management) and in macro economics even though my focus in this paper will be on the role of ignorance in business decision making. To carry on I first introduce the theory of the EOE and of competence blocs briefly, and then (second), for comparison, reduce it to the mainstream economizing model.

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[1] This should not necessarily be the case in political decision making , however. While business decision makers in the EOE – as we shall see- have to act prematurely on the basis of their intuition to survive, the political decision maker should preferably and in most situations hesitate when he does not understand what is going on, partly because he is not well organized to correct mistakes (Eliasson 1990a, footnote 9) and partly because the consequences of mistakes at that level may carry long-term disaster for a whole nation.

The next step is to introduce institutions and live actors (firms) and to derive the *strategic choices faced by firm management* in the EOE and the competence, or capabilities firms need to cope with their competition. What is it that firms actually do that is not part of the WAD model, but that occurs in the EOE?

I find that the theoretical advice of WAD economists to Government as well as to the top competent team of firms is analysis and central planning because of the illusion of central overview of the opportunities and control conveyed by the prior assumption of the WAD model. Firms managed on the basis of such beliefs will fail in the EOE, where broad experience, good business judgment (intuition, choice of decision model), and efficient correction of mistakes matter critically. Among the choices available only the theory of the EOE allows explicitly for this.

2. Introducing the EOE in four steps

Five steps are needed to introduce the theory of the EOE.

1). The *knowledge Based Information Economy* (Eliasson 1990b) develops the case for an almost infinite and non-transparent state space or business opportunities set. The assumptions of a resource rich world of the EOE are laid down, constrained only by a scarcity of human embodied knowledge. This is done in terms of the three information paradoxes of Table 2.

2). The theory of the EOE derives directly from "assumption a" , and we are confronted with an economic dynamic ("the Scumpeterian Creative Destruction" of Table 3) in which macro economic growth occurs through innovative project creation and selection from an immense opportunities set, featuring business mistakes as a standard cost for learning and economic development.

So much said we are far beyond WAD economics. In the EOE (of 2 above) the efficiency of project creation and selection determines economic growth (Eliasson 1992a, 1996a).

3). *Competence Bloc theory* deals with this efficiency problem by identifying categories of tacit competence needed to minimize the economic consequences of keeping losers on the budget for too long and losing the winners (Eliasson – Eliasson 1996).

4). *Institutions* that *define incentives*, *orient competition* and *reduce uncertainty* (property rights) such that economic growth occurs and introduce an opening for *market compatible policy* that contributes to long-term sustainable growth.

The EOE features (by implication) an unpredictable and arbitrary world for the individual. He and she need a

5) *Social Capital* to cope with unpredictable change and arbitrary treatment in the market, notably the exit process (Coleman 1988, Eliasson 2001a).

My focus will be on 1, 2 and 3 and the implications for policy and industrial development, But I will also discuss the implications for business management in the EOE environment thereby attempting to follow in Marshall´s footsteps. The competence bloc in the analysis to follow is defined from the market (customer) end and can be seen as an extended form firm

(Eliasson 1996b and Eliason -Eliasson 2002a), implying that the activities of the competence bloc can in principle be, and have been, internalized in the firm hierarchy. (4) relates to the endogenous growth of the Schumepterian creative destruction process of (2). Successful management in the EOE then becomes synonymous to being identified as a winner in the competence bloc and the identification and cultivation of winners to industrial scale production and distribution the key factor behind economic growth. So we have brought the agenda of business economics and economics together on a common footing. Competence bloc theory explains the invisible hand in Adam Smith's original 1776 dynamic setting, not in the static WAD fabrication.[2]

The knowledge based information economy – the three information paradoxes of the EOE

Adam Smith (1776) laid down the principles of a decentralized economy. The dynamics behind decentralization is moved by innovating firms that come up with different forms of decentralization among many different possible solutions. Among the many attempts (*innovations*) entrepreneurs have to identify and *select* the winners, many of them ,nevertheless, turning out to be mistakes. Once established , production has to be *coordinated* over markets (*competition*) or within hierarchies (*management*) drawing information and communications (transaction) costs in the process. One great contribution of Coase (1937) was to delimit the firm from the market by the relative costs of the two forms of coordination. This insight is also the principal foundation of the standard theory of the firm, or a hierarchy, i.e. the actor that minimizes transaction costs (Holmström-Tirole 1989). Another insight of Coase (1961) that has not yet been carried as far, is that positive transaction costs are theoretically incompatible with the principles of neoclassical theory. Once a winning organization of production over hierarchies and markets had been extablished competing actors will enter to learn and to *imitate*. The four forms of information and communications in the statistical accounts of the *knowledge based* economy in Table 1 (innovation, selection, coordination and learning) cover the concept of transaction costs. For didactic clarity these transaction or information and communications costs refer to both coordination over the market and within hierarchies. If these four forms of information and communications activities are assumed to be costless[3] we obtain the Arrow-Debreu (1954) model of a static economy with all its nice efficiency and welfare implications.
The basic premise of the theory of the EOE is that the opportunities set is enormous, bordering on the infinite, and at each time far beyond human comprehension . Hence , choice and selection will be the important economic activity and steeply escalating costs to explore it will characterize economic behavior. *Business mistakes* will abound and constitute a *normal cost for economic development* (Eliasson 1990a,b,1996a, Eliasson-Eliasson 2002). If information and communications costs can be demonstrated empirically to be dominant

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[2] For the same reason the economic policy situations are extremely different in the EOE and the WAD worlds. The WAD model is a model of an economy that can be centrally planned (Eliasson 1992a) in which the comprehensive role for the state can be derived to take responsibility for almost everything and all, including individual welfare. The state has no such theoretical prerogative in the EOE. On the contrary, if it tries excessively to take far reaching responsibility for the individual, stretching beyond its competence, it puts the individual in a disadvantaged long-run situation (Eliasson 1992b, 2001a). Efficiency, therefore, requires that responsibility be distributed over the individuals, using insurance principles as far as possible. Social capital is defined to accord with that task.

[3] And , in addition, if we assume strictly convex production and utility sets and continuous derivatives, markets can be demonstrated to be cleared at a unique profit and utility maximizing and cost minimizing point.

choice and selection become the dominant economic activity and technological change that moves the entire economy becomes dominated by technological change in information processing, communications and learning. This technological change in turn is intimately associated with organizational ("structural") change. *The economy becomes experimentally organized.*

(Tables 1, 2 and 3 in about here.)

We have shown elsewhere (Eliasson 1990a, b; Eliasson – Johansson 1999) that measured direct innovation, coordination and learning costs (items 1, 2 and 4 in Table 1), not counting costs of business failure, account for *at least* 50 percent of all direct resource use in the average manufacturing firm and the share is increasing. Some 85 percent of all resource use in the entire Swedish economy, GNP level, is devoted to various forms of information and communications services. Such resource use is to a larger extent than other forms of resource use knowledge based. Hence, the fix point used to navigate in (or the equilibrium of) the main stream model won´t exist or won´t be stable. It becomes dependent on how you recognize and approach it.The more you try to reach it the more it will evade you. It will become indeterminate.
In addition, exploring and learning about the unknown interior of the opportunities space will throw up new opportunities that expand the opportunities space.
The expanding business opportunities set (item 1, Table 1) fueled by inter alia Computing and Communications (C&C) technology makes exploration ("navigation") and learning even more difficult and important than before, but navigation and learning technology may very well be slower to develop than the opportunities set itself. In general an economic actor should assume (Eliasson 1990b, 1992a) that at each moment there are steeply diminishing returns to exploration and learning. Hence, in the distinctly non-linear economic environments we are discussing *Information Paradox no.* I (the Särimner effect)[4] emerges, namely (Eliasson 1990b, pp. 46 ff) *that we may be growing relatively less informed because the stock of knowledge that we can learn about is growing faster than vi can learn* (Table 2A). This observation carries an important implication for the theory of the EOE. If learning is faster than the rate of exploration of the opportunities space we will eventually be fully informed, and back in the WAD world. The auxiliary assumption of the EOE, therefore, is that Information Paradox I holds.

Furthermore, new technology, notably C&C-technology has been shifting competition from price competition between producers supplying the same products to innovative product (technological) competition (Eliasson, 1987a, p. 10, 22)[5], making the quality components in each product, and in inputs, notably labor quality (competence) the critical factor behind economic performance. Since also production rationalization is normally based on the introduction of technologically more advanced machines in the manufacturing process new

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[4] From the pig in the Viking sagas that was eaten for supper but returned again next morning to be eaten again, only that in the positive sum game of economics it would increase from being eaten (Eliasson 1987a, 1996a).

[5] Since innovative product quality competition has no meaning in the WAD model, authors such as Krugman 1981 and 1983a, b, Spencer – Brander 1983 etc. defined technological competition to be production rationalization and unit cost reductions. See also Eliasson 1987a, p. 10 and Chapter II. In doing so they came out with strong results on learning-by-doing and industrial targeting policy, all based on the prior assumptions made – and wrong.

technology introductions are for all practical purposes innovative product quality introductions. The difficulties associated with measuring quality are well known and, hence, *Information Paradox II* (Eliasson 1990b, p. 16) that we are becoming *less* and *less* informed about what is becoming *more* and *more* important (Table 2B). This paradox is making life difficult for the policy maker.

But this is not sufficient. The complexity of the New knowledge based information Economy and the impossibility for each to understand more than a fraction of it at each point in time mean (*Information Paradox III*; Eliasson, 1990b, pp. 34 f), that we are gradually moving from a knowledge based information economy into a *misinformation* society (Table 2C). "Truth", or the equilibrium – if it exists – is forever beyond human comprehension. Society will be awash with syndicators of information, or consultants to help you understand and to navigate through the EOE. The consequent variation in understanding and insight, however, is part of the innovation process that generates a different collective understanding that will enrich society when transformed into business decisions,[6] and adds to the expansion of the opportunities space. And society will be intellectually impoverished if this pluralism in understanding is replaced by one homogeneous simplistic form of misunderstanding that is always the ultimate ambition of political and religious power.

Growth through experimental selection – the markets in the EOE

In a non-linear economic world ruled by the three information paradoxes, traditional economic theory, including traditional price theory collapses. Selection occurs in dynamic markets on the basis of considerable ignorance , and business mistakes will abound. But business mistakes and misunderstanding are a natural part of experimental exploration and, therefore (as we have concluded) also contribute positively to economic learning and development. It is not necessarily bad to make a mistake, and mistakes occur naturally as soon as you do something. In addition, in the EOE doing nothing or waiting to see better is extremely risky, since you will probably be overrun by some of those many competitors that choose to act and succeed (Eliasson 1996a, Chapter III). In the EOE a premium is placed on daring actors with the right business intuition (See Table 5). So this had better be recognized in the choice of management decision model. Awareness of our ignorance shapes our understanding of the world around us and fashions our behavior.

With experimental project creation and selection being the dominant factor behind economic development we have introduced both the Schumpeterian creative destruction process and the dynamics of general monopolistic competition (Eliasson 1988,1992a) on a new format (Table 3). Innovative entry of firms (or products) is featured as the prime determinant of competition and the mover of growth, forcing incumbent firms to learn to *reorganize* to cope with competition, *rationalize,* or (fail) *exit*. The dynamics of this growth promoting competition will be reflected in the dynamics of rent formation in the capital markets, successful Schumpeterian innovators earning a temporary knowledge rent that will soon be

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[6] In fact, seemingly mistaken business experiments may make you discover opportunities that a firm guided by narrow or *boundedly rational* (to use the terminology of Simon 1955) information methods will miss. On this Antonov – Trofimov (1993) demonstrate, through simulations on a model of the experimentally organized economy, that opening up the choices of decision makers to an experimental mode, compared to the narrow, analytical mode of a centrally planned economy, raises growth.

competed away by Kirzner (1973) type imitators or new Schumpeterian innovators. In the process, and if the competence bloc is complete and embodied with a sufficiently varied competence (see below) , winners will be identified and carried on to industrial scale production, a dynamic that drives macroeconomic growth through Table 3[7]. As a consequence the capital market will never be in (exogenous) equilibrium and the firm population will constantly feature a wide distribution of rents subject to constant reshuffling over a variable population of incumbent and new firms, It should be recognized that Kenneth Arrow asked the profession already in 1959 to address this problem of general monopolistic competition, albeit within the general (exogenous) equilibrium model in mind. So far very little has been done. It is my conclusion that the task envisioned by Arrow is theoretically impossible within an Austrian/Schumpeterian 1911 market regime (Eliasson 1991a, 1992a).

The regime of competition driven experimental project creation and selection of the EOE defines the special theoretical environment for the business entity called a firm that I will come back to in Section 4. Efficiency of the economy relates directly to the capacity of the economic system to identify, select and promote winning projects and firms. Competence bloc theory deals with that efficiency problem within the EOE.

Competence bloc theory

Efficient selection in the EOE is defined as the "minimizing"[8] of the economic incidence of two types of errors (in Table 4A), i.e. keeping losers on for too long and "losing the winners". Centralizing knowledge to one point requires that it can be coded and interpreted as standard information, and, hence, reduces the total knowledge that enters each decision to such codable knowledge, or communicable information. Since tacit knowledge is the most important knowledge input in high level business decisions (Eliasson 1990a, 1996a) the analytical method of management will not only feed the wrong inputs into decisions. It is also likely to be grossly in error whenever something unusual occurs. Distributing tacit knowledge (or human or team embodied competencies) over the market is shown to maximize the exposure of a project to a competent and varied evaluation.[9] WAD thinking may make it superficially look as a cost minimizing organization of production to centralize, and internalize within large hierarchies (firms) or one large planning system all information processing. The theory of the EOE, on the other hand, by recognizing the economic loss of winners as a transaction cost tells the exact opposite story. Under an unfettered , experimental regime with great investment opportunities, innovation promoting entrepreneurial incentives and inhouse competition the supplies of innovations will always be much broader than the competence to identify, finance and commercialize innovations, and *the narrow selection criteria within a hierarchy will increase the probability of losing the winners* (Eliasson 1987a, p. 42). What looks like a cost efficient solution in the accounts, will be a costly proposition because of the increased loss of winners (G. Eliasson – Å. Eliasson 2002). Competence bloc theory, hence, is a market solution to the efficient allocation of tacit, human embodied competencies on

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[7] And in the Swedish micro-to-macro model (Eliasson 1991c, Eliasson-Johansson-Taymaz 2002)).

[8] "Minimize" is not the correct term. Minimization in the strict mathematical sense is not possible in a model of the EOE, except through complex numerical approximation.

[9] Note that this is the exact opposite conclusion to the one that emerges from the WAD model, in which the Walrasian super auctioneer is assumed to achieve a complete and (almost) costless overview of the economic landscape.

business problems. The competence bloc is defined from the product end (the market, the customer) and, hence, can be seen as an extended form firm. A competence bloc lists the minimum number of actors with economic and management competence that are needed to successfully generate, identify, select, expand and exploit new business ideas, and to carry the winners on to industrial scale production and distribution (G. Eliasson – Å. Eliasson 1996).

[The fundamental idea of Adam Smith (1776) was that specialization and distributed production give rise to enormous positive systems productivities in the use of scarce resources. He had a problem, however, with how to bound the economy from above, and settled on the size of the market as the upper limit, a solution to this theoretical problem used by many after him, including Karl Marx and more recently George Stigler (1951). This is the physical (materialist) interpretation of an economy leaving no room for intangible qualities. Allowing for intangible qualities changes the "picture" radically (Eliasson 1996a). While there is an upper limit to the volumes of physical products ("steel") that an economy can absorb, *there is no limit to how much quality that can be produced and consumed, except the competence of the customers to appreciate quality and the competence of firms to produce new qualities*. The perhaps most important quality demanded in an advanced market is product or quality *variation*. Only the customers can individually decide which variant he or she prefers.[10] This places the customer in core. One critical task of the competence bloc, hence, is to make sure that customers' preferences and competencies filter down to the actors in the competence bloc that create and select innovations. This requires that both customers and products be as well defined as possible, such that property rights can be assigned to contractual commitments throughout the competence bloc, making trading in these commitments possible such that the right prices be signaled, losers filtered away and winners selected. *The competence bloc becomes an allocator of tacit competencies* (Eliasson 2002b).]

Competence bloc theory, hence, explains the competitive creation and selection processes distributed over hierarchies and markets that generate growth in the experimentally organized economy (Eliasson 1991a, 1996a). When "efficiently" designed the competence bloc organization minimizes the economic incidence of the two types of errors. While the traditional Walras-Arrow-Debreu (WAD) model "embodies" only one (optimal) equilibrium solution, the EOE offers an incomprehensible variety of choices and ways of organizing this selection.[11] The minimum set of competent actors of the competence bloc is exhibited in Table 4B.

(Tables 4A, B in about here)

In an efficiently organized and well staffed (with competence) competence bloc *potential winners are exposed to a maximum of varied competencies such that they experience increasing returns to continued search*. One can say that the competence bloc defines the *receiver competence* (Eliasson 1986, 1990a) of the economy. In the selection process two types of phenomena appear; (a) synergies and spillovers arise (Eliasson 1997a, 1998b, c), (b) business mistakes appear as the necessary consequences of a learning process and figure as a

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[10] Product variation is a form of product quality. If the demand for variation is sufficiently large, information paradox two applies.

[11] Competence bloc theory, hence, is an analytical device to explain this organization and the development of an industry driven by the complex interaction of competent actors, the competence of whom to perform particular tasks (functions) cannot be defined (specified) as to content, only be characterized as to results (output).

standard cost for economic development (Eliasson 1992a). The innovation and selection process in the competence bloc (through Table 4B) is organized as follows:

First, the products created and chosen in the process never get better than what *customers* are capable of appreciating and willing to pay for. The long-term direction of technical change, therefore, is always set by the customers. This is so even though the innovator, entrepreneur or industrialist takes the initiative. But quite often the customer takes the initiative. Technological development, therefore, requires a sophisticated customer base, capable of appreciating new products (Eliasson 2003, G. Eliasson – Å. Eliasson 1996). The more advanced and radically new the product technologies, the more important customer quality becomes. The customers of the competence bloc contribute (commercial) competence in the technological choice process. They accept or reject products offered to them in the market, thereby signaling what they want. But they also actively look for products that they need, and they may be directly involved, contributing knowledge in some phases of the development of the product. This is often the case when it comes to advanced and complicated products such as military and commercial air planes (Eliasson 1995, 2001b). Advanced local customers, therefore, become a competitive advantage of a nation[12]. A rational strategy for a producer with sophisticated products that cannot find competent customers close by is to actively look for more sophisticated customers and a better market elsewhere, a strategy constantly forgotten in standard text books in marketing.

Second, basic technology is internationally available, but the capacity to receive it and make a business of it requires local competence. Part of this receiver competence (Eliasson 1987b, 1990a, 1996a, pp. 8, 14) is the ability to *create* new and winning combinations of old and new technologies. New technological combinations are created in the *innovation* slot of the competence bloc. This defines *the market for innovations* where the competence bloc overlaps with the technological system in Carlsson – Eliasson (2002).[13] As we know (see e.g. Larsson – Lembre – Mehldal 1998) a rich and varied supply of subcontractor (technology) services is part and parcel of the innovation process.

Third, some actors or organizations are better than others when it comes to achieving intellectual order in a seemingly chaotic business situation. We call them *entrepreneurs*. The task of the entrepreneur is to identify commercial winners among the suppliers of technical innovations and to get his/her *technology choice* on a commercial footing. The understanding of the entrepreneur may be of a long run nature, or more temporary in the sense that they may have to reconfigure their thoughts soon, or make a business mistake. The main thing is that the entrepreneur acts on a perceived business opportunity (*entre prendre* in French).

The entrepreneur, however, rarely has resources of his own to move the project forward. He, therefore, (*fourth*) needs funding from an *industrially competent venture capitalist*, i.e. a provider of risk capital, capable of understanding innovators of radically new technology and of being able to identify business needs and provide context. The money is the least important thing. *What matters* (G. Eliasson – Å. Eliasson 1996, Eliasson 1997) *is the competence to understand and identify winners and, hence, provide reasonably priced equity funding*.[14] The

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[12] Something recognized already by Burenstam-Linder (1961).
[13] Also see Day – Eliasson – Wihlborg (1993).

[14] The venture capitalists also contribute managerial, financing and marketing competence through their network, but this comes after the "understanding". Such services are normally available in the market and,

supply of such competent venture capital is extremely scarce. It is the critical part of the overall selection   process and, if lacking in performance, is liable to result in the "loss of winners".

Without a rich endowment of such competence, you won't see many entrepreneurs. Hence, the venture capitalist and his escape (*exit*) *market (fifth)* are the most important incentive supporting actors. With no understanding venture capitalists the price of new capital will be prohibitively high or funding will not come forward.

Finally and *sixth*, when the selection process has run its course and a winner has been selected a new type of industrial competence is needed to take the innovation on to industrial scale production and distribution. We cannot tell in advance what the formal role of the industrialist is (CEO, chairman of the Board, an active owner etc.). He or she figures in the competence bloc on account if his or her capacity to contribute functional competence. The innovative selection dynamics of the competence bloc is what endogenizes and moves economic growth in the EOE. Standard economic theory makes no distinction between the actors in the competence bloc and, hence, has great difficulties recognizing their respective competence contributions. Sometimes all functions of the competence bloc are internalized in one hierarchy, sometimes they are all distributed over he market. The compromise of each case reflects an instance of distributed management or of organizational competence when it comes to exploiting the respective advantages and a centralized hierarchical and distributed market technique of coordinating production, and of organizing development work (Eliasson-Eliasson 2002).

Without many industrial buyers competing for new innovative firms the exit markets won't function. With badly functioning exit markets the incentives for venture capitalists will be small and, hence, also for the entrepreneurs and the innovators. *Completeness* of the competence bloc is, therefore, a necessary requirement for the viable incentive structures that guarantee increasing returns to continued search for winners, i.e. for new industry formation.

The extreme diversity of the opportunity set of the EOE means that the competence needed to identify winners cannot be specified in advance. Hence, an efficient project identification and selection in the competence bloc requires that a large number of each type of actor in the competence bloc be present, such that if one actor does not understand there will be others who might. Such *horizontal variety* is a necessary condition for maximum exposure of each project to a competent evaluation. Compared to the internal project evaluation in a large firm direct transaction costs may be higher, since the evaluation is done in a distributed fashion involving many independent actors in the market. Narrowing down the evaluation to an internal procedure within a hierarchy, on the other hand, raises the risk of losing a winner which constitutes the really large cost, and hence is likely to lower the efficiency of project selection. Hence, "lost winners" should be part of transaction costs and that will turn the analytic conclusions of the WAD model on their head. Centralizing information processing for better overview reduces the competence input in the business project (Eliasson – Eliasson 2002). Large losses of winners are, in fact, not uncommon. Large firms, such as IBM

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consequently, are less critical. I *define* venture capital as financing associated with such industrial competence (Eliasson 1997).

internalized most of the competence for a long time and its 450 thousand staff got locked into mainframe thinking. It almost went down in the late 1980s. Business history is full of near losses, the only ones that can be identified (Eliasson, 2001a, 2003).

Sweden features an extreme concentration of large-scale business leadership competence (Eliasson 1990b), but this competence has been acquired in traditional hierarchies in mature industries that innovate slowly. The management of innovation in the new type of industries such as biotech is radically different from that in mature industries such as engineering. The general experience is that leadership competence from traditional industries is of limited use in radically new industry.

However, also large firms innovate in response to new competition, through innovative reorganization (cf. item 2 in Table 3). The old Swedish firms in traditional industries have been very successful in this task, first transforming themselves from basic materials producers to engineering companies during the 1950s and 1960s, then into R&D driven global exporters in the 1970s, to become pioneers in global product development, manufacturing and distribution during the 1980s. The 1990s have witnessed increased competition and less organizational innovation among the large companies, suggesting that the cohort of dominant old players in the 1970s cannot go on for ever being the backbone of Swedish growth. New actors have to fill in and they have not been forthcoming at the rate needed (Andersson et al. 1993, Eliasson 1993) due to a deficient competence bloc.

There is also another lesson to learn from competence bloc theory. It explicitly places technological innovations in a comprehensive economic context and obstructs the direct drive technology assumptions in both neoclassical and Schumpeterian 1942 growth models, such as national innovation systems models (Lundvall 1992). If the competence to *receive* (Eliasson 1986, 1988,1990a) or to absorb (Cohen – Levinthal 1990) new technology as embodied in the competence bloc is not in place, winners will be lost along the selection path and there won't be much growth.

The nature of management competence in the EOE

 A large firm always has some competence bloc functions internalized. The degree of internalization and its organization confer specific efficiency characteristics to the firm. Management theory deals with this organization of actors over competence blocs and their degree of internalization within a hierarchy. Five functions to be improved by management stand out: *flexibility*, *learnability*, *innovativeness*, *innovative pricing (a property rights institutions problem)* and *distributed production*.

In the EOE a premium is placed on *flexibility* and flexibility is the important characteristic of dynamic efficiency. Actors in the EOE are always ignorant of circumstances that may become critical for their survival but still have to move prematurely on the basis of scant and unreliable information.[15] If they don´t they will anyhow be overtaken and outcompeted by some of those who do it successfully. Hence, they constantly commit more or less serious business mistakes and have to be prepared to change their minds constantly. Flexibility in the

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[15] Their situation is summarized in terms of the three information paradoxes of Eliasson (1990b) and the competence specification of Table 2.

EOE is achieved in three ways. *First*, and most important, is to have the right business intuition (item 1 in Table 5). *Second*, and decisive when you are on the wrong track, is early identification, and correction of mistakes (items 3 and 4). *Third*, the competence bloc enforces flexibility when the first two functions fail, by withdrawing resources. As we will show below, a complete competence bloc distributed over the market in combination with new technology has significantly enhanced flexibility and dynamic efficiency during the last decade. This flexibility is reduced from internalization. A comparison of the designs of internal information and control systems in US and Swedish firms between the early 1970s and the late 1980s, furthermore, revealed a pronounced reorganization away from an analytical planning mode towards decentralization of operations and centralized profit targeting and control (Eliasson 1976, 1984a, 1996a, 1998b).

(Tables 5 and 6 in about here)

Learning, or knowledge accumulation (item 6 in Table 5) is a critical management task in the firm. It is done through hiring an firing and the internal career organization of the firm and through internal education and training programs (Eliasson 1996a, Section III,7). In the EOE you need knowledge to understand which information to gather and how to interpret it. Knowledge, therefore, is the most important production capital. It differs from other assets in two ways, not in principle but in degree.[16] It dominates other forms of capital in the production process (Eliasson 1989) and it is extremely heterogeneous.Knowledge and competence[17] are , therefore, difficult entities to define. While a machine can perform a few tasks at most, a competent individual is capable of performing a multitude of tasks. Human competence, therefore, is extremely heterogeneous and hence redundant in practically all applications (items 1 and 2 in Table 6). It is, furthermore, embodied in the sense of being to a large extent not codable and, therefore, incommunicable in abstract form. It is tacit. The economic value of knowledge , hence, becomes dependent on its allocation on tasks, i.e. on the performance of markets and management to allocate the same competence. Knowledge embodied in human beings, or groups of human beings, and competence defines the ability to put knowledge and information to efficient use in managing the firm (Eliasson 1990a,1996a, 2001a). Can what has been learnt, going through the decision process of Table 5 having arrived at a successful decision (solution, item 5) be reliably used in the next decision round? The answer is no in principle because the structures you need to know about are not exogenous – as in the WAD model – but endogenous and process dependent. In the WAD model information gathering is synonymous to both learning and understanding. The consequence is an allocation process of extreme complexity governed by actors endowed with a multidimensional knowledge distributed over markets. This allocation process will never settle because the allocation process itself will change and expand the knowledge base that is governed by itself. We have an infinite regress.The downside of this is that no exogenous equilibrium to eventually learn about (item 6 in Table 5) exists. There is no case for systematic learning and analytical management to help navigation in the EOE (Eliasson 1998b).

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[16] Note that the standard assumption of no depreciation of knowledge or information in WAD economics is incorrect if the knowledge is tacit and embodied in human beings (Eliasson 2000a).

[17] Information is codable knowledge, but *receiver* competence is needed to interpret the knowledge (Eliasson 1996a, p. 8). These are the definitions I will use. And we need them to model the allocation of tacit knowledge. This is a matter or organizing actors with defined functional abilities as in the competence bloc below.

In the long run *innovation* determines the fate of all firms, large and small and in all markets. Innovative capacity depends critically on the organizational regime under which new ideas are conceived, turned into innovations and introduced in production. Innovations are introduced through item 2 in the competence bloc and – being identified as a winner by an entrepreneur – then carried on through the competence bloc to industrial scale production and distribution. It makes a difference how large a part of this that takes place within one hierarchy and how much over the market. The main difference is that internalization within a hierarchy reduces both the horizontal diversity of the project evaluation and the number of projects to be evaluated and competing for available resources. Since the large firm is normally rich in resources internalization both reduces innovativeness by raising the risk of loosing a winner, and enhances the probability that a loser be carried for too long on the books. Dynamic efficiency in terms of Table 4A is reduced (G. Eliasson – Å. Eliasson 2002).

Schumpeterian Competition and Economic Growth

Another side of innovation in the New Economy is the increasing importance of intangible knowledge assets and the difficulties of charging for digitized information products. *Property rights* to physical and easy to define assets are fairly well protected by the institutions in markets. This is not the case for digitized information in the form of products (for instance CDs) and data bases in firms that, if accessed, can be stolen and distributed. The same is the case for tacit knowledge capital embodied in individuals or groups of individuals who can leave with the assets. While the WAD model has no explicit role for institutions, the non-linear world of the EOE needs institutions to make trade possible out of equilibrium (Day 1986) and institutions that support property rights to, and tradability in digital and difficult to define and charge for multidimensional products (Jonason 2001). The ability to claim property rights to intangible assets, therefore, becomes decisive for profitable production and investment.

A market, therefore, requires that two mutually dependent market functions be established

1. the property rights institutions (contracts)
2. efficient pricing formulae

to ensure *tradability*. *Y*ou have to know that you own what you buy, and the seller has to be able to demonstrate that he owns what he sells. This is a *property rights problem* and property rights are established through implicit or explicit *contracts*. While a contractual property right, furthermore, may not be sufficient to bring forward the full value of the good or service being traded, it may if it includes an efficient definition of the pricing base (a pricing formula) and an enforcement guarantee. Jonason (2001) calls the innovative redefinition of a multidimensional product to make it possible to charge for it *innovative pricing*. This may involve adding new dimensions to the product or bunching partly overlapping products into one and establishing property rights to the entire multidimensional product and an efficient pricing formula (base). Innovative pricing establishes tradability in difficult to define products. But the establishment of a market also requires, as a minimum, two competing actors. There has to be a basis for choice, i.e. competition between alternatives and exclusion (forced exit) or inclusion (entry) of actors. While complete unpredictability is not compatible with orderly economic behavior, the significant ongoing chaos of the EOE is, and *institutions* are what *introduce the minimum necessary order to ensure interpretable price signaling in markets, and the disciplining competition that coordinates markets*. These results carry

several implications for the ways dynamic markets operate and, hence, for firm behavior and management practice.

First, with more complex, quality loaded products heterogeneity in product offerings increase. Selection between different product qualities becomes a relatively more important (customer) market activity than finding the lowest price for the same product (Quality choice).

Second, and consequently, the marketing activities of producers will increasingly be a matter of choosing the right product technologies (technological choice), a selection activity that is largely experimental. The standard marketing text book approach of collecting data, analyzing the data and predicting demand will be of little use. In the experimentally organized, knowledge driven economy technological product choice in the form of designing a business experiment and testing it in the market will dominate behavior.

Third, with complicated choices on both the demand and the supply sides becoming increasingly important, everything else the same, the market will become less transparent. *Customer competence* (cf. receiver competence) will determine the benefits to the customer, and for less informed or knowledgeable customers, the building of brand recognition will be of increasing importance.

Fourth, with more complex products, and with relatively less informed customers there will be more opportunities for adverse selection and moral hazard.

Difficult to protect *information* can be controlled through internalization (vertical integration), even though innovative capacity might suffer as a consequence. Hence, the more efficient the institutions that define and protect (property) rights to intangible knowledge assets the more of production that can be distributed over actors in the markets and the more innovative and dynamically efficient the organization of production in the sense that winners are created , discovered and carried on through the competence bloc to industrial scale production. Competition is enhanced and macro economic growth occurs through the Schumpeterian creative destruction process of Table 3..

Institutions, hence, serve two purposes; supporting orderly market behavior (tradability) and protecting property rights. New C&C technology has made sophisticated distributed production technologically feasible in the last decade. Since distributed production can be shown to be – if competently organized – far more innovative and flexible than hierarchically organized production, and since the New Economy increasingly runs on intangible and difficult to protect assets, the institutions supporting (property) rights to intangible assets and the value of knowledge rents are becoming an increasingly important institutional problem in the New Economy (Eliasson – Wihlborg 2003) and decisive for the possibilities of organizing *distributed production*.

A fourth management task of importance, therefore, emerges from this theoretical analysis, namely the competence to manage a distributed organization or to (1) design the right mix between market and hierarchy and (2) to change it dynamically as circumstances change. On this mainstream economic theory has nothing to offer beyond the static principles of Coase (1937), and business administration and management theory is at a theoretical loss how to deal with this management problem conceptually. The theory of the EOE and of competence blocs takes us a bit further. First the learning feed back in Table 5 is disrupted under the

assumptions of the EOE. A manager with a repetitive career is likely to fail when he reaches the top in that firm. A varied career over many functions in different firms makes him/her more prepared: but the management *experience, however varied has to be complemented with a sophisticated cognitive ability to generalize from experience and to choose and synthesize all the various experiences into a new organizational (conceptual) whole.* This is exactly the opposite to the analytical or planning approach. Second, the competence bloc identifies the different management competencies that have to be integrated and from which management experience will be needed when choices between the mix of market and hierarchies are to be made.

4. The Nature of the Firm and strategic management in the EOE

The EOE is the natural habitat for the entity called a "firm". It exists there on of the basis of its temporary competence monopoly to improve and coordinate production more efficiently than the market, i.e. at less resource use (transaction costs) including the loss of potential winners. There will be no problems of size and of increasing returns resulting in corner solutions, as in the WAD model.

The firm in the EOE

Table 5 represents a typical situation of a firm in the EOE rich in resources (Eliasson 1996a, p. 56, 1998a, p. 87, 1999). *First*, no actor, including Government, can survey the entire business opportunities set from one point. It is not transparent and business mistakes will be made by all actors all the time. Such mistakes should be regarded as a normal cost for economic development. *Second*, some actors may hit upon the absolutely best solution by chance, but they will never know, and nobody else either. Hence, *third,* the economy will always be operating far below its production possibilities frontier, thus violating a standard assumption of neoclassical theory.

Fourth, as a business actor you must always believe in your proposed business experiment. If not, you cannot act decisively and forcefully. *Fifth*, however, whatever you have invented you know one thing with almost certainty; there will be many potential solutions that are much better. Therefore, and *sixth*, you have to recognize that among your many competitors you cannot be alone with such a good idea as yours. You have to act decisively and prematurely on the basis of your competent judgment (*intuition*) before somebody else has acted successfully and challenges your position. Each new solution, therefore, has the character of a business experiment, and the competence of a business firm is well categorized in Table 5. Firms will constantly have to act prematurely on the basis of their limited overview of the opportunities set (they are boundedly rational, Simon 1955). Hence, in the EOE it is *normally more risky to be passive and do nothing than to make a mistake*. A critical competence element is to be capable of early identification and correction of mistakes, thus minimizing the economic incidence of the two errors in Table 4A. This endogenizes growth through the Schumpeterian creative destruction process of Table 3.

From business planning to strategic management

Between 1969 and 1975 I carried out some 80 interviews of 60 US and European firms (Eliasson 1976) and their internal information and control systems. Then it was all short-term and long-range planning and a strong belief in a repetitive environment, analysis, forecasting

and central leadership of standardized production. Between 1975 and 1995 I carried out an additional series of some 70 interviews with 50 firms, several of them the same as in the earlier interview series, and also some 15 firms that had attempted in the early 1980s to establish themselves in the then hot business information systems market (Eliasson 1984a, 1996a, 1998b).

Two different intellectual worlds emerged. In 1970 it was all analysis and planning. The ambition was to do it right from the beginning using analytical methods within a centralized long- range planning system. In 1990 it was all experimenting, central profit control and access to information and people with competence and experience. The major focus of business information systems now was early identification and correction of business mistakes (items 3 and 4 in Table 5).

In between the two observation periods lay the great learning experience of the disorderly 1970s boiling down to one important fact; there was little to learn in the 1990s from management practice in the early 1970s and the management methods used in the 1990s had been of limited value in the 1960s, and probably misleading.

By the early 1970s many managers saw the world as predictable and locally (for the firm) plannable.

By the early 1980s, a decade of disorderly market experience had suppressed that view, but the rapidly diffusing information technology made many managers still believe that technology and universal business information systems would overcome complexity and provide top level management with general, and highly flexible information tools. The centralist view that Hayeck (1937,1940,1945) had once criticized so convincingly but still unsuccessfully was still alive among engineers of the product development departments of the large computing and telecommunications companies (Eliasson 1996a).

By 1995, after billions of dollars of lost development money managers have learned again.

A comparison of the management practices in the two periods is, therefore, interesting both theoretically and empirically. It illustrates how dependent we all are on the intellectual fashions of the day, the danger of applying standard management solutions to a world of extreme variety and the great value of a broad based experience in managing the correction of business mistakes.

We might also recall that the literature on business planning taught at the great management schools in the 1960s and – for a while – in the 1970s, all derived directly from the WAD model of mainstream economics, mechanical management. The people could come and go. The competence to run the business was embodied in the system (Eliasson 1976). That view was a disaster . And the learning experience of the 1980s/1990s appears not to have been very helpful in entering the new world of globally distributed production.

Competition generates growth through selection and checks monopoly rents

The firm of Table 5 appears as a competence based temporary monopoly. Winners earn monopoly rents as they are carried through the competence bloc to industrial scale production and distribution, but the rents are sooner or later competed away as new and successful winners enter the market. Competition, hence, both generates growth through selection and

keeps monopoly rents from accumulating indefinitely (Eliasson 1996a,pp.37-47). What matters for profit performance is to staff the firm with the right competence. But the firm does not have to be a strict hierarchy. Increasingly organizations composed of loosely integrated people populate the markets, their incentives to stay integrated depending on a set of more or less well defined implicit and explicit contracts. In a dynamic version of Coase (1937) such contracts can be ordered hierarchically forming a hierarchy of competent teams (a " firm") that constantly reorganizes. There is no longer such a thing as a well defined firm. And below the dominant superstructure of hierarchically ordered groups of people with competence is a loosely structured operations level where new technology is being churned out from R&D labs and (even further below) where production is carried out and products distributed. Even that structure is being increasingly fragmented, the "fragments" being reorganized in the market for strategic acquisitions into new temporary structures (G. Eliasson – Å. Eliasson 2002) disrupting the learning feed back of Table 5 (item 5) as well as the entire monitoring and control structure embodied in items 3 and 4. During the 1950s and 1960s fairly stable internal structures of the firm (as a hierarchy) gave meaning to the information generated by the internal information and control system – the internal language of the firm (Eliasson 1976, Pelikan 1969). As management firmed up this language to increase central control it also introduced a conserving rigidity. Innovation suffered. Hence, as technology was developed to organize production differently and more efficiently strong forces were at work breaking up the hierarchies of large firms. Large hierarchically organized firms could not stay innovative in markets that placed increasing demands on their flexibility and innovativeness. New C&C technology made it possible, not only to distribute development work over markets but also to achieve large positive systemic productivity effects from distributing, reorganizing and integrating previously internalized production over markets. To do this right, however, required a new type of management competence on which neither previous management with experience from hierarchically organized firms nor standard economic theory had any reliable advice to offer. The theory of the EOE and of competence blocs, however, offers some guidance. The way out is to rely heavily on markets for project creation and selection, production and the organization of the firm and to give up on the ambition of analytical management. The art of management in the New distributed Industry, hence, will be developed in markets. Eventually the theory of the EOE and of competence blocs might help organize that experience on a teachable format.

Managing distributed production to achieve systemic productivity effects

Information and communications activities account for more than half of the resources used up in the average manufacturing firm. Hence, the efficient allocation of resources to information and communication activities becomes a core management problem. This is a central fact underlying the theory of the EOE and of competence blocs.

The same theory also predicts that there are always much more efficient allocations of information and physical resources than the current ones. These superior allocations cannot be realized immediately because of lack of management competence and local resistance from people lacking the social capital needed to cope with large, unpredictable organizational change (Eliasson 2001a).

(Table 7 in about here)

The nature of these feasible reorganizations of resources to achieve superior allocations of resources can, however, be clarified and empirically supported. It can also be explained why

C&C technology is making such superior allocations accessible. New C&C technology makes more efficient use of information, and different organization of information and communication activities possible (items 1 and 3 in Table 7). Similarly, new C&C technology makes it possible to speed up and reorganize physical production flows. For instance, the paper lines in paper making mills have been made both much longer and much faster during the last decade.

Each of the improvements of items 1 through 4 of Table 7 are, however, partial and studies (see Eliasson 2002a, b) demonstrate that the productivity effects are fairly small for such partial improvements. The large systemic effects are achieved when all improvements are simultaneously introduced, and this is rarely possible in an old plant. The technical risks are too large and the management competence to do it right is normally lacking.

This is also easy to understand. Internalized production in a hierarchically organized firm always means a compromise when it comes to exploiting economies of scale and the fully internalized organization is not very flexible. Distributed production, on the other hand, of modularized and separable components that can be outsourced to specialized subcontractors makes it possible to achieve optimum scale in each production activity, given that the subcontractors can also produce for other customers. This production organization, hence, is more efficient than internalized production providing the final product assembly can be *integrated* into a systemic and more flexible whole. The enhanced flexibility also makes such a distributed production organization dynamically efficient. C&C technology makes it all increasingly feasible. But to conceive the new superior organization is extremely demanding on organizational and management talent (Eliasson 1996b) and such reorganization is rarely attempted, except in small steps of existing large firms and sometimes when a new and small firm is being reorganized (Eliasson 1998a, 2000b)

5. Conclusions

By changing the assumptional foundation of economic theory from the narrow perspective on the economic environment of the mainstream neoclassical model to the openness of the theory of the experimentally organized economy, we make the actors fundamentally ignorant rather than marginally uninformed. The firm model derived from the theory of the EOE is that of an experimentator constantly committing business mistakes rather than an analytical planning machine that is at worst assumed always to be right in expectation. The change in the global market environment from the seemingly orderly early post World War II development in the 1960s to the difficult to predict environment of the possibly emerging New Economy of the late 1990s is reflecting this change in assumptions. For the record, however, should be noted that the seemingly orderly behavior of the 1960s was not a different world but simply a temporary lull in the dynamics of an EOE and no reason whatsoever to engage in a naïve central planning management mode.

The problem is that while management practice has to cope with the realities of the EOE and the emerging new economy there is no matching theoretical development neither in the theory of the firm nor in management theory that represents what is occurring to help guide practice. This is notably the case when it comes to dealing with management flexibility and learning in a business organization that is increasingly distributed and diffused over the market.

Appendix

The Axioms of the WAD Model and of the theory of the EOE

Any model of an economy can be characterized in the three dimensions of Table 8. The critical assumption concerns the nature of state space or the business opportunity set. The state space of the WAD model is very small by assumption, sufficiently small and transparent to make optimization feasible in the sense of identifying a unique optimum, if it exists. This is "technically" achieved by assuming strict convexity of production and utility sets and continuous derivates. Imposing market clearing (which is now feasible) profit and utility maximization are achieved simultaneously with cost minimization. Arrow – Debreu (1954) were first to work the mathematics out in full. Technically this means that ex- ante and ex- post are identical barring a randing factor. *If* it happens to be there, there are no incentives for an actor to move away from an equilibrium neither ex- ante nor ex- post. There are no transaction- and information costs and time has no economic meaning. There is, furthermore, no explanation of how an actor can find its way to an equilibrium, so analysts look for properties of the system that would automatically return it to equilibrium, if it has departed from it. So called Liapunov functions (see LaSalle – Lefschetz, 1961) determine when this happens, and local stability normally only allows the system to depart imperceptibly from equilibrium. In static comparative equilibrium analysis the corresponding stability problem is whether the price vector will return to the equilibrium price vector, i.e. for tâtonnement to have occurred (Arrow – Hahn 1971, Ch. 11, Arrow – Hurwicz 1977, Part II). There will be great difficulties of achieving this desired systems property in an economic model with significant positive transaction - and information costs. Hence, information costs are assumed to be zero or approximately so and the model of the economy is assumed to be sufficiently linear for an exogenous equilibrium to exist, i.e. to be solvable.. Later developments have introduced the possibility of random deviations between ex- ante and ex- post establishing a stochastic general equilibrium situation. This is generally done in such a way that all information in the random noise is removed such that it exercises no influence on the external equilibrium of the model (see Samuelson 1965). The temporary knowledge rents in the Schumpeterian creative destruction process have been reduced to white noise and carry no influence on the real world. Separability prevails. We are now in the identical worlds of rational expectations, efficient markets or statistical learning. But in this world departures from equilibrium can only be marginal, or insignificant, if the system is ever going to return to equilibrium. The strict convexity assumptions of production sets define a world of scarcity. The situation can be mathematically described as (Eliasson 1992a);

1. Agents maximize expected utility – MAX(U).

2. Expectations are formed from subjective probability distributions conditioned by "all available information" (Ω), that is, historic realizations of all stochastic variables – EXP(X) = P(X | Ω).

3. Agents form (from points 1 and 2) actual, ex-post probability distributions that are identical with the subjective probability distributions under § 2, that is EX POST P(X) = P(X | Ω).

4. EX POST P(X) are stationary.[18]

This is the neoclassical model, formulated on a rational expectations mode, as it appears in modern finance (efficient market) and modern learning theory.

Item 4 is needed for economic ("econometric") learning, something made clear already by Haavelmo (1944). A steady stream of observations from the realization of P(X) will eventually, and with the precision desired, allow an unbiased estimate of the parameters of P(X). Item 4 also establishes the learning feed back of Table 5 as reliable and efficient.

(Table 8 in about here)

Item 3 hides the fundamental equilibrium conditions of the neoclassical model that should be given up in an essay on Schumpeterian economics. In no way – states item 3 – will the search for information [read: attempts to estimate the parameters of P(X)] change the distribution function P(X). Ex ante is always identical to ex- post baring a randomly distributed difference term.

Ex-ante and ex-post distribution functions define the state space of the neoclassical model. Changes in state space are occasioned by *events* (Fama et al. 1969), defined as changes in the set of available information or shifts in the conditional probability distribution $P(X \mid \Omega)$

to $P(X \mid \Omega^*)$ and agents quickly learn the parameters of the new probability distribution

($P(X \mid \Omega^*)$. Efficient markets immediately return the ex-ante, ex-post distributions to a stationary distribution. This leaves no room for the Schumpeterian innovator or entrepreneur, who changes the parameters of the system, only for the Kirznerian traders or entrepreneurs, who equilibrate the system at no transaction costs after it has been perturbed .

So far we are still in the WAD model and the manager of a business is adviced to be a good analyst and central planner. The only *new* thing is that under the rational expectations/efficient market/statistical learning regime he also has to know some insurance mathematics.

Empirically these assumptions are unreasonable. They are only needed to facilitate optimizing mathematics and to stay within the Walras – Arrow – Debreu paradigm. If you feel at home with simulation mathematics you can discard all that. Simulation is also far more appropriate for the studying of complex dynamic economic problems than calculus. Under the three information paradoxes, including the Särimner effect, you also have to move out of the WAD world. Then three new phenomena arrive on the scene (items 2 in Table 8). Actors in the model become *boundedly rational* (in Simon's (1955) terminology) being only capable of appreciating their

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[18] Most analyses assume stationarity in the sense that distributions have constant means and variation. There are, however, attempts to break through this restrictive assumption(see Wallis 1980). To avoid a "technical misunderstanding" please note that both paragraphs 3 and 4 are stochastic equilibrium conditions. During a learning phase, non stationarity is possible. To avoid having learning itself affect the stationary equilibrium learning costs have normally been assumed to be zero. See, however, Fourgeaud, Gourieroux, and Pradel (1986), where the equilibrium is made dependent on the learning process. Detemple – Selden (1991), furthermore, demonstrate that the introduction of a call option in an incomplete market for securities with diverse investor beliefs and an exogenously given (incomplete) market structure will raise the equilibrium price of the underlying stock. This can be interpreted as a change from one given to another given level of transaction costs, notably in the form of lowered volatility of the underlying stock rate of return.

environments in a narrow and fragmented fashion, based on their respective industrial knowledge/competence. Since that individual competence base necessarily differs between actors, it can be demonstrated (Eliasson 1990a) that communicability is restricted and that *tacit knowledge* in the sense of limited communicability is a necessary characteristic of the EOE. From this follows immediately that *decisions are constantly taken on the basis of knowledge that cannot be more than partially communicated*. We would call that *intuition*.

It also follows that business mistakes that are not random (and insurable) in the sense of rational expectations and efficient market theory will constantly be made. The EOE world features Knightian (1921) *uncertainty* as distinct from the *calculable risks* of efficient market theory. In the non-linear EOE business mistakes are not random and independent of the rest of the economy, but systematic and feed back on the market agents, affecting their decisions. Ex-ante and ex-post probability distributions (§ 3 above) are not identical. We have to explain ex- post outcomes in terms of ex- ante perceptions of the environment and decisions. We are now fully in the Austrian camp of Carl Menger (1871), and its special version of the Stockholm school economics, transferred to Stockholm from Lund by Knut Wicksell (Eliasson 1992a).

Carl Menger discussed ignorance as a typical characteristic of actors in the Austrian economic model. Ignorance in Menger's sense and in the sense of the EOE is, however, not complete ignorance. There is always some a priori information about the opportunity set or the possible states of nature. But if actors are sufficiently ignorant it becomes meaningless to assume the existence of subjective probabilities associated with possible outcomes to achieve calculability. Under complete ignorance, however, observe Arrow – Hurwicz (1977b), Shackle's (1949) theory would allow a different way of looking at the situation; [19] all situations now have zero potential surprise. The rational decision maker would now focus attention on the maximum and minimum pay off to a given action. The more ignorant actors the more of this decision focus would be rational and the more experimentators rather than analytical machines would be decision makers. They would be prepared to make business mistakes that are stochastic and of zero consequence in expectation.

Systematic business mistakes are typical of innovations. They become systematic when they involve an element of learning (as is the case under the Särimner effect).

Full *access* (item 3 in Table 7) to state space can be limited in both natural and artificial ways. We then talk about *monopoly* formation. The largest monopoly of all is the state, and in this purely theoretic exercise the state can play an important principal monopoly role by limiting access to state space.

Regulation is one example of limited access to state space, notably the craft system that kept continental Europe in a preindustrial grip for some time after the industrial revolution had begun in the UK and the US (Eliasson 1991b). The most destructive case of limiting access to the state space of business opportunities to the extent that no disturbing innovations (experiments) occurred were the centrally planned regimes of the previous Soviet Bloc. The principle of that regime is now clear. Remove all possibilities for individual innovation and entrepreneurship and you find yourself in a dead WAD environment. You can now manage your firm hierarchy

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[19] This is a reversal of the completely negative view on Shackle's theory expressed in Arrow (1965, p. 13).

undisturbed by unpredictable innovators, but economic progress will also be entirely gone.

Bibliography

Andersson Thomas – Pontus Braunerhjelm – Bo Carlsson – Gunnar Eliasson – Stefan Fölster – Lars Jagrén – Eugenia Kazamaki Ottersten – Kent Rune Sjöholm, 1993. *Den långa vägen – Om den ekonomiska politikens begränsningar och möjligheter att föra Sverige ur 1990-talets kris*. Stockholm: IUI.

Antonov, M. – G. Trofimov, 1993." Learning through Short-Run Macroeconomic Forecasts in a Micro-to-Macro Model", *Journal of Economic Behavior and Organization*, 21 (2), June.

Arrow, Kenneth, 1959, " Toward a Theory of Price Adjustment", in Abramowitz et al *The Allocation of Economic Resources,* Stanford,CA: Stanford University Press

Arrow, Kenneth J., 1965. *Aspects of the Theory of Risk-Bearing*. Helsingfors: Yrjö Jahnsson Lectures.

Arrow, Kenneth J. – Gerard Debreu, 1954. "Existence of Equilibrium for a Competitive Economy". *Econometrica*, 22 (3) (July), 265-290.

Arrow, Kenneth J. – F.H. Hahn, 1971. *General Competitive Analysis*. San Francisco, Edinburgh.

Arrow, Kenneth J. – L. Hurwicz, 1977a. *Studies in Resource Allocation Processes*. Cambridge,London, New York, Melbourne.

Arrow, Kenneth J. – L. Hurwicz, 1977b. "An Optimality Criterion for Decision Making under Ignorance"; in Arrow – Hurwicz (1977a).

Buigues, Pierre – Alexi Jacquemin – Jean-Francois Marchipoints, 2000. *Competitiveness and the Value of Intangible Assets*. UK and USA: Edvard Elgar.

Carlsson, Bo (ed.), 1989. *Industrial Dynamics. Technological, Organizational, and Structural Changes in Industries and Firms*. Boston / Dordrecth / London: Kluwer Academic Publishers.

-------- (ed.), 2002. *Technological Systems in the Bio Industries*. Boston/Dordrecht/London: Kluwer Academic Publishers.

Carlsson, Bo – Gunnar Eliasson, 2002, *Industrial Dynamics and Endogeneous Growth,* paper presented to this conference.

Coase, R.H., 1937. "The Nature of the Firm". *Economica*, IV (13-16) (Nov.), 386-405.

Cohen, W.M. – D.A. Levinthal, 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly*, 35, 128-152.

Coleman, J.S., 1988. "Social Capital in the Creation of Human Capital", *American Journal of Sociology*, 94, Suppl., S95-S120.

Day, R.H., 1986. "Disequilibrium Economic Dynamics: A Post-Schumpeterian Contribution"; in Day – Eliasson; eds (1986).

Day, R.H. – G. Eliasson, 1986. *The Dynamics of Market Economies*, Stockholm: IUI and Amsterdam: North-Holland.

Day, Richard H. – G. Eliasson, – C. Wihlborg (eds.), 1993. *The Markets for Innovation, Ownership and Control*. Stockholm: IUI, and Amsterdam: North-Holland.

Detemple, Jerome – Larry Selden, 1991. "A general equilibrium analysis of option and stock market interactions, *International Economic Review*, Vol. 32, No. 2 (May), pp.   279-303.

Eliasson, Gunnar, 1976. *Business Economic Planning – Theory, Practice and Comparison.* London etc.; John Wiley & Sons.

--------, 1977. "Competition and Market Processes in a Simulation Model of the Swedish Economy", *American Economic Review*, 67 (1), 277-281.

--------, 1984a. "Informations- och styrsystem i stora företag" (Information and Control Systems in Large Business Organizations); in G. Eliasson, H. Fries, L. Jagrén and L. Oxelheim (1984).

--------, 1984b. "Micro Heterogeneity of Firms and Stability of Growth", *Journal of Behavior and Economic Organization*, 5 (3-4), (Sept.-Dec.)249-298 (also in R.H. Day – G. Eliasson, eds., 1986).

--------, 1986. *Kunskap, information och tjänster – en studie av svenska industriföretag* (Knowledge, Information and Service Production – a study of Swedish manufacturing firms). Stockholm: IUI.

--------, 1987a. *Technological Competition and Trade in the Experimentally Organized Economy*, Research Report No. 32. Stockholm: IUI.

--------, 1987b. "The Knowledge Base of an Industrial Economy"; in *The Human Factor in Economic and Technological Change*, OECD Educational Monograph. Series No. 3. Also published as Research Report no. 33, "The Knowledge Base of an Industrial Economy" by IUI, Stockholm, 1988.

---------, 1988, " Schumpeterian Innovation, Market Structure and the Stability of Industrial Development", in Hanusch (1988)

--------, 1989. "The Dynamics of Supply and Economic Growth"; in Bo Carlsson, ed., 1989.

--------, 1990a. "The Firm as a Competent Team", *Journal of Economic Behavior and Organization*, 13 (3), 275-298.

--------, 1990b. "The Knowledge-Based Information Economy"; Chapter I in G. Eliasson – S. Fölster et al., 1990, *The Knowledge Based Information Economy*. Stockholm: IUI.

--------, 1991a. "Modeling the Experimentally Organized Economy", *Journal of Economic Behavior and Organization*, 16 (1-2), 153-182.

--------, 1991b. "Deregulation, Innovative Entry and Structural Diversity as a Source of Stable and Rapid Economic Growth", *Journal of Evolutionary Economics*, (1), 49-63.

--------, 1992a. "Business Competence, Organizational Learning, and Economic Growth: Establishing the Smith-Schumpeter-Wicksell (SSW) Connection"; in F.M. Scherer –   M. Perlman (eds), *Entrepreneurship, Technological Innovation, and Economic Growth. Studies in the Schumpeterian Tradition*. Ann Arbor: The University of Michigan Press, 1992.

--------, 1992b. *Arbetet – dess betydelse, dess innehåll, dess kvalitet och dess ersättning* (Work). Stockholm: Industriens Utredningsinstitut (IUI).

---------, 1993, "Företagens, institutionernas och marknadernas roll i Sverige", Appendix 6 in A. Lindbeck (ed.), *Nya villkor för ekonomi och politik* (SOU 1993:16)

--------, 1994. "Educational Efficiency and the Markets for Competence", *European Journal for Vocational Training*, 2/94.

--------, 1995. *Teknologigenerator eller nationellt prestigeprojekt? Exemplet svensk flygindustri.* Stockholm: City University Press.

-------, 1996a. *Firm Objectives, Controls and Organization – the use of information and the transfer of knowledge within the firm.* Boston/Dordrecht/London: Kluwer Academic Publishers.

--------, 1996b. "Spillovers, Integrated Production and the Theory of the Firm", *Journal of Evolutionary Economics*, 6, 125-140.

--------, 1997. "The Venture Capitalist as a Competent Outsider"; mimeo, INDEK, KTH, IEO R: 1997-06, Stockholm.An updated version has been published under the same title as chapter in Alho-Lassila-Ylä-Antilla (eds), 2002, *Economic Research and Decision Making,* Helsinki: ETLA/Taloystieto Oy. A revised and further updated version will appear as a chapter in Eliasson (2004).

--------, 1998a. "Information Efficiency, Production Organization and Systems Productivity - Quantifying the Systems Effects of EDI Investments"; in Macdonald – Madden – Salama (eds.), 1998, *Telecommunications and Social Economic Development*. Amsterdam: North Holland.

----------, 1998b, *The nature of Economic Change and Management in the Knowledge Based Information Economy,* Stockholm:KTH TRITA-IEO-*R* 1998:19. Revised version forthcoming in *Information Economics and Policy* under the title " Management in the New and Experimentally Organized Economy".

--------, 1999. "Communication, Information Technology and Firm Performance"; in Macdonald – Nightingale (1999).

--------, 2000a. "Making Intangibles Visible – the Value, the Efficiency and the Economic Consequences of Knowledge"; in Buigues – Jacquemin – Marchipon, eds (2000).

--------, 2000b. "The Anatomy of a Production Plant", Mimeo, Indek, KTH, Stockholm.

--------, 2001a. "The Role of Knowledge in Economic Growth"; in Helliwell, John, ed. (2001).

--------, 2001b. "Advanced Purchasing, Spillovers, Innovative Pricing and Serendipitous Discovery". Paper presented at the E.A.R.I.E. 2001 Conference in Dublin 30th - 2nd Sept. 2001. KTH TRITA 2001:13, Stockholm.

--------, 2002a. *Den Nya och Omedelbara Ekonomin – ett Internet-perspektiv* (The New and Immediate Economy – an Internet perspective). Teldok and Vinnova, Stockholm (Telematik).

----------, 2002b, *The Macroeconomic Effects of Computing and Communications Technology- entering a New and Immediate Economy,*Stockholm: KTH TRITA IEO-R 2002:17

--------, 2002c. "Dynamically Efficient Allocations of Resources in an Experimentally Organized Economy (EOE)". Mimeo, KTH, Stockholm.

--------, 2003." Global Economic Integration and Regional Attractors of Competence", *Industry and Innovation* , Vol. 10,No1:75-102 (March)

----------, 2004, *The Life and Death of Firms in a growing and Experimentally Organized Economy- studies in Schumpeterian creative destruction,* Manuscript , RATIO Institute, Stockholm

Eliasson, Gunnar – Åsa Eliasson, 1996. "The Biotechnological Competence Bloc", *Revue d'Economie Industrielle*, 78-4[0], Trimestre.

Eliasson, Gunnar – Åsa Eliasson, 2002. "The Theory of the Firm and the Markets for Strategic Acquisitions". Paper presented to the 9th Congress of the International Joseph A. Schumpeter Society (ISS), Gainesville, Florida, USA, March 28-30, 2002. To be published in the conference proceedings 2004.

Eliasson, Gunnar – Harald Fries – Lars Jagrén – Lars Oxelheim, 1984. *Hur styrs storföretag? - en studie av informationshantering och organisation* (How Are Large Business Groups Managed? - A Study of Information Handling and Organization). Stockholm: IUI, and Kristianstad: Liber.

Eliasson, Gunnar – Dan Johansson, 1999. *Dynamik och flexibilitet i svensk IT-industry* (Dynamics and Flexibility in Swedish IT-industry). Stockholm: City University Press.

Eliasson, Gunnar – Dan Johansson – Erol Taymaz, 2001. "Firm Turnover and the Rate of Growth – simulating the macroeconomic effects of Schumpeterian creative destruction.", mimeo, INDEK, KTH, Stockholm.

Eliasson, Gunnar – Clas Wihlborg, 2003. "On The Macroeconomic Effects of Establishing Tradability in Weak Property Rights". *J.Evol.Econ (*2003*)* 13:6067-632

Fama, E.F. – L. Fisher – M.C. Jensen – R. Roll, 1969. "The Adjustment of Stock Prices to New Information", *International Economic Review*, 10 (Febr.), 1-21.

Fourgeaud, C. – C. Gourieroux – J. Pradel, 1986. "Learning Procedure and Convergence to Rationality," *Econometrica*, 54 (4) (July), 845-868.

Haavelmo T., 1944. "The Probability Approach in Econometrics'',' *Econometrica*, 12 (July), Supplement.

Hanusch, Horst (ed), 1988, *Evolutionary Economics- Applications of Schumpeter´s Ideas,*Cambridge, New York etc: Cambridge University Press

Helliwell, John (ed.), 2001. *The Contribution of Human and Social Capital to Sustained Economic Growth and Well*-being, HRDC. Canada.

Johansson, Dan, 2001, *The Dynamics of Industry Growth,* Stockholm: KTH (Dissertation)

Jonason, Andreas, 2001. "Innovative Pricing". Doctorate thesis. Department of Industrial Economics and Management INDEK), Royal Institute of Technology (KRTH). Stockholm.

Kirzner, Israel,M. 1973, *Competition and Entrepreneurship,* Chicago: Chicago University Press

Knight, F., 1921. *Risk, Uncertainty and Profit*. Boston: Houghton-Mifflin.

Krugman, Paul R., 1981. "Intraindustry Specialization and the Gains from Trade," *Journal of Political Economy*, 89 (51), 959-973.

--------, 1983a. "New Theories of Trade Among Industrial Countries," *American Economic Review, Papers and Proceedings*, 73 (2) (May), 343-347.

--------, 1983b. "Targeted Industrial Policies: Theory and Evidence." Paper presented at Industrial

Change and Public Policy, Symposium sponsored by the Federal Reserve Bank of Kansas City.

Larson, Anders – Per Lembre – Cecilia Meldahl, 1998, "Science Parks and Industrial Development – a competence bloc analysis of Swedish, Taiwanian and US Industrial Districts". Short version of Masters thesis, KTH, TRITA, Stockholm.

La Salle, Joseph – Solomon Lefschetz, 1961. Stability by Liapunov's Direct Method. With Applications. RIAS Baltimore, Maryland. New York, London: Academic Press.

Lundvall, Bengt-Åke, 1992. *National Systems of Innovations*. London: Pinter Publishers Ltd.

Macdonald, Stuart – John Nightingale, 1999. *Information and Organization*, North Holland.

Mathews, John, 2002, Schumpeterian Competitive Dynamics and Economic Learning – an economy-wide resource-based view. Paper presented to the DRUID summer conference 6-8 June, Copenhagen, Denmark.

Menger, Carl, 1871. *Grundsätze der Volkswirtschaftslehre*, Vienna.

Pelikan, Pavel, 1969, Language as a Limiting Factor for Centralization, *American Economic Review*, Vol. LIX, No. 4 (Sept.).

Samuelson, Paul A., 1965. "Proof that Properly Anticipated Prices Fluctuate Randomly , *Industrial Management Review* (Spring), 41-49.

Schumpeter, Joseph, A.,1911. *Theorie der Wirtschaftlichen Entwicklung*, Jena: Dunker und Humblot.

--------, 1942, *Capitalism, Socialism and Democracy*. New York: Harper & Row.

---------, 1954, *History of Economic Analysis,* Oxford: Oxford University Press

Shackle, G.L.S., 1949, *Expectations in Economics,* Cambridge: Cambridge University Press

Simon, H.A., 1955. "A Behavioral Model of Rational Choice", *Quarterly Journal of Economics*, 69, 99-118.

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealthy of Nations*. New York: Modern Library, 1937.

Spencer, B.J. – J.A., Brander, 1983, "International R&D Rivalry and Industrial Strategy", *Review of Economic Studies*, Vol. L, No. 163 (Oct.), pp 707-722.

Stigler, G.J., 1951. "The Division of Labor is Limited by the Extent of the Market", *Journal of Political Economy*, LIX, 3 (June), 185-193.

Wallis, K.F., 1980, Econometric Implications of the Rational Expectations Hypothesis, *Econometrica*, Vol. 48, No. 1 (Jan.), pp. 49-73.

Walras, L., 1874, *Elements d'économie politique pure*. (English translation of 1926 edition: Elements of Pure Economics, or the Theory of Social Wealth). London: Allen and Unwin, 1954.

Table 1.   The statistical accounts of the knowledge-based information economy

1 Innovation	*Creating Business Opportunities*

(exploring and expanding state space)   ■ customer interaction

■ innovation

■ experiments

■ technical development

2   Choice and selection   *Economic Filtering & allocation*

 (identifying business opportunities)   ■ entrepreneurship/entry

■ venture capitalism

■ exit

■ mobility/flexibility

■   varied careers

3   Coordination   **Disciplining**

■ competition (in markets)

■ management (in hierarchies)

4   Learning   *Knowledge transfer*

■ education

■ imitation

■ diffusion

■ receiver competence

Source: Modified version of Eliasson, G., *Technological Competition and Trade in the Experimentally Organized Economy*, Research Report No. 32, IUI, Stockholm 1987, p. 12.

Table 2.

A. INFORMATION PARADOX I

> **Are we growing relatively less informed because the stock of knowledge we can know about is growing faster than we can learn?**

Source: Eliasson, G., 1990. *The Knowledge Based Information Economy;* IUI and Swedish Telecon. Stockholm: Almqvist & Wicksell, 1990, pp. 46f.

B. INFORMATION PARADOX II

> **Are we becoming *less* and *less* informed about what is becoming *more* and *more* important?**

Source: Eliasson, G., 1990, *The Knowledge Based Information Economy*, IUI, Telecon, Stockholm, p. 16.

C. INFORMATION PARADOX III

> **Are we moving from a knowledge based information economy towards a *misinformation* society?**

Source: Eliasson, G., 1990, *The Knowledge Based Information Economy*, IUI, Telecon, Stockholm, p. 34f.

Table 3.   The four mechanisms of Schumpeterian creative destruction and economic growth

1. Innovative entry
   enforces (through competition)

2. Reorganization

3. Rationalization

   or

4. Exit (shut down)

Source: "Företagens, institutionernas och marknadernas roll i Sverige", Appendix 6 in A. Lindbeck (ed.), *Nya villkor för ekonomi och politik* (SOU 1993:16) and G. Eliasson (1996a, p. 45).

Table 4A. The dominant selection problem

Error Type I: Losers kept too long

Error Type II: Winners rejected

Source: G. Eliasson – Å. Eliasson, 1996. "The Biotechnological Competence Bloc", *Revue d'Economie Industrielle,* 78-4[0], Trimestre.

Table 4B. Actors in the competence bloc

1. Competent and active *customers*

2. *Innovators* who integrate technologies in new ways

3. *Entrepreneurs* who identify profitable innovations

4. *Competent venture capitalists* who recognize and finance the entrepreneurs

5. *Exit markets* that facilitate ownership change

6. *Industrialists* who take successful innovations to industrial scale production

Source: G. Eliasson – Å. Eliasson, 1996. "The Biotechnological Competence Bloc", *Revue d'Economie Industrielle,* 78-4[0], Trimestre.

Table 5.   Competence specification of the experimentally organized firm

Orientation
1. Sense of direction (business intuition)
2. Risk willing

Selection
3. Efficient identification of mistakes
4. Effective correction of mistakes

Operation
5. Efficient coordination
6. Efficient learning feedback to (1)

Source: Eliasson, G. 1996. *Firm Objectives, Controls and Organization – the use of information and the transfer of knowledge within the firm.* Boston/Dordrecht/London: Kluwer Academic Publishers, p. 56.

Table 6.   The characteristics of competence capital

Competence capital is

1. Heterogeneous

2. Redundant in any application

3. Embodied

4. Valuable depending on its allocation and

5. Valuable relative to competing competence carriers locally and globally

Source: Eliasson, G. , 1994a. *Högre utbildade i företag* (The Employment of highly educated people in firms). Report No. 14, Agenda 2000. Stockholm: Swedish Ministry for Education and Eliasson, G., 2000a., Industrial Policy, Competence Blocs and the Role of Science in Economic Development", *Journal of Evolutionary Economics*, No. 1, 2000.

Table 7.   Systems effect categories at different levels of aggregation in Knowledge Based Information Economy

1. Speed up info flows   over given structures
                              (*rationalization*)

2. Speed up physical flows   over given structures
                              (*rationalization*)

3. Reorganize info flows

4. Reorganize physical flows

5. Do all simultaneously   (*integrated production*)

Source: Eliasson, G., 1998c. Information Efficiency, Production Organization and Systems Productivity – quantifying the effects of EDI investments; in Macdonald - Madden - Salama (eds.), *Telecommunications and Socio-Economic Development.* Amsterdam: North-Holland, 1998.

Table 8.   The axioms of the WAD and EOE models

1. State space; very small or enormous and extremely varied

2. Behavior characteristics (agent autonomy)

      -        bounded rationality
      -        tacit knowledge
      -        intuition

3. Institutions regulating entry into state space.

Source: Eliasson, G. 1996. *Firm Objectives, Controls and Organization – the use of information and the transfer of knowledge within the firm.* Boston/Dordrecht/London: Kluwer Academic Publishers, p. 24.